

NFPA®

1931

Standard for
Manufacturer's Design of
Fire Department Ground Ladders

2020



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NFPA® 1931

Standard for

Manufacturer's Design of Fire Department Ground Ladders

2020 Edition

This edition of NFPA 1931, *Standard for Manufacturer's Design of Fire Department Ground Ladders*, was prepared by the Technical Committee on Fire Department Ground Ladders. It was issued by the Standards Council on November 4, 2019, with an effective date of November 24, 2019, and supersedes all previous editions.

This edition of NFPA 1931 was approved as an American National Standard on November 24, 2019.

Origin and Development of NFPA 1931

In 1959, new material was added to NFPA 193, *Fire Department Ladders — Ground and Aerial*, covering requirements for the construction of ground ladders while continuing to cover their use, maintenance, and testing. These requirements recognized aluminum as a product for the construction of fire department ground ladders.

In May 1972, a complete revision of the 1959 edition of NFPA 193 was adopted.

In 1975, NFPA 193 was separated into two documents, NFPA 1931, *Standard on Fire Department Ground Ladders*, and NFPA 1904, *Recommended Practice for the Maintenance, Care, Testing and Use of Fire Department Aerial Ladders and Elevating Platforms*.

The 1979 edition incorporated extensive revisions, including editorial and style changes.

In 1984, the text of NFPA 1931 was again divided into two documents. NFPA 1931 contained the requirements for manufacturers on design and design verification testing for new ground ladders. A companion document, NFPA 1932, *Standard on Use, Maintenance, and Service Testing of Fire Department Ground Ladders*, covered requirements for the ground ladder user. The 1984 revision increased the requirements for the strength of the ladder as well as dimensional requirements.

The 1989 edition included additional requirements for labels, modified requirements for rung spacing, added requirements for securing halyards, and required staypoles to be stowable against the base section if they could not be properly deployed.

The 1994 edition added a table of ladder duty ratings, added additional requirements for wood ground ladders, and modified some of the labeling requirements. The 1999 edition basically editorially revised and updated the standard to keep it current.

The 2004 edition changed the title of the document to *Standard for Manufacturer's Design of Fire Department Ground Ladders* and revised the scope and purpose statements to emphasize that the document is for the ground ladder manufacturer, not the end user. The entire document was revised to comply with the *Manual of Style for NFPA Technical Committee Documents* and updated to clarify vague or ambiguous language in the standard.

The 2010 edition of this standard included multipurpose ladders. NFPA 1901, *Standard for Automotive Fire Apparatus*, recognized the installation of multipurpose ladders in lieu of folding ladders on apparatus. As such, a statement of construction specification was necessary to ensure a minimum duty rating ladder is employed.

The 2015 edition of NFPA 1931 had few changes from previous editions. The technical committee recognized its mature development and made only minor adjustments to mandatory language.

For the 2020 edition, the committee established a new chapter addressing ladder accessories. Definitions and references to American Ladder Institute standards were also updated.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the design, inspection, testing, and use of ground ladders for the fire service.

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NFPA 1931

Standard for

Manufacturer's Design of Fire Department Ground Ladders

2020 Edition

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Information on referenced and extracted publications can be found in Chapter 2 and Annex B.

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard specifies the requirements for the design of fire department ground ladders and for the design verification tests that are to be conducted by the ground ladder manufacturer.

1.1.2 The tests specified herein are the responsibility of the ladder manufacturer only and are not to be performed by fire departments.

1.2 Purpose.

1.2.1* This standard provides the manufacturer of fire department ground ladders with a set of performance requirements against which ladders are to be certified to ensure that the ground ladders are reliable and safe to use.

1.2.2 It is not the purpose of this standard to specify the details of construction.

1.2.3 The limitations imposed are for the purpose of providing reasonable safety requirements and establishing test methods.

1.3 Application.

1.3.1 This standard applies to the manufacture of all new ground ladders and multipurpose ladders intended for use by fire department personnel for rescue, fire-fighting operations, and training.

1.3.2* These ladders are not to be used for any other purpose.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1932, *Standard on Use, Maintenance, and Service Testing of In-Service Fire Department Ground Ladders*, 2020 edition.

2.3 Other Publications.

2.3.1 ALI Publications. American Ladder Institute, 330 North Wabash Avenue, Suite 2000, Chicago, IL 60611.

ANSI-ASC A14.1, *American National Standard for Ladders — Wood Safety Requirements*, 2007.

