North Carolina Agricultural and Technical State University
OFFICE OF ENVIRONMENTAL HEALTH & SAFETY

Safety Manual

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Approved By: Louisa V. Newman Director of Environmental Health & Safety	Signature:

Stairways and Ladders

Scope

The OSHA rules and minimum requirements apply to stairways and common types of ladders used by employees in University operations including ladders used in construction, alterations, repair and demolition of worksites.

Other types of special ladders, fruit pickers' ladders, combination step and extension ladders, stockroom stepladders, aisle way stepladders, shelf ladders and library ladders are not specifically covered by this section, however, use, maintenance and care sections apply.

General Requirements

Following the requirements for stairways and ladders can prevent many injuries.

- A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches (48 cm) or more and no ramp, runway, embankment or personnel hoist is provided.
- Where there is only one point of access between levels, it must be kept clear to permit free passage by workers. If free passage becomes restricted, a second point of access must be provided and used.
- All construction stairway and ladder fall protection systems required by these rules must be installed and all duties required by the stairway and ladder rules must be performed before employees begin work that requires them to use stairways or ladders and their respective fall protective systems.

Fixed Industrial Stairs: (See OSHA 1910.24)

Fixed stairs shall be provided for access from one structure to another where operations demand regular travel between levels and for access to operating platforms at any equipment which requires attention routinely during operations. Fixed stairs shall also be provided where access to elevations is daily or at each shift for such purposes as gauging, inspection, regular maintenance, etc., where such work may expose employees to acids, caustics, gases, or other harmful substances, or for which purposes the carrying of tools or equipment by hand is normally required. (This does not preclude the use of fixed ladders for access to fixed tanks, towers, and similar structures, overhead traveling cranes, etc. where the use of fixed ladders is a common practice.) Spiral stairways shall not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway. Winding stairways may be installed on tanks and similar round structures where the diameter of the structure is not less than five (5) feet.

Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated but never of less strength than to carry safely a moving concentrated load of 1,000 pounds. Fixed stairways shall also have a minimum width of 22 inches.

Stair Treads and Platforms

All treads shall be reasonably slip-resistant and the nosings shall be of non-slip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite non-slip design. Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs.

Stairway platforms shall be no less than the width of a stairway and a minimum of 30 inches in length measured in the direction of travel. Vertical clearance above any stair tread to an overhead obstruction shall be at least 7 feet measured from the leading edge of the tread.

Fixed stairs shall be installed at angles to the horizontal of between 30 deg. and 50 deg. Any uniform combination of rise/tread dimensions may be used that will result in a stairway at an angle to the horizontal within the permissible range. Table 1, below, gives rise/tread dimensions which will produce a stairway within the permissible range, stating the angle to the horizontal produced by each combination. However, the rise/tread (Pitch) combinations are not limited to those given in the table below.

Angle to horizontal	Rise (in inches)	Tread run (in inches)
30 deg. 35′	6½	11
32 deg. 08′	6¾	10¾
33 deg. 41′	7	10½
35 deg. 16′	7¼	10¼
36 deg. 52′	7½	10
38 deg. 29′	7¾	9¾
40 deg. 08′	8	9½
41 deg. 44′	8¼	9¼
43 deg. 22′	8½	9
45 deg. 00′	8¾	8¾
46 deg. 38′	9	8½
48 deg. 16′	9¼	8¼
49 deg. 54′	9½	8

Stair Rails and Handrails

The following apply to all stair rails and handrails.

- A stairway having four or more rises, or rising more than 30 inches (76 cm) in height, whichever is less, must have at least one handrail provided on closed stairways preferably on the right-side descending. A stair rail must also be installed along each unprotected

side or edge. When the top edge of a stair rail system also serves as a handrail, the height of the top edge must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stair rail to the surface of the tread.
- Employees should always use handrails whenever ascending or descending stairs.

Portable Metal Ladders:

Types of Portable Stepladders

Type I

Industrial stepladder, 3 to 20 feet for heavy duty, such as utilities, contractors, and industrial use.

Type II

Commercial stepladder, 3 to 12 feet for medium duty, such as painters, offices, and light industrial use.

Type III

Household stepladder, 3 to 6 feet for light duty, such as light household use.

All 'two-section' extension ladders shall consist of 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.

Uniform step spacing shall be employed that is no more than 12 inches. Steps shall be parallel and level when the ladder is in position for use. The minimum width between side rails at the top, inside to inside, shall be not less than 11 1/2 inches. From top to bottom, the side rails shall spread at least 1 inch for each foot of length of stepladder.

