NFPA 1932
Standard on Use, Maintenance, and Service Testing of Fire Department Ground Ladders

1999 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Standard on

Use, Maintenance, and Service Testing of Fire Department Ground Ladders

1999 Edition

This edition of NFPA 1932, *Standard on Use, Maintenance, and Service Testing of Fire Department Ground Ladders,* was prepared by the Technical Committee on Fire Department Ground Ladders and acted on by the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

This edition of NFPA 1932 was approved as an American National Standard on August 13, 1999.

Origin and Development of NFPA 1932

In 1984, the text of NFPA 1931 was divided into two documents with NFPA 1931 containing the requirements for manufacturers on design and design verification testing for new ground ladders. NFPA 1932 was developed as a companion document to cover the requirements for the use, maintenance, and service testing of fire department ground ladders.

The 1989 edition added requirements for routine maintenance as well as additional cautions regarding accidental heating of ladders. The horizontal bending test for folding ladders was added. The horizontal bending test for extension ladders was modified to reflect changes determined acceptable from field experience with the use of the test method.

The 1994 edition removed an exception that allowed the authority having jurisdiction to use a reduced test weight for the horizontal bending test for extension ladders built prior to 1984. This exception was in previous editions to allow a phase in to the more stringent testing requirement introduced in 1984. The standard was revised in a number of places to keep it up to date, including adding requirements for retrofitting heat sensor labels after appropriate testing.

This 1999 edition incorporates minor editorial revisions, removes some ambiguous wording, and rearranges the document to better organize the material. Requirements on the storage of ground ladders were moved to Chapter 2 and the title of that chapter was changed to Ground Ladder Mounting and Storage. Inspection issues are now presented in Section 4-1 while maintenance issues are presented in Section 4-2. Chapter 5 was rearranged to put the test procedures for optional testing after the procedures for required testing.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of this document.

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.

Contents

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Appendix B.

Chapter 1 Administration

1-1 Scope.

1-1.1* This standard specifies requirements for the use, maintenance, inspection, and service testing of fire department ground ladders.

1-1.2* This standard shall apply to all ground ladders, regardless of year of manufacture, used by fire departments for rescue, fire-fighting operations, and training. Fire department ground ladders shall not be used for any other purpose.

1-1.3 The service tests specified in this standard shall be the only tests conducted by fire department personnel, or other testing personnel, on in-service fire department ground ladders.

1-2* Purpose.

1-2.1 The purpose of this standard shall be to provide reasonable safety for fire fighters and victims during the use of fire department ground ladders.

1-2.2 This standard also shall provide users of fire department ground ladders with a means to determine if in-service fire department ground ladders meet the standard for continued service.

1-3 Definitions.

Angle of Inclination. The pitch for portable, non–self-supporting ground ladders.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

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

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

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

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. A butt can be the lower end of beams, or can be added devices.

Butt Spurs (Feet). That component of ground ladder support that is in contact with the lower support surface to reduce slippage. It can be the lower end of beams, or can be added devices.

Collapsible Ladder. See *Folding Ladder.*

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

Design Verification Tests.* Tests of a ladder structure and components thereof to prove conformance to the requirements of NFPA 1931, *Standard on Design of and Design Verification Tests for Fire Department Ground Ladders,* 1999 edition.

Designated Length. The length marked on the ladder.

Dogs. See *Pawls.*

Duty Rating. The recommended in-service working load.

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.

Fire Department Ground Ladder. Any portable ladder specifically designed for fire department use in rescue, fire-fighting operations, or training, and not permanently attached to fire apparatus.

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

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.

Free Weight.* Test weights that are not controlled from any direction except by the force of gravity.

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

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

In-Service Fire Department Ground Ladder. Any ground ladder that meets the requirements of this standard and currently is in use or available for use by a fire department.

Inside Ladder Width. The distance measured from the inside edge of one beam to the inside edge of the opposite beam. *(See also Outside Ladder Width.)*

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

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.

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

Nondestructive Tests (NDT). A method of testing that does not damage the ladder structure or components thereof.

Outside Ladder Width. The distance measured from the outside edge of one beam to the outside edge of the opposite beam, or the widest point of the ladder including staypoles when provided, whichever is greater. *(See also Inside Ladder Width.)*

Pawls. Devices attached to a fly section(s) to engage ladder rungs near the beams for the purpose of anchoring the fly section(s) when extension ladders are used in the extended position.

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

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.

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

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

Scaling Ladder. See *Pompier Ladder.*

Service Tests. Tests performed on a ground ladder to determine if it meets the standard for continued service.

Set. See *Permanent Deformation.*

Shall. Indicates a mandatory requirement.

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

Side Rail. See *Beam.*

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

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

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.

Tested. Verification of compliance with test requirements as specified in this standard.

Tormentors or Tormentor Poles. See *Staypoles.*

Ultimate Failure. Collapse of a ground ladder structure or components thereof.

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

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

Working Length. The length of a non–self-supporting portable ladder measured along the beams from the base support point of the ladder to the point of bearing at the top.

Chapter 2 Ground Ladder Mounting and Storage

2-1 Requirements for Mounting of Ground Ladders.

2-1.1 Ground ladders shall not be forced into brackets or slides on fire apparatus. Ground ladder nesting requirements shall be based on outside ladder width.

