

# NFPA 1932

## Use, Maintenance, and Service Testing of Fire Department Ground Ladders 1989 Edition



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There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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**NFPA 1932**  
**Standard on**  
**Use, Maintenance, and Service Testing of**  
**Fire Department Ground Ladders**  
**1989 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 Equipment and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 15-18, 1989 in Washington DC. It was issued by the Standards Council on July 14, 1989, with an effective date of August 7, 1989, and supersedes all previous editions.

The 1989 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

**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. This document was developed as a companion document to cover the requirements of the use, maintenance, and service testing of fire department ground ladders.

The 1989 edition includes amendments to keep the standard up to date. Additional requirements for routine maintenance as well as additional cautions regarding accidental heating of ladders were added. An exception allowing the authority having jurisdiction to use a reduced test weight for the horizontal bending test for extension ladders built prior to 1984 was added. The horizontal bending test for folding ladders was added. The horizontal bending test for ladders was modified to reflect changes determined acceptable from field experience with the use of the test method.

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## Contents

<b>Chapter 1 Administration</b> .....	<b>1932- 4</b>
1-1 Scope .....	<b>1932- 4</b>
1-2 Purpose .....	<b>1932- 4</b>
1-3 Definitions .....	<b>1932- 4</b>
<b>Chapter 2 Ground Ladder Mounting</b> .....	<b>1932- 6</b>
2-1 Requirements for All Ground Ladders .....	<b>1932- 6</b>
<b>Chapter 3 Use of Ground Ladders</b> .....	<b>1932- 6</b>
3-1 Requirements for All Ground Ladders .....	<b>1932- 6</b>
3-2 Additional Requirements for Extension Ladders Only .....	<b>1932- 6</b>
3-3 Additional Requirements for Metal Ground Ladders Only .....	<b>1932- 7</b>
3-4 Additional Requirements for Wood Ground Ladders Only .....	<b>1932- 7</b>
3-5 Additional Requirements for Fiberglass Ground Ladders Only .....	<b>1932- 7</b>
<b>Chapter 4 Inspection and Maintenance of Ground Ladders</b> .....	<b>1932- 7</b>
4-1 Requirements for All Ground Ladders .....	<b>1932- 7</b>
4-2 Additional Requirements for Roof Ladders Only .....	<b>1932- 8</b>
4-3 Additional Requirements for Extension Ladders Only .....	<b>1932- 8</b>
<b>Chapter 5 Service Testing Ground Ladders</b> .....	<b>1932- 8</b>
5-1 Requirements for All Ground Ladders .....	<b>1932- 8</b>
5-2 Strength Service Testing Requirements for All Ladders Except Pompier and Folding Ladders .....	<b>1932- 9</b>
5-3 Strength Service Testing Requirements for Pompier Ladders Only ..	<b>1932-11</b>
5-4 Hardness Service Testing Requirements for Metal Ground Ladders Only .....	<b>1932-12</b>
5-5 Strength Service Testing Requirements for Folding Ladders Only ..	<b>1932-12</b>
<b>Chapter 6 Referenced Publication</b> .....	<b>1932-13</b>
<b>Appendix A</b> .....	<b>1932-13</b>
<b>Index</b> .....	<b>1932-15</b>

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

1989 Edition

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

Information on referenced publications can be found in Chapter 6.

**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.

*Exception: Extension ladders that were constructed prior to the adoption of the 1984 edition of NFPA 1931, Standard on Design of and Design Verification for Fire Department Ground Ladders, may be tested in accordance with the Exception to 5-2.1 if approved by the authority having jurisdiction and used in accordance with the Exception to Table 3-1.1. This Exception shall not be used after July 1, 1994.*

**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 shall also provide users of fire department ground ladders with a means to determine if in-service fire department ground ladders are suitable for continued service.

**1-3\* Definitions.**

**Angle of Inclination.** The pitch for portable, non-self-supporting ground ladders. The preferred angle of inclination is 75½ degrees.

**Approved.\*** Acceptable to the "authority having jurisdiction."

**Authority Having Jurisdiction.\*** The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

**Base (Bed) Section.** The lowest, or widest, section of non-self-supporting ground ladders.

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

**Bedded Position.** The position in which fly section(s) of extension ladders are stored in the nonextended position with the pawls resting on a rung of the supporting section.

**Butt.** The end of the beam placed on the ground, or other lower support surface, when ground ladders are in the raised position. It may be the lower end of beams, or added devices.

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

**Collapsible Ladder.** See Folding Ladder.

**Combination Ladder.** A ground ladder capable of being used both as a step ladder, and single or extension ladder.

**Design Verification Tests.** Tests of the design ladder structure, and components thereof. The design verification tests are the responsibility of the ladder manufacturer and are only to be performed on new, unused ladders.

**Designated Length.** The length marked on the ladder.

**Dogs.** See Pawls.

**Extension Ladder.** A non-self-supporting ground ladder, adjustable in length. It consists of two or more sections traveling in guides, brackets, or equivalent so arranged as to permit length adjustment.