Ladders that **should not** be supplied:
- Any **wooden** ladder
- Stepladders longer than 20 feet.
- Single ladders longer than 30 feet.
- 'Two-section' extension ladders longer than 60 feet shall not be supplied.
- Trestle ladders, or extension sections or base sections of extension trestle ladders longer than 20 feet shall not be supplied.
- Painter's stepladders longer than 12 feet.
- Mason's ladders longer than 40 feet.
- Trolley ladders and side-rolling ladders longer than 20 feet should not be supplied shall not be supplied.

Locking Device

A metal spreader or locking device of sufficient size and strength shall be a component of each stepladder to securely hold the front and back sections in open positions. All sharp points should be covered or removed to protect the user. For Type III ladder, the pail shelf and spreader may be combined in one unit (the so-called shelf-lock ladder).

Ladder Care

(Pertains to All Ladders)

Ladders shall be maintained in good condition at all times, the joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous, Do Not

Use". Ladders with broken or missing steps, rungs, or cleats, broken side rails, or other faulty equipment shall not be used. (Improvised repairs shall not be made.)

Rungs should be kept free of grease, oil, and other slippery substances that may present a hazard.

Metal bearings of locks, wheels, pulleys, and other ladder parts shall be lubricated on a regular basis.

Frayed or badly worn rope shall be replaced.

Safety feet and other auxiliary equipment shall be kept in good condition to insure proper performance.

Ladders must not be loaded beyond the maximum intended load for which they were built or beyond the manufacturers' rated capacity.

<u>Use</u>
(Pertains to All Ladders)

- DO NOT USE THE TOP OF THE LADDER OR THE TOP STEP ON ANY LADDER.
- The area around the top and bottom of the ladders must be kept clear.
- Portable ladders are designed as a one-man working ladder based on a 200-pound load.
- Always maintain 3 points of contact with the ladder. (ex. Two hands and one foot, two feet and one hand)
- Ladders should only be used for the purpose for which they were designed.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental movement. If used on an unstable surface:
    - The user should equip all portable rung ladders with non-slip bases when there is a hazard of slipping. Non-slip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.
- Do not climb on the bracing of a ladder. The bracing is only designed to increase stability, not to hold the weight of a worker. The backside of the ladder can be used if it is designed and provided with steps for climbing on both front and rear sections.
- Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support). The ladder shall be so placed as to prevent slipping, or it shall be lashed, or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds.
- Do not place ladders in front of doors that open toward the ladder unless the door is blocked, locked, or guarded.
- Do not splice short ladders together to provide long sections.
- Ladders should not be used that are made by fastening cleats across a single rail.
- Ladders shall not be used as guys, braces, or skids, or for any other purpose other than their intended function.
- Do not place ladders on boxes, barrels, or other unstable bases to obtain additional height.
- 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. 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 support.
- 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.

On two-section extension ladders the minimum overlap for the two sections in use shall be as follows:

Size of Ladder (feet)	Overlap (feet)
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

- Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal measured from the back side of the ladder.
- Ladders must not be moved, shifted or extended while in use.
- Ladders must have nonconductive side rails if they are used where the worker or the ladder could contact exposed energized electrical equipment.
- Users are cautioned to take proper safety measures when metal ladders are used in areas containing electrical circuits to prevent short circuits or electrical shock.
- Ladders must be inspected by a competent person for visible defects on a periodic basis and after any incident that could affect their safe use.
- When ascending or descending a ladder, employees must face the ladder.
- An employee on a ladder shall not carry any object or load that could cause the worker to lose balance and fall.

Specifics for Metal Ladders

The design shall be such as to produce a ladder without structural defects or accident hazards such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements, and shall be protected against corrosion unless inherently corrosion-resistant.

The spacing of rungs or steps shall be on 12-inch centers. Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

The minimum width between side rails of a straight ladder or any section of an extension ladder shall be 12 inches.

The length of single ladders or individual sections of ladders shall not exceed 30 feet. Two-section ladders shall not exceed 48 feet in length and over two-section ladders shall not exceed 60 feet in length.

Extension ladders shall be equipped with positive stops which will insure the overlap specified in the overlap table below:

Size of Ladder (feet)	Overlap (feet)
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

The length of a stepladder is measured by the length of the front rail. To be classified as a standard-length ladder, the measured length shall be within plus or minus one-half inch of the specified length.

The bottoms of the four rails are to be supplied with insulating non-slip material for the safety of the user.

An immediate inspection should be conducted if a ladder tips over. It should be inspected for side rails dents or bends, or excessively dented rungs; check all rung-to-side-rail connections; check hardware connections; check rivets for shear.