2-1.2 Ground ladders shall be protected to prevent movement and abrasion, or other damage, to the ground ladder while on the fire apparatus.

2-1.3 When mounted on the apparatus, ground ladders shall not be subject to exposure to heat sources (such as engine heat) of 300°F (149°C) or greater.

2-1.4 Side- or top-mounted ground ladders shall be supported to prevent any sagging or distortion.

2-1.5 The rollers and other moving parts of the frame holding the ground ladders on the apparatus shall be lubricated in accordance with the apparatus manufacturer's instructions at least every 6 months. Prior to relubricating rollers or moving parts, old lubricant shall be removed. If rollers and other moving parts are rusted, they shall be brushed with a wire brush and cleaned to remove all loose scale, and then painted before lubricating.

2-2 Requirements for Storage of Ground Ladders.

2-2.1 Ground ladders shall not be stored in an area where they are exposed to the elements.

2-2.2* Wood ground ladders shall be stored away from steam pipes, radiators, forced hot air heaters, and out of the direct sunlight.

2-2.3* Fiberglass ground ladders shall be stored out of direct sunlight.

Chapter 3 Use of Ground Ladders

3-1 Requirements for All Ground Ladders.

3-1.1* Ground Ladder Loading. The total weight on the ground ladder, including persons, their equipment, and any other weight, such as a charged fire hose, shall not exceed the duty rating load as given in Table 3-1.1. These loads shall not be imposed on the ground ladder unless the ground ladder is set at the correct angle of inclination and secured as specified in this section.

Table 3-1.1 Ground Ladder Duty Rating

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

3-1.2 Ground ladders shall be visually inspected in accordance with Section 4-1 after each use. If, in an emergency, ground ladders are used other than as specified in this standard, they shall be removed from service, inspected, and service tested prior to further use.

3-1.3 Ground ladders shall be used for rescue, fire-fighting operations, and training and shall not be used for any other purpose.

3-1.4 Ground ladders shall not be tied together to provide longer units.

3-1.5 Ground ladder butts shall be set on a firm, level base before ground ladders are used.

3-1.6 Ground ladders shall not be placed on ice, snow, or slippery surfaces unless means to prevent slipping are employed.

3-1.7* Ground ladders shall be secured at the base, either by a fire fighter or by mechanical means, to prevent slippage. Extreme caution shall be used when the angle of inclination is less than 70 degrees. At angles less than 70 degrees, mechanical means shall be used to prevent slippage.

3-1.8 Ground ladders shall be secured at the top, to prevent slippage, by the first person to climb the ladder.

3-1.9* To provide the optimum combination of load carrying and stability, ground ladders shall be set at the correct angle of inclination by positioning the base section a horizontal distance from the vertical wall equal to one-quarter the effective working length of the ground ladder. An angle of inclination of between 70 and 76 degrees shall be permitted with an angle of $75\frac{1}{2}$ degrees being optimum.

3-1.10 Raised ground ladders shall not be slid along cornices or roof edges.

3-1.11 Ground ladders shall not be "rolled" beam-over-beam to reach a new position.

3-1.12 Raised ground ladders shall not be repositioned from the top, nor shall they be repositioned while a person is on the ladder.

3-1.13 Ground ladders that have been removed from apparatus shall not be exposed to heat (such as from the apparatus exhaust pipe) of 300°F (149°C) or greater.

3-2 Additional Requirements for Extension Ladders.

3-2.1 Fly sections of extension ladders shall not be used as single ladders unless they have been certified by the manufacturer for single ladder use.

3-2.2 Extension ladders shall be used in the fly-up, fly away from the building position unless otherwise specified by the manufacturer.

3-2.3* Halyards on extension ladders shall be tied off to the base section or shall be otherwise secured before the ground ladder is climbed.

3-2.4 Length adjustments shall not be made from the top of extension ladders.

3-2.5 If an extension ladder is equipped with staypoles, the staypoles shall be placed to act as stabilizers and shall not be placed so as to become load-bearing members under no load conditions (no one on the ladder).

3-2.6* If an extension ladder is equipped with staypoles and both poles cannot be properly placed due to obstructions or terrain, then neither staypole shall be placed.

3-3 Additional Requirements for Metal Ground Ladders. Extreme caution shall be used when working around charged electrical circuits because metal ground ladders conduct electricity. All metal ground ladders shall be kept away from power lines or other potential electrical hazards.

3-4* Additional Requirements for Wood Ground Ladders. Extreme caution shall be used around electrical hazards because wet wood ground ladders can conduct electricity.

3-5* Additional Requirements for Fiberglass Ground Ladders. Extreme caution shall be used around electrical hazards because wet fiberglass ground ladders can conduct electricity.

Chapter 4 Inspection and Maintenance of Ground Ladders

4-1 Inspection of Ground Ladders.

4-1.1 All ground ladders shall be inspected in accordance with the manufacturer's recommendations.

4-1.2 Ground ladders shall be visually inspected at least once every month and after each use.