**Fire Department Ground Ladders.** All ground ladders specifically designed for fire service use that are in the possession of a fire department or other fire service organization, and that are used for, or intended to be used for, rescue, fire fighting operations, or training.

**Fly Section.** Upper section(s) of an extension ladder. The first section above the base section is the first fly section, the second section above the base section is the second fly section, etc.

**Folding Ladder.** A single ladder designed so that the rungs can be folded or moved in a manner to allow the beams to be brought together for storage or carrying purposes.

**Free Weight.** Test weights that are not controlled from any direction except by the force of gravity. For example: sand bags, concrete blocks, water tanks, or lead weights.

**Ground Ladder.** Ladders that are not mechanically or physically attached permanently to fire apparatus, and do not require mechanical power from the apparatus for use or operation of the ladder.

**Halyard.** Rope used on extension ladders for the purpose of raising fly section(s). A wire cable may be referred to as halyard when used on the uppermost fly section(s) of three or four section extension ladders.

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

**In-Service Fire Department Ground Ladders.** Any fire department ground ladder that meets the requirements of this standard.

**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, an exception to this definition.*)

**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 pawls engaged.

**May.** This term is used to state a permissive use, or an alternative method to a specified requirement.

**Non-Destructive Tests (NDT).** A method of testing that does not damage the ladder structure, or component 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 fly section(s) for the purpose of anchoring fly section(s) when extension ladders are used in the extended position. Pawls engage ladder rungs near the beams for anchoring purposes.

**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.

**Pitch.** The included (acute) angle between the horizontal and the ladder, which is measured on the side of the ladder opposite the climbing side.

**Pompier Ladder (Scaling Ladder).** A ladder having a single beam only with a large hook on top 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 to be performed on a regular basis after a ground ladder is in service to determine suitability for service.

**Set.** See Permanent Deformation.

**Shall.** This term indicates a mandatory requirement.

**Should.** This term, as used in the Appendix, indicates a recommendation or that which is advised but not required.

**Side Rail.** See Beam.

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

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

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

**Test Failure.** Failure of the ground ladder structure, or components thereof, to pass the required tests.

**Tormentors or Tormentor Poles.** See Staypoles.

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

**Visible Damage.** Damage that is clearly evident by visual inspection without recourse to optical measuring devices.

**Visual Inspection.** Inspection by the eye without recourse to any optical devices, except prescription eyeglasses. May include physical and mechanical examination.

**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

### 2-1 Requirements for All 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 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 provided with sufficient supports to prevent any sagging or distortion.

**2-1.5** Ground ladders mounted internally in fire apparatus shall be shielded against excessive heat exposure from the engine and exhaust system.

**2-1.6** 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 six months. Prior to re-lubricating 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.

## Chapter 3 Use of Ground Ladders

### 3-1 Requirements for All Ground Ladders.

**3-1.1\*** **Ground Ladder Loading.** Duty ratings for various ground ladders are given in Table 3-1.1. These loads shall not be imposed upon ground ladders unless the ground ladder is set at the correct angle of inclination and secured as specified in this section. 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.

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

*Exception: Extension ladders that were constructed prior to the adoption of the 1984 edition of NFPA 1931, and which have been tested in accordance with the Exception to 5-2.1, shall be used with a maximum load limit of 500 lb (227 kg) distributed or 400 lb (181 kg) concentrated.*

**3-1.2** 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** Damaged ground ladders, or ground ladders having defects, shall be removed from service, marked, repaired, and service tested prior to further use.

**3-1.4** Ground ladders shall be used for rescue, fire fighting operations, and training and shall not be used for any other purpose.

**3-1.5** Ground ladders shall not be tied together to provide longer units.

**3-1.6** Ground ladder butts shall be placed on a secure footing with a firm, level base before using.

**3-1.7** Ground ladders shall not be placed on ice, snow, or slippery surfaces unless suitable means to prevent slipping are employed.

**3-1.8\*** Ground ladders shall be secured at the base either by a fire fighter or mechanical means, to prevent slippage. Extreme caution shall be used when the angle of inclination is less than 70 degrees and mechanical means shall be used to prevent slippage.

**3-1.9** Ground ladders shall be secured at the top, to prevent slippage, by the first person to climb the ladder.

**3-1.10\*** 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  $\frac{1}{4}$  the effective working length of the ground ladder, an angle of between 70 and 76 degrees with 75½ degrees being optimum.

**3-1.11** Raised ground ladders shall not be slid along cornices or roof edges.

**3-1.12** Ground ladders shall not be "rolled" beam-over-beam to reach a new position.

**3-1.13** Raised ground ladders shall not be repositioned from the top or with a person on the ladder.

**3-1.14** Ground ladders that have been removed from apparatus shall not be placed near heat sources (such as the apparatus exhaust pipe) such that the ladders are exposed to heat of 300 °F (149 °C) or greater.