ANSI-ASC A14.2, *American National Standard for Ladders — Portable Metal — Safety Requirements*, 2017.

ANSI-ASC A14.5, *American National Standard for Ladders — Portable Reinforced Plastic — Safety Requirements*, 2017.

ANSI-ASC A14.8, *American National Standard for Ladders — Safety Requirements for Ladder Accessories*, 2013.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2016.

2.3.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections. (Reserved)

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

3.2.4 Should. Indicates a recommendation or that which is advised but not required.

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Angle of Inclination. The angle incorporated between the beams and a level plane.

3.3.2 Attic Extension Ladder. An extension ladder that is specifically designed to be used to gain entry through a scuttle, hatch, or other similarly restricted opening.

3.3.3 Bark Pocket. See 3.3.45.1, **Bark Pocket Wood Irregularity**.

3.3.4 Base (Bed) Section. The lowest or widest section of an extension ladder.

3.3.5 Beam (Side Rail). The main structural side of the ground ladder.

3.3.6 Bedded Position. The position in which the fly section(s) of an extension ladder is fully retracted with the pawls engaged.

3.3.7* Butt. The end of the beam that is placed on the ground, or other lower support surface, when ground ladders are in the raised position.

3.3.8* Butt Spurs (Feet). That component of ground ladder support that is in contact with the lower support surface to reduce slippage.

3.3.9 Check. See 3.3.45.2, **Check Wood Irregularity**.

3.3.10 Collapsible Ladder. See 3.3.18, **Folding Ladder**.

3.3.11 Combination Ladder. A ground ladder that is capable of being used both as a stepladder and as a single or extension ladder.

3.3.12* Design Verification Tests. Tests of a ladder structure and components thereof that are performed by the ladder manufacturer to prove conformance to design requirements and which can potentially compromise the integrity of the tested ladder.

3.3.13 Designated Length. The length marked on the ladder.

3.3.14 Duty Rating. The maximum load the ladder is designed to support when it is in use and properly positioned.

3.3.15 Extension Ladder. A non-self-supporting ground ladder that consists of two or more sections traveling in guides, brackets, or the equivalent arranged so as to allow length adjustment.

3.3.16 Fire Department Ground Ladder. Any portable ladder specifically designed for fire department use in rescue, fire-fighting operations, or training.

3.3.17 Fly Section(s). The upper section(s) of an extension ladder.

3.3.18 Folding Ladder. A single-section ladder with rungs that can be folded or moved to allow the beams to be brought into a position touching or nearly touching each other.

3.3.19 Halyard. Rope used on extension ladders for the purpose of raising a fly section(s).

3.3.20 Heat Sensor Label. A label that changes color at a preset temperature to indicate a specific heat exposure.

3.3.21 Knot. See 3.3.45.3, **Knot Wood Irregularity**.

3.3.22 Ladder. A device consisting of two beams (side rails) joined at regular intervals by cross pieces called rungs on which a person is supported during climbs for ascending or descending. (See also 3.3.30, **Pompier Ladder**.)

N 3.3.23 Ladder Accessory. A device that — when installed or attached to a ladder — expands the ladder’s function, utility, and safety, but is not essential for the ladder’s intended function.

3.3.24 Ladder Nesting. The procedure whereby ladders of different sizes are positioned partially within one another to reduce the amount of space required for their storage on the apparatus.

3.3.25 Maximum Extended Length. The total length of the extension ladder when all fly sections are fully extended and all pawls are engaged.

3.3.26* Multipurpose Ladder. A ground ladder capable of being used as either a step ladder or a straight ladder and comprising two telescoping adjustable-length-section assemblies connected via a hinge assembly.

3.3.27 Pawls. Devices attached to a fly section(s) to engage ladder rungs near the beams of the section below for the purpose of anchoring the fly section(s); also referred to as “dogs.”

3.3.28 Permanent Deformation. That deformation remaining in any part of a ladder or its components after all test loads have been removed from the ladder.

3.3.29 Pitch Pocket. See 3.3.45.4, **Pitch Pocket Wood Irregularity**.

3.3.30 Pompier Ladder (Scaling Ladder). A ladder having a single center beam only with rungs protruding on either side of the beam and with a large hook on top that is used for scaling.

N 3.3.31 Pulley. A device attached to a ladder section, consisting of a wheel(s) over which a rope or cable runs for the purpose of changing direction while extending or lowering an extension ladder.