4-1.3 A visual inspection shall include, but not be limited to, the following:

(1) Heat sensor labels on metal and fiberglass ladders, and on wood ladders if provided, for a change indicating heat exposure
(2) All rungs, for snugness and tightness
(3) All bolts and rivets for tightness; bolts on wood ladders for snugness and tightness without crushing the wood
(4) Welds, for any cracks or apparent defects
(5) Beams and rungs, for cracks, splintering, breaks, gouges, checks, wavy conditions, or deformation
(6) Butt spurs, for excessive wear or other defects
(7) Halyards, for fraying or kinking
(8) Roof hooks for sharpness and proper operation
(9) Rungs, for punctures, wavy conditions, worn serrations, or deformation
(10) Surface corrosion
(11) Ladder slide areas, for galling or absence of wax, if required by the manufacturer
(12) Loss of gloss on fiberglass and wood ladder beams, damage to the varnish finish on wood ground ladders
(13) Proper operation of the pawl assemblies
(14) Wire rope on 3- and 4-section ladders for snugness when the ladder is in the bedded position, to ensure proper synchronization of upper sections during operation

4-1.4 Any signs of damage or defect during a visual inspection shall be cause to remove the ground ladder from service until it has been repaired for fire service use or until it is destroyed. Scratches and dents shall not be cause to fail a ladder if it passes the appropriate load test as specified in Chapter 5.

4-1.5 If a wood ground ladder develops dark streaks in the beams, the ladder shall be removed from service and shall be service tested as specified in Chapter 5 prior to further use.

4-2 Maintenance of Ground Ladders.

4-2.1 All ground ladders shall be maintained in accordance with the manufacturer's recommendations. Temporary repairs of damaged or missing ladder parts shall not be made.

4-2.2 Ground ladders that are not maintained as specified in this standard shall be removed from service and shall be service tested as specified in Chapter 5 prior to further use.

4-2.3 Ground ladders shall be maintained as free of moisture as is possible and shall be wiped dry after being sprayed with water or used in the rain.

4-2.4 Ground ladders shall not be painted except for the top and bottom 18 in. (457 mm) of each section for purposes of identification or visibility.

4-2.5* Pawl assemblies on extension ladders shall be kept clean and lubricated in accordance with the manufacturer's instructions.

4-2.6 Ladder slide areas on extension ladders shall be kept lubricated in accordance with the manufacturer's instructions.

4-2.7* Halyards and wire rope on extension ladders shall be replaced when they become frayed or kinked.

4-2.8 Folding roof hook assemblies on roof ladders shall be kept operational by removing rust and other contaminants and by keeping the mechanisms lubricated.

4-2.9 Surface Finish.

4-2.9.1 The surface finish on fiberglass ground ladders shall be maintained in accordance with the ladder manufacturer's recommendations.

4-2.9.2 Wood ground ladders shall be protected by at least three coats of phenolic-tung oil varnish with ultraviolet ray inhibitors.

4-2.9.3 The varnish finish on wood ground ladders shall be redone at least annually or at such frequency as specified by the ladder manufacturer.

4-2.9.4 If the varnish coating becomes damaged, the following procedure shall be conducted to repair the finish.

(1) Peeling areas shall be removed by scraping and sanding with sandpaper to remove all the loose or damaged finish.
(2) Bare sanded spots shall be spot-primed with varnish.
(3) The coating shall be resanded when dry and coated with at least two coats of clear spar varnish.

4-2.10 Heat Sensor Labels.

4-2.10.1* If the heat sensor label has an expiration date and that date has passed, the heat sensor label shall be replaced.

4-2.10.2 If the ladder is constructed of metal or fiberglass materials and it does not have heat sensor labels, the ladder shall be tested in accordance with Chapter 5. If the ladder passes all the tests, heat sensor labels shall be applied to the ladder. The heat sensor labels shall be located on the inside of each beam of each section immediately below the second rung from the tip of each section and in the center of that section.

Exception: For folding ladders, the heat sensor labels shall be permitted to be applied to either the inside or outside of the ladder.

Chapter 5 Service Testing Ground Ladders

5-1 Requirements for All Ground Ladders.

5-1.1 The design verification tests specified in NFPA 1931, *Standard on Design of and Design Verification Tests for Fire Department Ground Ladders*, 1999 edition, shall *not* be performed by fire departments. Design verification tests to certify compliance with NFPA 1931 shall be the responsibility of the ground ladder manufacturer only.

5-1.2* The service tests for ground ladders specified in this chapter shall be conducted by the fire department or by a testing organization that is acceptable to the authority having jurisdiction.

5-1.3* Caution shall be used when performing service tests on ground ladders to prevent damage to the ladder or injury to personnel during testing. The test load shall be placed on the ladder in a manner so as to avoid any shocks or any impact loading.

5-1.4 Personnel involved in service testing shall be competently trained in the service testing procedures and equipment. Personnel shall be fully cognizant at all times of the possibility of sudden and dramatic failure of the ground ladder undergoing service testing, and shall take all personal safety precautions possible to protect themselves.

5-1.5 Any ground ladder that appears to be unserviceable, or bordering on unserviceability, shall be service tested or destroyed.

5-1.6 Any signs of failure during service testing shall be cause to remove the ground ladder from service until it has been repaired for fire service use or until it is destroyed.

5-1.7 All ground ladders shall be service tested on the following schedule:

(1) Before the ladder is placed in service for the first time
(2) At least annually
(3) At any time a ladder is suspected of being unsafe
(4) After the ladder has been subjected to overloading *(see Table 3-1.1)*
(5) After the ladder has been subjected to impact loading or unusual conditions of use
(6) After heat exposure *(see 5-1.8, 5-1.9, and 5-1.10)*
(7) After any repairs have been completed, unless the only repair was replacing the halyard

5-1.7.1 All ground ladders, except pompier ladders and folding ladders, shall be service tested as specified in Section 5-2.