### 3-2 Additional Requirements for Extension Ladders Only.

**3-2.1** Fly sections of extension ladders shall not be used as single ladders unless they have been certified by the manufacturer as being suitable 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 securely tied off to the base section or otherwise secured before climbing the ground ladder.

**3-2.4** Extension ladders shall only be operated from the ground or other suitable stationary points. Adjustments shall not be made from the top of extension ladders.

**3-2.5** When extension ladders are equipped with staypoles, the staypoles shall be placed to act as stabilizers, and shall not be placed as to become load bearing members under no load conditions (no one on the ladder).

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

### **3-3 Additional Requirements for Metal Ground Ladders Only.**

**3-3.1 EXTREME CAUTION** shall be used when working around charged electrical circuits as metal ground ladders conduct electricity. All metal ground ladders shall be kept away from power lines or other potential electrical hazards.

**3-3.2** The heat sensor labels shall be checked before and after each use of the ladder. If the heat sensor label has changed, the ladder shall be removed from service and service tested as specified in Chapter 5 of this standard prior to further use.

### **3-4 Additional Requirements for Wood Ground Ladders Only.**

**3-4.1 EXTREME CAUTION** shall be used around electrical hazards as wet wood ground ladders can conduct electricity.

**3-4.2** If the protective finish becomes charred or blistered, the ladder shall be removed from service and service tested as specified in Chapter 5 of this standard prior to further use.

### **3-5 Additional Requirements for Fiberglass Ground Ladders Only.**

**3-5.1 EXTREME CAUTION** shall be used around electrical hazards as wet fiberglass ground ladders can conduct electricity.

**3-5.2** The heat sensor labels shall be checked before and after each use of the ladder. If the heat sensor label has changed, the ladder shall be removed from service and service tested as specified in Chapter 5 of this standard prior to further use.

**3-5.3** Fiberglass ground ladders that have been subjected to any sharp impact shall be removed from service and service tested as specified in Chapter 5 of this standard prior to further use.

## **Chapter 4 Inspection and Maintenance of Ground Ladders**

### **4-1 Requirements for All Ground Ladders.**

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

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

**4-1.3** Visual inspection shall include but not be limited to:

- (a) Heat sensor label on metal and fiberglass ladders, and on wood ladders when provided, for change indicating heat exposure;
- (b) All rungs, for snugness and tightness;
- (c) All bolts and rivets, for tightness;
- (d) Welds, for any cracks or apparent defects;
- (e) Beams and rungs, for cracks, splintering, breaks, gouges, checks, wavy conditions, or deformation;
- (f) Butt spurs, for excessive wear or other defects.

**4-1.4** Any signs of failure during visual inspection shall be sufficient cause to remove the ground ladder from service and repair for fire service use or destroy.

**4-1.5** Ground ladders shall be maintained as free of moisture as is possible and shall be wiped after being sprayed with water or used in the rain.

**4-1.6** Ground ladders shall not be stored in an area where they are exposed to the elements.

**4-1.7** 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.

**4-1.8** Ground ladders not maintained as specified in this standard shall be removed from service and service tested as specified in Chapter 5 prior to further use.

**4-1.9 Additional Requirement for Metal Ground Ladders Only.** To preserve the surface finish and inhibit corrosion, an occasional application of a good automotive paste wax shall be used.

### **4-1.10 Additional Requirements for Wood Ground Ladders Only.**

**4-1.10.1** Visual inspection shall include the bolts for snugness and tightness without crushing the wood.

**4-1.10.2** When a wood ground ladder develops dark streaks in the beams, the ladder shall be removed from service and service tested as specified in Chapter 5 of this standard prior to further use.

**4-1.10.3\*** Wood ground ladders shall be stored away from steam pipes, radiators, forced hot air heaters, and out of the direct sunlight.

**4-1.10.4** Wood ground ladders shall be protected by at least two coats of a good quality clear spar varnish.

**4-1.10.5** The varnish finish shall be inspected at least every month and redone at least annually or at such frequency as specified by the ladder manufacturer.

**4-1.10.6** If the varnish coating becomes damaged, the following procedure shall be conducted to repair the finish:

- (a) Remove peeling areas by scraping and sanding with sandpaper to remove all the loose or damaged finish,
- (b) Spot prime bare sanded spots with varnish,
- (c) Resand when dry and coat with at least two coats of a good quality clear spar varnish.

#### **4-1.11 Additional Requirements for Fiberglass Ground Ladders Only.**

**4-1.11.1\*** Fiberglass ground ladders shall be stored out of direct sunlight.

**4-1.11.2** To preserve the surface finish and inhibit surface deterioration, an occasional application of a good automotive paste wax shall be used.

#### **4-2 Additional Requirements for Roof Ladders Only.**

**4-2.1** These inspection requirements shall be in addition to the inspection and maintenance requirements specified in Section 4-1 of this chapter.