Fixed Ladders, Cages, and Wells

All ladders, appurtenances, and fastenings shall be designed to meet the following load requirements:

The minimum design live load shall be a single concentrated load of 200 pounds. The number and position of additional concentrated live-load units of 200 pounds each as determined from anticipated usage of the ladder shall be considered in the design. All rungs shall have a minimum diameter of three-fourths inch for metal ladders, except as covered in OSHA 1010.27 (b)(7)(i) and a minimum diameter of 1 1/8 inches for wood ladders. The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end. (See Design D-1 in OSHA 1910.27)

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.

Adequate means shall be employed to protect dissimilar metals from electrolytic action when such metals are joined.

<u>Deterioration Prevention</u>
Metal ladders and appurtenances shall be painted or otherwise treated to resist corrosion and rusting when location demands. Ladders formed by individual metal rungs imbedded in concrete, which serve as access to pits and to other areas under floors, are frequently located in an atmosphere that causes corrosion and rusting. To increase rung life in such atmosphere, individual metal rungs shall have a minimum diameter of 1 inch or shall be painted or otherwise treated to resist corrosion and rusting.

A clear width of at least 15 inches shall be provided each way from the centerline of the ladder in the climbing space for ladders without a cage or well.

The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal. Fixed ladders shall be considered as substandard if they are installed within the substandard pitch range of 60 and 75 degrees with the horizontal.

Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range shall be considered as a critical range to be avoided, if possible. Ladders having a pitch of more than 90 degrees with the horizontal are prohibited.

(See OSHA 1910.27 for more specific guidelines pertaining to Fixed Ladders)

Cages and Well for Ladders

Cages

- Cages shall extend a minimum of 42 inches above the top of landing, unless other acceptable protection is provided.
- Horizontal bands must be fastened to the side rail ladders or directly to the structure, building or equipment for individual rung ladders.
- Vertical bars must be on the inside of the horizontal bands and must be fastened to them.
- Cages shall extend down the ladder to a point not less than 7 feet and not more than 8 feet above the base of the ladder, with bottom flared not less than 4 inches, or portion of cage opposite ladder shall be carried to the base.
- Cages must not extend less than 27 inches (68 cm) or more than 30 inches (76 cm) from the center line of the step or rung and must not be less than 27 inches (68 cm) wide.
- The inside of the cage must be clear of projections.
- Horizontal bands must be spaced at intervals not more than 4 feet (1.2m) apart measured from center line to center line.
- Vertical bars must be spaced at intervals not more than 9 1/2 inches (24 cm) apart measured from center line to center line.

Wells

- Ladder wells shall have a clear width of at least 15 inches measured each way from the centerline of the ladder. Smooth-walled wells shall be a minimum of 27 inches from the centerline of rungs to the well wall on the climbing side of the ladder. Where other obstructions on the climbing side of the ladder exist, there shall be a minimum of 30 inches from the centerline of the rungs.
- Wells must completely encircle the ladder.
- The bottom of the well above the point of access to the bottom of the ladder, must be between 7 feet (2.1 m) and 8 feet (2.4 m).

Landing Platforms

(OSHA 1910.27)

When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.

Where a man must 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 2 1/2 inches.

All landing platforms shall be equipped with standard railings and toe-boards, 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.

The side rails of through or side-step ladder 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 and not 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 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.

Ladder Safety Devices and Related Support Systems for Fixed Ladders

All safety devices must be capable of withstanding, without failure, a drop test consisting of a 500-pound weight (226 kg) dropping 18 inches (41 cm).

- All safety devices must permit the worker to ascend or descend without continually having to hold, push or pull any part of the device, leaving both hands free for climbing.
- All safety devices must be activated within 2 feet (.61 m) after a fall occurs and limit the descending velocity of an employee to 7 feet/sec (2.1 m/sec or less).
- The connection between the carrier or lifeline and the point of attachment to the body belt or harness must not exceed 9 inches (23 cm) in length.

Items That Are Unsafe and Are to Not Be Used in the Place of a Ladder

- Desks
- Chairs (Stationary or Ones that have Wheels)
- Boxes
- Step Stools
- Filing Cabinets
- Carts
- Any other type of object other than the correct ladder that can be used to stand out to reach an area above head.

Training Requirements

A training program must be provided for each employee using ladders and stairways. The program must enable each employee to recognize hazards related to ladders and stairways and to use proper procedures to minimize these hazards. For construction operations, additional employee training is required.

Employees must be trained by a competent person in the following areas, as applicable:

- The nature of fall hazards in the work area.
- The correct procedure for erecting, maintaining and disassembling the fall protection systems to be used.
- The proper construction, use, placement and care in handling of all stairways and ladders.

- The maximum intended load carry capacities of ladders used.

Retraining must be provided for each employee as necessary so that the employee maintains the understanding and knowledge acquired through use of safe work practices, procedures and equipment. (ex. When using different ladders, changing job positions, etc.)