5-1.7.2 Pompier ladders shall be service tested as specified in Section 5-3.

5-1.7.3 Folding ladders shall be service tested as specified in Section 5-4.

5-1.8 Whenever any metal ground ladder has been exposed or is suspected of having been exposed to direct flame contact, or whenever the heat sensor label has changed to indicate heat exposure, the ladder shall be service tested as specified in either Section 5-2 or Section 5-5.

5-1.9 Whenever any wood ground ladder has been exposed or is suspected of having been exposed to direct flame contact, the ladder shall be service tested as specified in Section 5-2.

5-1.10 Whenever any fiberglass ground ladder has been exposed or is suspected of having been exposed to direct flame contact, or whenever the heat sensor label has changed to indicate heat exposure, the ground ladder shall be service tested as specified in Section 5-2.

5-1.11 All service test results shall be permanently recorded. Minimum information recorded shall be as required in Figure 5-1.11.

Figure 5-1.11 Fire department ground ladder record.

Manufacturer's ladder identification number or code _____

Fire department identification (if different) _____

Ground ladder manufacturer _____

Fire department company where ground ladder is assigned _____

Date purchased _____

Date placed in service _____

Type of Ground Ladder

❑ Single ❑ Combination
❑ Roof ❑ Folding
❑ Extension ❑ Pompier

Ladder Construction

❑ Wood ❑ Solid beam
❑ Metal ❑ Truss beam
❑ Fiberglass

Heat sensor label check _____

Previous repairs, reason for repair, and date of repair _____

_____

Type of test, test date, and person(s) performing test _____

_____

Reason for test _____

Test Results

Horizontal bending test — amount of permanent deformation _____

❑ Passed ❑ Failed

Hardware test

❑ Passed ❑ Failed

Roof hook test

❑ Passed ❑ Failed

Pompier ladder test

❑ Passed ❑ Failed

Hardness test — readings for each test point _____

❑ Passed ❑ Failed

Liquid penetrant test — location of inspection and results _____

Repairs needed _____

Repairs completed _____

Person(s) performing repairs _____

Date completed _____

Person signing record _____

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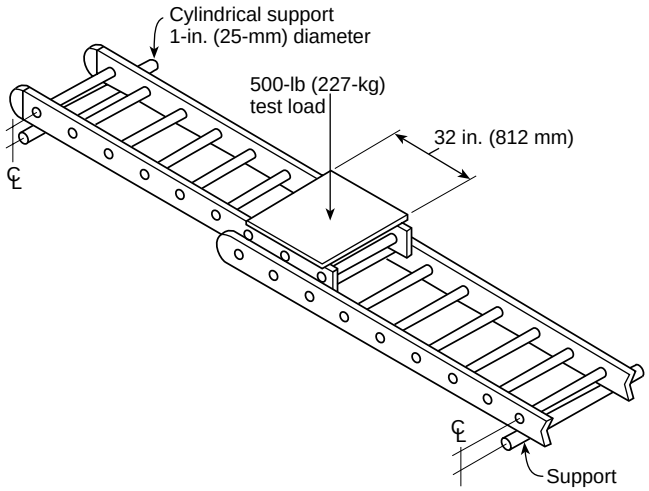
5-1.12 If the ground ladder does not meet all the requirements of this chapter, the ladder shall be removed from service, repaired, and tested for fire service use, or it shall be destroyed.

5-2 Strength Service Testing Requirements for All Ladders Except Pompier and Folding Ladders.

5-2.1* Horizontal Bending Test. All ladders, except pompier and folding ladders, shall be strength service tested as required by 5-1.7 in accordance with 5-2.1.1 through 5-2.1.3. Hardness service testing as permitted in Section 5-5 shall not replace the need for load testing as required by 5-1.7.

5-2.1.1 The ladder shall be placed in a flat horizontal position and supported under the first rung from each end of the ladder as shown in Figure 5-2.1.1. Extension and combination ladders shall be extended to their maximum extended length, with pawls engaged. The test load shall be applied equally to a center span that covers 16 in. (406 mm) each side of the center inclusive. The test load shall be applied to a flat test surface resting on the beams in the center area. The test load shall consist of free weights in increments consistent with safety and ease of handling. All test loads shall include the weight of the test surface.

Figure 5-2.1.1 Extension ladder positioned for horizontal bending test.



5-2.1.2 Metal and Fiberglass Ground Ladders. Metal and fiberglass ground ladders shall be tested in accordance with 5-2.1.2.1 through 5-2.1.2.7.

5-2.1.2.1 Straps or other ties that do not increase the strength of the ladder shall be permitted to be used to ensure that the ladder locks remain engaged during the test.

5-2.1.2.2 The ladder shall be loaded with a preload of 350 lb (159 kg) applied equally to the center span that covers 16 in. (406 mm) each side of the center inclusive. Caution shall be exercised whenever applying or removing the weights to minimize any impact loading. The load shall be allowed to remain for at least 1 minute to "set" the ladder prior to completing the rest of the test.

5-2.1.2.3 After removing the preload, the distance between the bottom edge of each side rail and the surface upon which the ladder supports are placed shall be measured. All measurements shall be taken at a consistent location at the center of the ladder.