**4-2.2** Visual inspection shall include an operational check of the roof hook assemblies for proper operation.

#### **4-3 Additional Requirements for Extension Ladders Only.**

**4-3.1** These inspection and maintenance requirements shall be in addition to the inspection and maintenance requirements specified in Section 4-1 of this chapter.

**4-3.2** Visual inspection shall include an operational check of the pawl assemblies for proper operation.

**4-3.3\*** Pawl assemblies shall be kept cleaned and lubricated in accordance with manufacturer's instructions.

**4-3.4\*** Pawl torsion springs shall be replaced every five years or sooner if pawl operation appears weak.

**4-3.5** Ladder slide areas shall be kept lubricated in accordance with manufacturer's instructions.

**4-3.6** Halyards and wire cables on extension ladders shall be replaced when they become frayed or kinked.

**4-3.7** Wire rope on 3- and 4-section ladders shall be snug, when the ladder is in the bedded position, to ensure proper synchronization of upper sections during operation.

## **Chapter 5 Service Testing Ground Ladders**

### **5-1 Requirements for All Ground Ladders.**

**5-1.1** Design verification tests specified in NFPA 1931, *Standard on Design of and Design Verification Tests for Ground Ladders*, 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** Only the service tests for ground ladders specified in this chapter shall be conducted by fire departments on fire department ground ladders.

**5-1.2.1\*** The fire department may contract with an approved testing organization to perform the service tests specified in this chapter.

**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. These service tests may require the purchase of measuring instruments.

**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 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 sufficient cause for the ground ladder to be removed from service and repaired for fire service use or destroyed.

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

- (a) At least annually,
- (b) At any time a ladder is suspected of being unsafe,
- (c) After the ladder has been subjected to overloading, (*see Table 3-1.1*);
- (d) After the ladder has been subjected to impact loading or unusual conditions of use;
- (e) After heat exposure (*see 5-1.9, 5-1.10, and 5-1.11*);
- (f) After any deficiencies have been repaired 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, Strength Service Testing, of this chapter.

**5-1.7.2** Pompier ladders shall be service tested as specified in Section 5-3 of this chapter.

**5-1.7.3** Folding ladders shall be service tested as specified in Section 5-5 of this chapter.

**5-1.8** All service test results shall be permanently recorded. Minimum information recorded shall be as required in Table 5-1.8.

Table 5-1.8

**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 \_\_\_\_\_

**5-1.9** If the ground ladder does not meet all the requirements of this chapter, the ladder shall be removed from service and repaired for fire service use or destroyed.

**5-1.10 Additional Requirements for Metal Ground Ladders Only.**

**5-1.10.1** Metal ground ladders shall be further tested as specified in Section 5-2, Strength Service Testing, of this chapter at least annually.

**5-1.10.2** 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, Strength Service Testing, or Section 5-4, Hardness Service Testing, of

this chapter. Hardness service testing does not replace the need for load testing as outlined in 5-1.7 and 5-2.

**5-1.11 Additional Requirements for Wood Ground Ladders Only.** 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, Strength Service Testing, of this chapter.

**5-1.12 Additional Requirements for Fiberglass Ground Ladders Only.** 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, Strength Service Testing, of this chapter.

**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 the following provisions.

*Exception: Extension ladders that were constructed prior to the adoption of the 1984 edition of NFPA 1931 may, when tested in accordance with this section, be tested with a minimum test load of 400 lb (181 kg) and a pre-load of 300 lb (136 kg), if approved by the authority having jurisdiction. All of the test procedures shall apply when the reduced test load is used. Ladders tested in accordance with this Exception shall be subject to the reduced use rating as noted in the Exception to Table 3-1.1.*

**5-2.1.1** The ladder shall be positioned for testing and tested as shown in Figure 5-2.1. The ladder shall be placed in a flat horizontal position supported under the first rung from each end of the ladder. Extension and combination ladders shall be extended to their maximum extended length, with pawls engaged, for this test. The test load shall be applied equally to a center span covering 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.

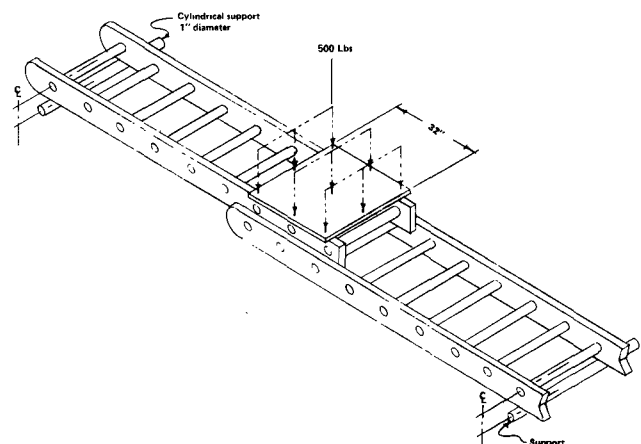


Figure 5-2.1 Extension ladder positioned for horizontal bending test.