3.3.32 Roof Ladder. A single ladder equipped with hooks at the top end of the ladder.

3.3.32.1 Double-Ended Roof Ladder. Roof ladder with hooks at both ends and spurs on at least one end.

3.3.33 Rungs. The ladder cross pieces on which a person steps while ascending or descending.

3.3.34 Scaling Ladder. See 3.3.30, Pompier Ladder.

3.3.35 Side Rail. See 3.3.5, Beam.

3.3.36 Single Ladder. A non-self-supporting ground ladder, nonadjustable in length, consisting of only one section.

3.3.37 Slope of Grain. See 3.3.45.5, *Slope of Grain Wood Irregularities*.

3.3.38 Split. See 3.3.45.6, *Split Wood Irregularity*.

3.3.39 Staypoles (Tormentors). Poles attached to each beam of the base section of extension ladders and used to assist in raising the ladder and to help provide stability of the raised ladder.

3.3.40 Tip. The end of the ladder opposite the butt end.

3.3.41 Tormentors or Tormentor Poles. See 3.3.39, Staypoles.

3.3.42 Ultimate Failure. Collapse of a ground ladder structure or component thereof.

3.3.43 Visible Damage. A permanent change in condition that is clearly evident by visual inspection without recourse to optical measuring or observation devices.

3.3.44 Visual Inspection. Observation by eye unaided by optical devices, except prescription eyeglasses or lenses.

3.3.45 Wood Irregularities. Natural characteristics in or on the wood that can lower its durability, strength, or utility.

3.3.45.1* Bark Pocket Wood Irregularity. An opening between annual growth rings that contains bark.

3.3.45.2 Check Wood Irregularity. A separation of the wood along the fiber direction that usually extends across the rings of annual growth and commonly results from stresses set up in the wood during seasoning.

3.3.45.3* Knot Wood Irregularity. A portion of a branch or limb embedded in the tree and cut during the process of lumber manufacture.

3.3.45.4 Pitch Pocket Wood Irregularity. An opening extending parallel to the annual growth rings that contains, or that has contained, either solid or liquid pitch.

3.3.45.5* Slope of Grain Wood Irregularities. A deviation of the fiber direction from a line parallel to the sides of the piece.

3.3.45.6 Split Wood Irregularity. A separation of the wood parallel to the fiber direction due to tearing of the wood fibers.

Chapter 4 Ladder Design

4.1 Requirements for All Ground Ladders.

4.1.1 Duty Rating. Ground ladders shall have a duty rating as specified in Table 4.1.1 when raised at a 75½ degree angle of inclination.

Table 4.1.1 Ground Ladder Duty Rating

Type	Maximum Load	
	kg	lb
Folding ladders	136	300
Multipurpose ladders	136	300
Pompier ladders	136	300
Combination ladders	340	750
Single and roof ladders	340	750
Extension ladders	340	750

4.1.2 Materials of Construction. Materials used in ground ladder construction shall meet the performance requirements of this standard.

4.1.2.1 All structural components of ground ladders shall be constructed of materials such that the ground ladder maintains at least 75 percent of the strength necessary to pass all test requirements in this standard at 149°C (300°F).

4.1.2.2 If varying types of metal are used in the construction of ground ladders, then the metals shall be chosen or finished to reduce electrolytic action.

4.1.2.3 Fiberglass materials shall meet the performance requirements of Chapter 7 of ANSI-ASC A14.5, *American National Standard for Ladders—Portable Reinforced Plastic—Safety Requirements*.

4.1.2.4 Wood components shall meet the requirements of Chapter 5 of ANSI-ASC A14.1, *American National Standard for Ladders—Wood Safety Requirements*.

4.1.2.5 Wood irregularities shall not exceed the following requirements:

- (1) The general slope of the grain shall not be steeper than 1 in 15.
- (2) Knots shall not appear, except that pin knots in rungs shall be permitted.

Pitch and bark pockets shall be permitted, provided that there is not more than one that is 1 mm ($\frac{1}{32}$ in.) in width, 51 mm (2 in.) in length, and 3 mm ($\frac{1}{8}$ in.) in depth.

Checks shall not be more than 51 mm (2 in.) in length or 3 mm ($\frac{1}{8}$ in.) in depth.

- (3) Splits shall not be more than 51 mm (2 in.) in length or 3 mm ($\frac{1}{8}$ in.) in depth.
- (4) Cracks shall not be permitted.
- (5) Compression wood shall not be permitted.
- (6) Cross grain shall not be permitted.
- (7) Chambers associated with black streaks shall not be permitted.