5-2.1.2.4 The ladder shall be loaded with a test load of 500 lb (227 kg) applied equally to the center span that covers 16 in. (406 mm) each side of the center inclusive. The test load shall remain in place for 5 minutes.

5-2.1.2.5 The test load shall then be removed and the distance between the bottom of each side rail and the surface upon which the ladder supports are placed shall be measured. Five minutes shall elapse after removing the test loads before conducting this measurement.

5-2.1.2.6 Differences in measurements taken in 5-2.1.2.3 and 5-2.1.2.5 shall not exceed those values shown in Table 5-2.1.2.6. Any ladder that does not meet this criterion shall be removed from fire service use and shall be destroyed.

Table 5-2.1.2.6 Allowable Differences in Horizontal Bending Test Recovery

Length of Ladder (ft)	Difference in Measurements (in.)
25 or less	$^1/_2$
26–34	1
35 or over	$1^1/_2$

For SI units: 1 in. = 25.4 mm; 1 ft = 0.3048 m

5-2.1.2.7 There shall be no visible permanent change or failure of any hardware.

5-2.1.3 Wood Ground Ladders. Wood ground ladders shall be tested in accordance with 5-2.1.3.1 and 5-2.1.3.2.

5-2.1.3.1 The ladder shall be loaded with a test load of 500 lb (227 kg) applied equally to a center span that covers 16 in. (406 mm) each side of the center inclusive. The test load shall remain in place for 5 minutes and then be removed.

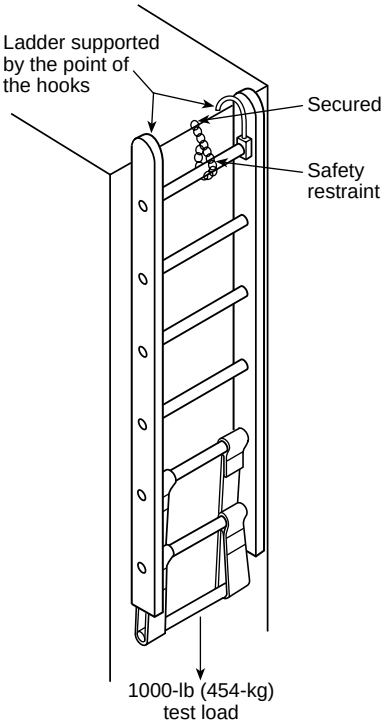
5-2.1.3.2 To pass the test, the ladder and all components shall not show ultimate failure. Any ladder that does not meet this criterion shall be removed from fire service use and shall be destroyed.

5-2.2 Test Procedure for Roof Hooks. If the ladder is equipped with roof hooks, the roof hooks shall be tested in accordance with 5-2.2.1 through 5-2.2.5.

5-2.2.1 The test method depicted in 5-2.2.2 through 5-2.2.5 represents the preferred method of testing the roof hooks. Variations from the specific method depicted herein shall be permitted provided the variations are acceptable to the authority having jurisdiction and the variations provide equivalent results and are consistent with the intent of this preferred test method.

5-2.2.2 The ladder shall be positioned for testing and shall be tested as shown in Figure 5-2.2.2. The ladder shall be hung solely by the roof hooks, with the hooks supported only by the points of the hooks, in a vertical position from a fixture that is capable of supporting the entire test load and weight of the ladder. The ladder shall be secured in such a manner to retain the ladder in the test position to prevent injury to test personnel if the hooks fail during the test.

Figure 5-2.2.2 Roof ladder positioned for roof hook test.



5-2.2.3 A test load of 1000 lb (454 kg) shall be placed over as many rungs as needed. The test load shall consist of weight increments that are consistent with safety and ease of handling.

5-2.2.4 The test load shall be applied for a minimum of 1 minute.

5-2.2.5* After removal of the test load, there shall be no permanent deformation.

5-2.3 Test Procedure for Extension Ladder Hardware. If the ladder is an extension ladder, the hardware shall be tested in accordance with 5-2.3.1 through 5-2.3.5.

5-2.3.1 The test method depicted in 5-2.3.2 through 5-2.3.5 represents the preferred method of testing the extension ladder hardware. Variations from the specific method depicted herein shall be permitted provided the variations are acceptable to the authority having jurisdiction and the variations provide equivalent results and are consistent with the intent of this preferred test method.

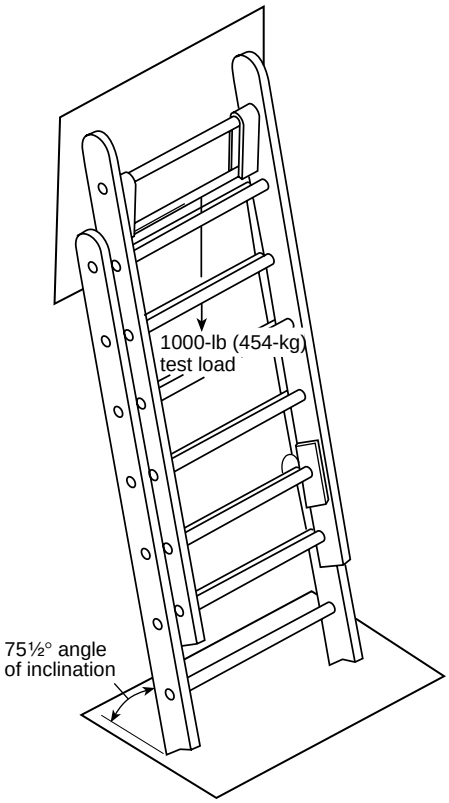
5-2.3.2 The ladder shall be positioned for testing and shall be tested as shown in Figure 5-2.3.2. The ladder shall be extended a minimum of one rung beyond the bedded position.