### 5-2.1.2 Test Procedures for Metal and Fiberglass Ground Ladders Only.

**5-2.1.2.1** Straps or other ties that do not increase the strength of the ladder may 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 pre-load of 350 lb (159 kg) applied equally to the center span covering 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 one minute, to "set" the ladder prior to completing the rest of the test.

**5-2.1.2.3** After removing the pre-load, 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 as near as practical to 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 covering 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 distance between the bottom of each side rail and surface upon which the ladder supports are placed shall be measured. Five minutes shall elapse before conducting this measurement after removing the test loads.

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

Table 5-2.1.2.6

Length of ladder	Difference in Measurements
25 ft or less	½ in.
26 ft to 34 ft	1 in.
35 ft or over	1 ½ in.

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 Test Procedures for Wood Ground Ladders Only.

**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 covering 16 in. (406 mm) each side of the center inclusive. The test load shall remain in place for 5 minutes and then 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 criteria shall be removed from fire service use and destroyed.

### 5-2.2 Additional Requirements for Roof Ladders Only — Roof Hook Test.

**5-2.2.1** The test methods depicted in this section represent the preferred methods to be followed in determining

whether a ladder conforms to the requirements of this standard. Variations from the specific methods depicted in the various diagrams shall be acceptable provided such alternate means provide equivalent results and comply with the intent of the applicable preferred test method.

**5-2.2.2** The ladder shall be positioned for testing and tested as shown in Figure 5-2.2. 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 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.

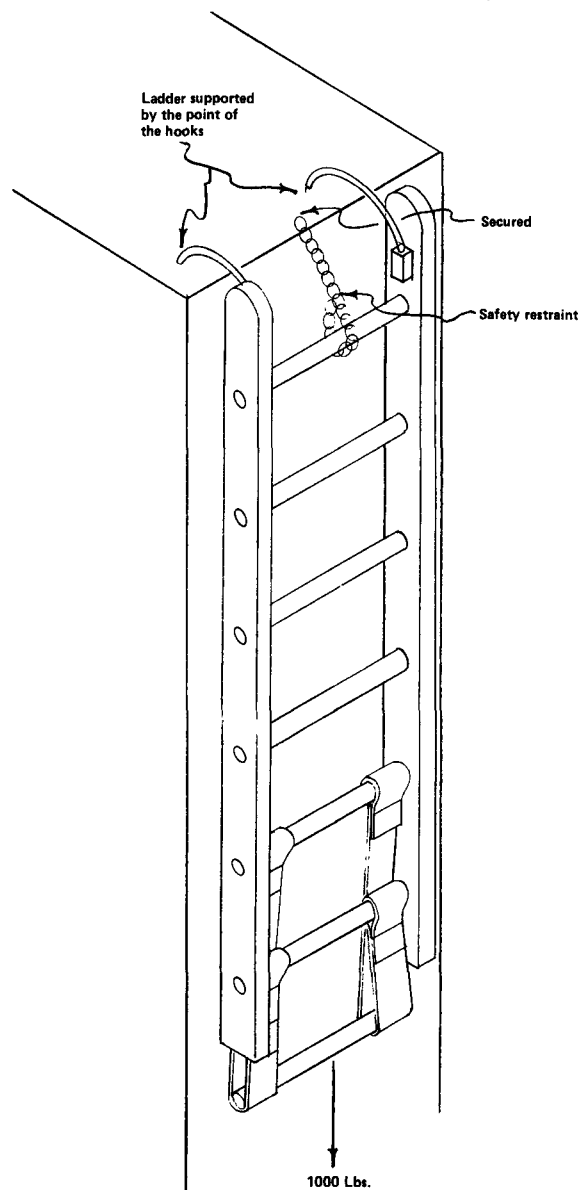


Figure 5-2.2 Roof ladder positioned for roof hook test.

**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 consistent with safety and ease of handling.

**5-2.2.4** Test load shall be applied for a minimum of one minute.

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

### 5-2.3 Additional Requirements for Extension Ladders Only — Hardware Test.

**5-2.3.1** The test methods depicted in this section represent the preferred methods to be followed in determining whether a ladder conforms to the requirements of this standard. Variations from the specific methods depicted in the various diagrams shall be acceptable provided such alternate means provide equivalent results and comply with the intent of the applicable preferred test method.

**5-2.3.2** The ladder shall be positioned for testing and tested as shown in Figure 5-2.3. 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 consistent with safety and ease of handling.

**5-2.3.4** Test load shall be applied for a minimum of one minute.

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

### 5-3 Strength Service Testing Requirements for Pom-pier Ladders Only.

**5-3.1** The test methods depicted in this section represent the preferred methods to be followed in determining whether a ladder conforms to the requirements of this standard. Variations from the specific methods depicted in the various diagrams shall be acceptable provided such alternate means provide equivalent results and comply with the intent of the applicable preferred test method.

**5-3.2** The ladder shall be positioned for testing and tested 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 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.