4.1.3 Ladder Construction.

4.1.3.1 Ground ladders shall be constructed in a manner to ensure that structural and workmanship defects do not exist that result in the structural strength being reduced below the requirements of this standard.

4.1.3.2 Ground ladders shall be constructed in a manner to ensure that sharp edges, burrs in excess of 0.4 mm ($\frac{1}{64}$ in.), or other defects that cut or tear clothing or skin do not exist.

4.1.3.3 The beams at the tip of each section of an extension ladder or a roof ladder shall be rounded to allow the ladder to slide on irregular surfaces without catching or snagging during placement or operations, except a single ladder, which can have butt spurs on both ends.

4.1.3.4 Butt spurs shall be provided on the butt end of each beam of single ladders and on the butt end of each beam of the base section of extension ladders.

4.1.3.5 Rungs shall not be less than 32 mm (1¼ in.) in diameter except as allowed by 4.1.3.5.1 and 4.1.3.5.2.

4.1.3.5.1 Folding, multipurpose, and pompier ladder rungs shall be excluded from this requirement.

4.1.3.5.2 Swell center rungs on wood ladders shall be permitted to taper to 28.6 mm (1⅝ in.).

4.1.3.6* Rungs shall be uniformly spaced ± 3 mm ($\pm \frac{1}{8}$ in.) on centers that are between 305 mm and 356 mm (12 in. and 14 in.).

4.1.3.7* The surfaces of rungs that are designed for use while ascending, descending, working, or standing shall be corrugated, serrated, knurled, dimpled, or coated with a skid-resistant material across their entire width.

4.1.4 Ladder Marking.

4.1.4.1 The designated length of the ground ladder shall be marked within 305 mm (12 in.) of the butt of each beam of single ladders and on each beam of the base section of extension ladders.

4.1.4.2 An alphanumeric code and the month and year of manufacture shall be branded or metal-stamped on each ground ladder or stamped on a metal plate that is permanently attached to each ground ladder.

4.1.4.3 All metal ground ladders shall bear the electrical hazard warning label that is shown in Figure 4.1.4.3 on the outside of each beam between 1.37 m and 1.83 m (4½ ft and 6 ft) from the butt.

4.1.4.4 All fiberglass and wood ground ladders shall bear the electrical hazard warning label that is shown in Figure 4.1.4.4 on the outside of each beam between 1.37 m and 1.83 m (4½ ft and 6 ft) from the butt.

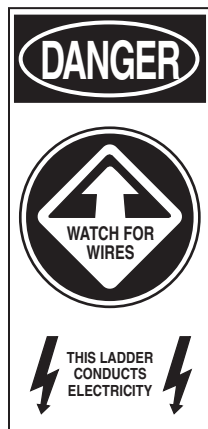


FIGURE 4.1.4.3 Electrical Hazard Warning Label for Metal Ground Ladders.

4.1.4.5 All ground ladders shall bear the ladder positioning label that is shown in Figure 4.1.4.5 between 1.37 m and 1.83 m (4½ ft and 6 ft) from the butt on the outside of both beams. Single ladders that are designed to be asymmetrical shall be permitted to have the label without the word “out” and the directional arrow.



FIGURE 4.1.4.4 Electrical Hazard Warning Label for Fiberglass and Wood Ground Ladders.

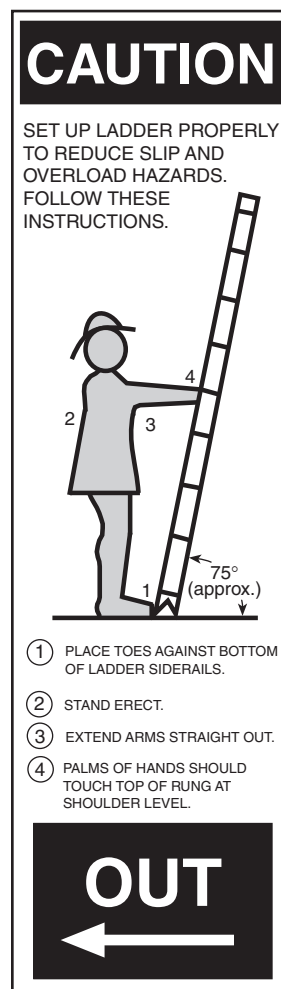


FIGURE 4.1.4.5 Ladder Positioning Label.