5-2.3.3 A test load of 1000 lb (454 kg) shall be placed on the rungs of the fly section. The test load shall consist of weight increments that are consistent with safety and ease of handling.

5-2.3.4 The test load shall be applied for a minimum of 1 minute.

5-2.3.5 Ladders shall sustain this test load with no permanent deformation or other visible weakening of the structure.

Figure 5-2.3.2 Extension ladder positioned for hardware test.



5-3 Service Testing Requirements for Pompier Ladders. All pompier ladders shall be service tested as required by 5-1.7 in accordance with the provisions of 5-3.1 through 5-3.4.

5-3.1 The test method depicted in 5-3.2 through 5-3.4 represents the preferred method of testing the strength of pompier ladders. Variations from the specific method depicted herein shall be permitted provided the variations are acceptable to the authority having jurisdiction and the variations provide equivalent results and are consistent with the intent of this preferred test method.

5-3.2 The ladder shall be positioned for testing as shown in Figure 5-3.2. The ladder shall be tested in the vertical hanging position supported only by its hook from a fixture that is capable of supporting the entire test load and weight of the ladder. The ladder shall be secured in such a manner to retain the ladder in the test position to prevent injury to test personnel if the hook fails during the test.

5-3.3 A test load of 1000 lb (454 kg) shall be applied over multiple rungs.

5-3.4 The ladder shall withstand this test without ultimate failure. Any pompier ladder that does not meet this criterion shall be removed from fire service use and shall be destroyed.

5-4 Service Testing Requirements for Folding Ladders. All folding ladders shall be service tested as required by 5-1.7 in accordance with the provisions of 5-4.1 through 5-4.4.

5-4.1 The ladder shall be placed in a flat horizontal position and supported under the first rung from each end of the ladder as shown in Figure 5-4.1. Folding ladders shall be in their unfolded configuration for this test.

Figure 5-3.2 Pompier ladder positioned for test.

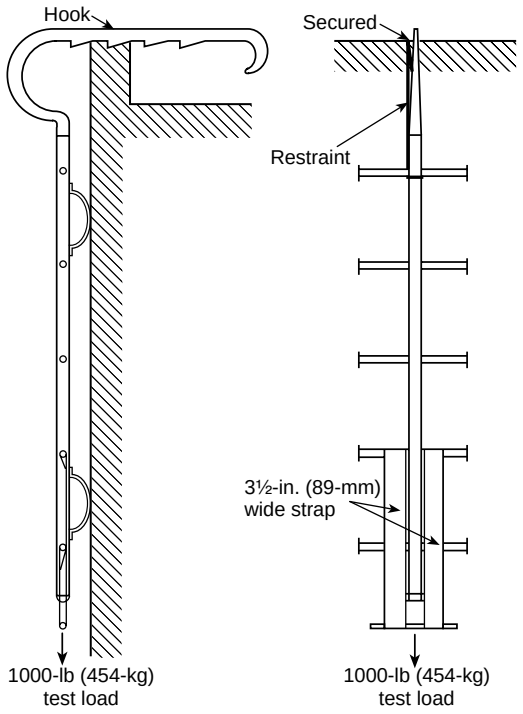
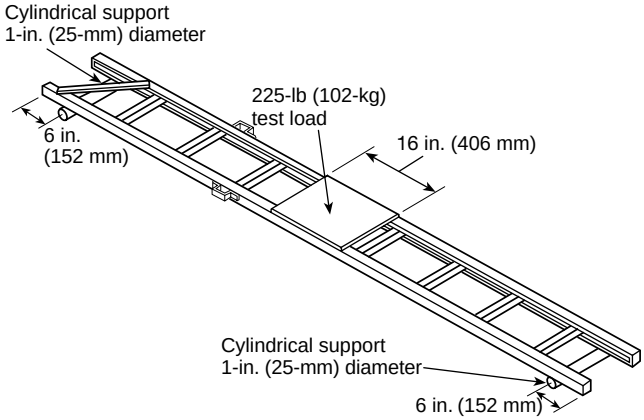


Figure 5-4.1 Folding ladder positioned for horizontal bending test.



5-4.2 The test load shall be applied to a flat test surface resting on the beams in the center area. The test load shall consist of weight increments that are consistent with safety and ease of handling. All test loads shall include the weight of the test surface.

5-4.3 Metal and fiberglass folding ladders shall be tested in accordance with 5-4.5.

5-4.4 Wood folding ladders shall be tested in accordance with 5-4.6.

5-4.5 Metal and Fiberglass Folding Ladders.

5-4.5.1 The ladder shall be loaded with a preload of 160 lb (73 kg) applied equally to the center span that covers 8 in. (203 mm) on each side of the center inclusive. Caution shall be exercised whenever applying or removing the weights to minimize any impact loading. The load shall be allowed to remain for at least 1 minute to "set" the ladder prior to completing the rest of the test.