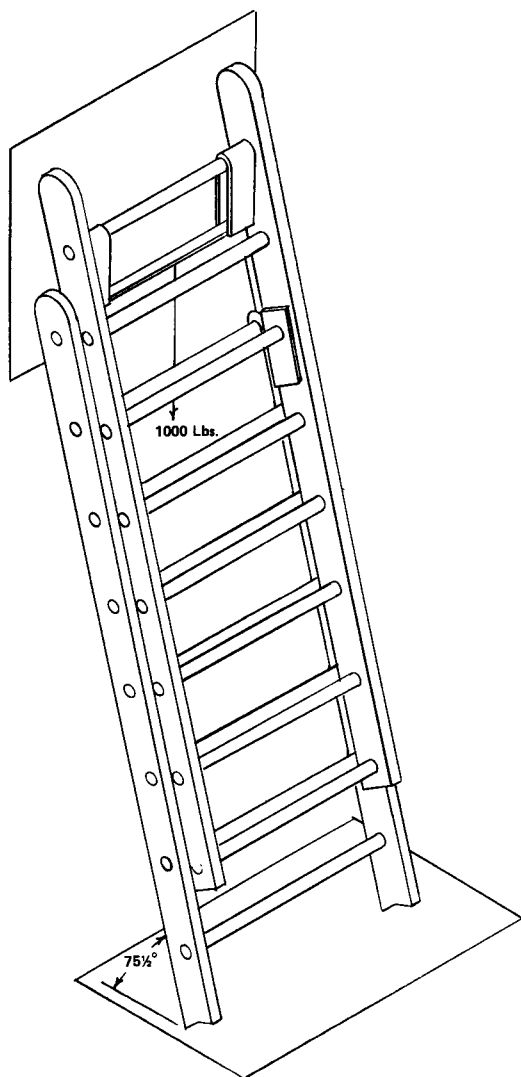


Figure 5-2.3 Extension ladder positioned for hardware test.

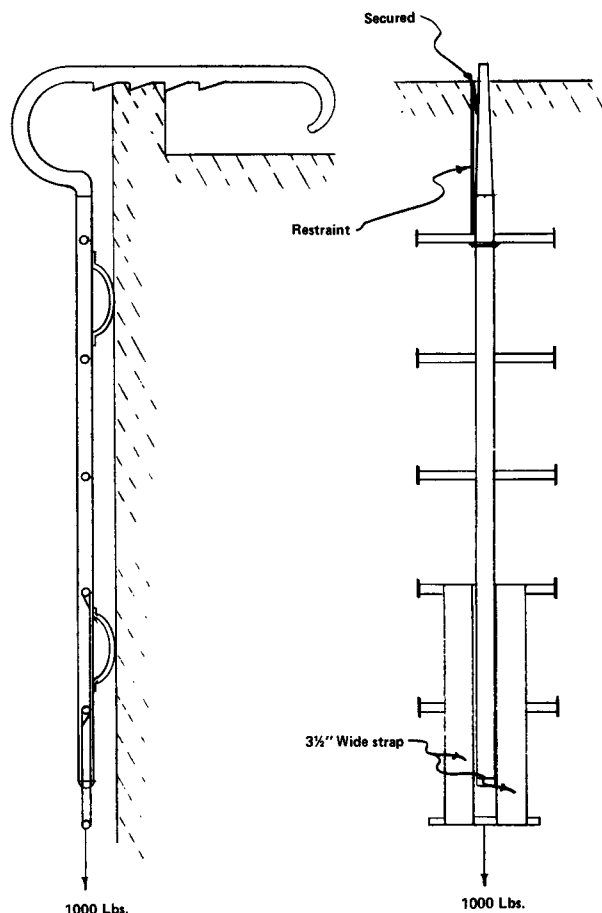


Figure 5-3.2 Pom-pier ladder positioned for test.

**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 criteria shall be removed from fire service use and destroyed.

**5-4\* Hardness Service Testing Requirements for Metal Ground Ladders Only.**

**5-4.1** 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.

**5-4.2** The hardness service test shall be performed at a test point 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.

**5-4.3** The hardness testing device shall be calibrated immediately before testing and calibration verified immediately after testing in accordance with the manufacturer's requirements for that specific hardness testing device.

**5-4.4** 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 5-4.4.

**Table 5-4.4**

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

**5-4.5** If a reading at a test point is less than the value given in Table 5-4.4 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 5-4.5. No one reading of these three shall be less than the minimum value given in Table 5-4.5 for the respective hardness testing scale.

**Table 5-4.5**

Hardness Testing Scale	Average of 3 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

**5-4.6** If the ladder does not meet the hardness service test requirements specified in 5-4.4 or 5-4.5 of this section, the ladder shall be removed from service and tested to the requirements of Section 5-2, Strength Service Testing, of this chapter.

**5-5 Strength Service Testing Requirements for Folding Ladders Only.**

**5-5.1 Horizontal Bending Test.**

**5-5.1.1** The ladder shall be positioned for testing and tested similar to that shown in Figure 5-5.1. The ladder shall be placed in a flat horizontal position supported under the first rung from each end of the ladder. Folding ladders shall be in their unfolded configuration for this test. The test load shall be applied equally to a center span covering 8 in. (203 mm) on 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 weight increments consistent with safety and ease of handling. All test loads shall include the weight of the test surface.

**5-5.1.2 Test Procedures for Metal and Fiberglass Folding Ladders Only.**

**5-5.1.2.1** The ladder shall be loaded with a pre-load of 160 lb (73 kg) applied equally to the center span covering 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 one minute, to "set" the ladder prior to completing the rest of the test.

**5-5.1.2.2** After removing the pre-load, 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 as near as practical to the center of the ladder.

**5-5.1.2.3** The ladder shall be loaded with a test load of 225 lb (102 kg) applied equally to the center span covering 8 in. (203 mm) on each side of the center inclusive. The test load shall remain in place for 5 minutes.

**5-5.1.2.4** 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 before conducting this measurement after removing the test loads.

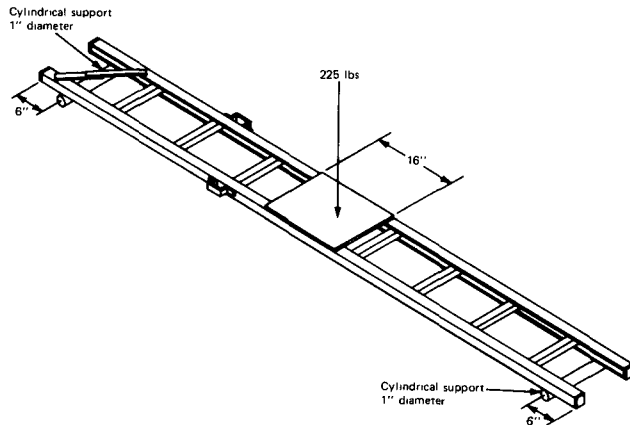
**5-5.1.2.5** There shall be no more than ½ in. (13 mm) difference between measurements taken in 5-5.1.2.2 and 5-5.1.2.4. Any ladder that does not meet this criterion shall be removed from fire service use and destroyed.

**5-5.1.2.6** There shall be no visible permanent change or failure of any hardware.

**5-5.1.3 Test Procedures for Wood Folding Ladders Only.**

**5-5.1.3.1** The ladder shall be loaded with a test load of 225 lb (102 kg) applied equally to a center span covering 8 in. (203 mm) on each side of the center inclusive. The test load shall remain in place for 5 minutes and then removed.

**5-5.1.3.2** 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 destroyed.



**Figure 5-5.1** Folding ladder horizontal bending test.

## Chapter 6 Referenced Publication

**6-1** The following documents or portions thereof are referenced within this document and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

**6-1.1 NFPA Publication.** National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 1931-1989, *Standard on Design and Design Verification Tests for Ground Ladders*.

## Appendix A

*This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.*

**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 may 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. Since 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 in station maintenance, etc., and not transported, 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 NFPA 1931, *Standard on Design, and Design Verification Tests for Fire Department Ground Ladders*, 1989 edition. The 1984 edition of this standard included significant increases in the required strength of ladders, based on new information and technology that became available after the issuance of the 1979 edition of NFPA 1931. The new information relates 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.

It is strongly recommended that all fire departments work toward compliance with these new criteria as rapidly as feasible. Since these requirements will require the replacement of some existing ladders, a time has been identified to allow for a phase-in of the new ladders. During the phase-in period, it is important to recognize the limitations of the older ladders and to ensure that they are tested regularly and used safely. The identification of unsafe ladders and their removal from service is a primary concern.

An interim test option has been identified for ladders constructed prior to 1984. This option applies only to the horizontal bending test as described in 5-2.1. The use of this option requires approval by the authority having jurisdiction.

The Exception to the horizontal bending test allows for a 400-lb (181-kg) test load for ladders constructed prior to 1984. All other service test and inspection requirements are unchanged. When ladders are tested in accordance with this option, the use of these ladders should be restricted to the limits identified in the Exception to Table 3-1.1. The Exception to the loading table reflects the load conditions that were assumed at the time those ladders were constructed.

After July 1, 1994, the use of the optional test will no longer be recognized in this standard.

**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, US Department of Agriculture Forest Products Laboratory, and the Aluminum Association. This standard should never be interpreted as establishing lower materials strength criteria than what may 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 or 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 concerned with product evaluations which is 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, 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 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-3-1.1** The design criteria for ladders assumes the weight of a fire fighter with protective clothing, SCBA, and equipment as 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 should be grouped together, such as a rescuer and a victim.

Extension ladders that are tested in accordance with the Exception to 5-2.1 have a maximum load rating of 500 lb (227 kg). These ladders should be limited to two persons on the ladder at any time and a maximum concentrated load of 400 lb (181 kg). The load rating of these ladders is based on two fire fighters separated by at least 10 ft (3.048 m) or a fire fighter carrying a victim with a combined weight of 400 lb (181 kg).