5-4.5.2 After removing the preload, the distance between the bottom edge of each side rail and the surface upon which the ladder supports are placed shall be measured. All measurements shall be taken at a consistent location at the center of the ladder.

5-4.5.3 The ladder shall be loaded with a test load of 225 lb (102 kg) applied equally to the center span that covers 8 in. (203 mm) on each side of the center inclusive. The test load shall remain in place for 5 minutes.

5-4.5.4 The test load shall then be removed, and the distance between the bottom of each side rail and the surface upon which the ladder supports are placed shall be measured. Five minutes shall elapse after removing the test loads before conducting this measurement.

5-4.5.5 There shall be no more than 0.5 in. (13 mm) difference between measurements taken in 5-4.5.2 and 5-4.5.4. Any ladder that does not meet this criterion shall be removed from fire service use and shall be destroyed.

5-4.5.6 There shall be no visible permanent change or failure of any hardware.

5-4.6 Wood Folding Ladders.

5-4.6.1 The ladder shall be loaded with a test load of 225 lb (102 kg) applied equally to a center span that covers 8 in. (203 mm) on each side of the center inclusive. The test load shall remain in place for 5 minutes and then be removed.

5-4.6.2 To pass the test, the ladder and all components shall not show any permanent damage. Any ladder that does not meet this criterion shall be removed from fire service use and shall be destroyed.

5-5* Hardness Service Testing. If, in the interim between annual strength service testing, any metal ground ladder has been exposed or is suspected of having been exposed to direct flame contact, or whenever the heat sensor label has changed to indicate heat exposure, the ladder shall be permitted to be service hardness tested as specified in this section. Hardness service testing does not replace the need for load testing as required in 5-1.7.

5-5.1 The testing criteria specified in this section shall apply *only* to metal ground ladders constructed from 6061-T6 aluminum alloy. For other aluminum alloys or for other metals, the ladder manufacturer shall supply the hardness testing criteria.

5-5.2 The hardness service test shall be performed at a test point that is located between every rung on both beams. For beams of truss construction, the test point shall be located on both the top chord and the bottom chord of the truss between every rung on both beams. One reading shall be taken at each test point.

5-5.3 The hardness testing device shall be calibrated immediately before testing and calibration shall be verified immediately after testing in accordance with the manufacturer's requirements for that specific hardness testing device.

5-5.4 The reading obtained at each test point shall not be less than the value given for any of the hardness measuring scales specified in Table 5-5.4.

Table 5-5.4 Minimum Single Hardness Readings

Hardness Testing Scale	Minimum Reading
Barber Coleman	76
Brinell	80
Rockwell B	48
Rockwell E	84
Rockwell F	84
Rockwell H	103
Vickers	88

5-5.5 If a reading at a test point is less than the value given in Table 5-5.4 for the respective hardness testing scale, three readings shall be taken at that test point. The average of the three readings shall not be less than the value given in Table 5-5.5. No one reading of these three shall be less than the minimum value given in Table 5-5.5 for the respective hardness testing scale.

Table 5-5.5 Minimum Average Hardness Readings

Hardness Testing Scale	Average of Three Readings Not Less Than	No One Reading At or Less Than
Barber Coleman	76	73
Brinell	80	71
Rockwell B	48	33
Rockwell E	84	79
Rockwell F	84	79
Rockwell H	103	100
Vickers	88	76

5-5.6 If the ladder does not meet the hardness service test requirements specified in 5-5.4 or 5-5.5, the ladder shall be removed from service and shall be tested to the requirements of Section 5-2.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-1.1 Ground ladders used in the fire service must be constructed to rigid standards of the highest quality. These ladders are often the only means of fire fighter entry into a building or portions of a building and might be the only means of egress for victims trapped by a fire within a building. Fire department ladders serve as a means of transporting people, equipment, and extinguishing agents from one area to another. Because the lives of the fire fighters and fire victims often rely on the performance without failure of these valuable pieces of fire department equipment, these standards of performance must be such that ladders can be used with the maximum of ease and assurance at all times.

A-1-1.2 Ladders used by fire department personnel solely at fire stations for maintenance and reaching high places should be covered by the applicable ANSI and OSHA standards for the same.

The service testing procedures contained within this standard are based on the design criteria that are specified in the editions of NFPA 1931, *Standard on Design of and Design Verification Tests for Fire Department Ground Ladders*, since 1984. The 1984 edition of NFPA 1931 included significant increases in the required strength of ladders, based on information and technology that became available after the issuance of the 1979 edition of NFPA 1931. The new information related to dynamic loads that result from actual use.

Ladders that were constructed to comply with earlier editions of NFPA 1931 were designed for lesser loads and less demanding test requirements that were the state of the art at that time. The new criteria are believed to be more accurate and provide a higher level of safety.

A-1-2 It is recognized that specific details on ladder construction materials have been established by other organizations such as the American National Standards Institute, U.S. Department of Agriculture Forest Products Laboratory, and the Aluminum Association. This standard should never be interpreted as establishing lower materials strength criteria than what might be set forth in other recognized standards such as these.

A-1-3 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-1-3 Design Verification Tests. Design verification tests are the responsibility of the manufacturer and are to be performed only on new, unused ladders, which are destroyed after completion of the tests. These tests are not intended to be performed by fire departments.

A-1-3 Free Weight. Free weights typically include sandbags, concrete blocks, water tanks, or lead weights.

A-2-2.2 Continued exposure to a heating source or direct sunlight will cause wood ladders to deteriorate.

A-2-2.3 Continued exposure to direct sunlight will cause ultraviolet erosion of the surface of fiberglass ladders, causing the glass fibers to become exposed.

A-3-1.1 The design criteria for ladders assumes the weight of a fire fighter with protective clothing, SCBA, and equipment to be 250 lb (113 kg). Ladders rated for 300 lb (136 kg) are designed for one person. Ladders rated for 750 lb (340 kg) are designed for a maximum of three persons on the ladder at any time. On a three-person ladder, not more than two persons should be grouped together, such as a rescuer and a victim.

Ladders are designed so that the stress on the ladder structure and component parts or materials does not exceed 25 percent of the yield strength of the structure, component parts, or materials when the ladder is statically loaded in accordance with Table 3-1.1.

A-3-1.7 Using a ladder at an angle less than 70 degrees drastically increases the possibility of ladder slippage.

A-3-1.9 Using a ladder at an angle less than 70 degrees drastically reduces the ladder's load-carrying capacity.

A-3-2.3 Tying off or securing the halyard provides a secondary method of securing the fly section in the event of pawl disengagement. When a continuous halyard prevents tying off, a camlock, as is used for securing a sailboat halyard, might be used.

A-3-2.6 The use of one staypole introduces an artificial twist in the ladder that is dangerous to the climber and can cause permanent damage to the ladder.

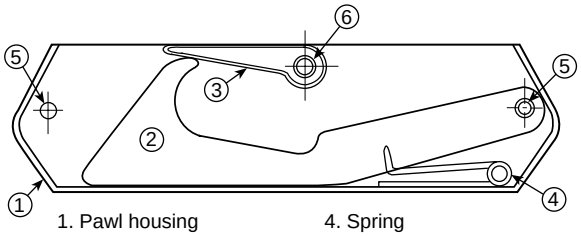
A-3-4 Wood materials normally do not conduct electricity. However, under conditions of high voltage or moisture, surface contamination on the wood surface can conduct enough electricity to cause injury or death. Therefore, caution should be used around electrical wiring.

A-3-5 Fiberglass materials normally do not conduct electricity. However, under conditions of high voltage or moisture, surface contamination on the fiberglass surface can conduct enough electricity to cause injury or death. Therefore, caution should be used around electrical wiring.

A-4-2.5 When reinstalling ladder pawl assemblies, caution must be used to prevent over tightening of pawl assembly fasteners, as this causes binding of pawl assembly parts. Figure A-4-2.5 illustrates the parts of a pawl housing. Replacement springs and parts are available from the ladder manufacturer.

A-4-2.7 Replacement halyards should not be less than $^3/_8$ in. (9.5 mm) in diameter with a minimum breaking strength of 825 lb (374 kg). They should be of sufficient length for the purpose intended and should not be spliced. Wire rope should have a 5 to 1 safety factor while supporting two times the dead load weight of the fly section(s) that the wire rope is intended to raise.

Figure A-4-2.5 Pawl housing showing parts.



A-4-2.10.1 If a heat sensor label is present without an expiration date, contact the ladder manufacturer to determine when that heat sensor label should be replaced.

A-5-1.2 The authority having jurisdiction contracting with a testing organization for testing fire department ground ladders should evaluate the qualifications and experience of the testing organization.

A-5-1.3 Wood ladders are particularly vulnerable to damage, and weakening might not be readily visible and might cause failure when used in emergency situations.

A-5-2.1 The horizontal bending test uses the horizontal position to make the testing procedure easier and safer. This position also provides a safety factor when compared to the same load at an angle of $75\,^1/_2$ degrees. This safety factor is necessary to account for the dynamic forces that might be created by moving loads on the ladder as it is used *(see also A-1-1.2 and A-3-1.1)*. The horizontal bending test is not designed to test a ladder for use as a bridge but rather to provide a test to ensure a safe ladder when it is used in the elevated position.

A brand new ladder has manufacturing tolerances that might give a false reading the first time the test is run. These false readings are less likely to occur on a ladder that has been in service and has been climbed prior to being tested. Therefore, a new ladder should either be set up and climbed several times prior to being tested, or the test should be run one time with the results not being counted and then repeated as the official test.

A-5-2.2.5 Many roof ladders manufactured prior to 1984 were equipped with mild steel roof hooks $^5/_8$ in. (16 mm) in diameter that do not meet the requirements of the roof hook test. Alloy steel (chrome-moly) roof hooks $^5/_8$ in. (16 mm) in diameter or mild steel roof hooks $^3/_4$ in. (19 mm) in diameter normally do meet the roof hook test requirement.

A-5-5 Hardness testing is used to ensure proper evaluation of aluminum material in ground ladders. Hardness is the ability of a material to resist indentation or penetration. Tensile strength of a material is directly related to the hardness of a material. Hardness testing on ground ladders should be performed whenever there is question of annealing of the material due to exposure to heat.

The hardness service test can be used at any time between annual service tests to verify the hardness of the metal in the ladder, but it is only an option when there is an indication that the ladder has been exposed to heat. *(See 5-1.8.)* If a ladder is exposed to heat and has not been load tested within the previous year, a load test is required in lieu of, or in addition to, the hardness test.