It is the intent that the stress on the ladder structure and component parts or materials shall 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-3-1.8** Using a ladder at an angle of less than 70 degrees drastically increases the possibility of ladder slippage.

**A-3-1.10** Using a ladder at angles less than 70 degrees drastically reduces the load carrying capacity

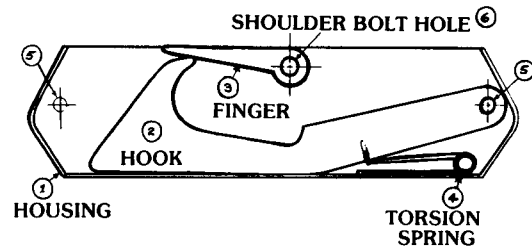
**A-3-2.3** Tying off or securing the halyard provides a secondary method of securing the fly section in the event of pawl disengagement. When a continuous halyard prevents tying off, a camlock as is used for securing sailboat halyard might be used.

**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-4-1.10.3** Continued exposure to a heating source or direct sunlight will cause wood ladders to deteriorate.

**A-4-1.11.1** Continued exposure to direct sunlight will cause ultraviolet erosion of the surface of fiberglass ladders, causing the glass fibers to become exposed.

#### A-4-3.3 Pawl Housing Showing Parts.



- |                           |                        |
|---------------------------|------------------------|
| 1. Pawl Housing           | 4. Spring              |
| 2. Pawl Hook              | 5. Mounting Bolt Holes |
| 3. Finger (Note Position) | 6. Shoulder Bolt Hole  |

**A-4-3.4** When reinstalling ladder pawl assemblies use caution to prevent over-tightening of pawl assembly fasteners, as this will cause binding of pawl assembly parts. Replacement springs and parts are available from the ladder manufacturer.

**A-5-1.2.1** Fire departments contracting with a testing organization for testing of aluminum ground ladders should require said testing firm to provide the following non-destructive testing. Interpretation of testing results from the following methods are highly critical and must be performed only by certified personnel. Testing agencies should provide, on request, certification documents stating that their personnel meet the American Society of Non-Destructive Testing (ASNT) requirements and that the personnel are proficient in maintaining certification in all methods and that refresher courses are administered as required in accordance with ASNT and company policies.

#### Hardness Testing.

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.

Hardness testing should be conducted in accordance with the procedures defined in Section 5-4 of this standard.

#### Liquid Penetrant Testing.

Liquid penetrant testing is primarily used on fire department ground ladders formed of nonferromagnetic material (aluminum) to find discontinuities. Penetrant inspection is basically a very simple process. First, a liquid penetrant is applied to the surface. It is permitted to remain on the surface for a period of time during which it penetrates into any defect open at the surface. After the penetrating period, the excess penetrant remaining on the surface is removed. Then an absorbent light colored powdered material called a developer is applied to the surface. This developer acts as a blotter and draws out a portion of the penetrant which has previously seeped into the surface opening. As the penetrant is drawn out it diffuses into the coating of the developer forming indications that are much wider than the surface opening with which they are associated. Liquid penetrant testing should be performed on all welds and areas of concern.

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

**A-5-2.1** The horizontal bending test utilizes 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 75½ degrees. This safety factor is necessary to account for the dynamic forces that may be created by moving loads on the ladder as it is used. (See also A-1-1.2 and A-3-1.1.) This 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 which may 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 ⅝ in. (16 mm) in diameter which will not meet the requirements of the roof hook test. Alloy steel (chrome-moly) roof hooks ⅝ in. (16 mm) in diameter or mild steel roof hooks ¾ in. (19 mm) in diameter will normally meet the roof hook test requirement.

**A-5-4** The hardness service test may be used at any time to verify the hardness of the metal in the ladder but is only required as an option when there is an indication the ladder has been exposed to heat (see 5-1.10.2).

## Index

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<b>-A-</b>	<b>-F-</b>
<b>Angle of inclination</b> Definition ..... 1-3	<b>Failure</b> Test Definition ..... 1-3 Ultimate Definition ..... 1-3 <b>Fiberglass ground ladders</b> ..... see Ground ladders, Fiberglass <b>Fly section</b> Definition ..... 1-3 <b>Folding ladders</b> Definition ..... 1-3 Strength service testing ..... 5-1.7.3, 5-5
<b>-B-</b>	<b>-G-</b>
<b>Base (bed) section</b> Definition ..... 1-3 <b>Beam (side rail)</b> Definition ..... 1-3 <b>Bedded position</b> Definition ..... 1-3 <b>Butt</b> Definition ..... 1-3 <b>Butt spurs (feet)</b> Definition ..... 1-3	<b>Ground ladders</b> Definition ..... 1-3 Fiberglass ..... 3-5 Inspection and maintenance ..... 4-1.11, A-4-1.11.1 Service testing ..... 5-1.12, 5-2.1.2 Use ..... 3-5 Fire department Definition ..... 1-3 In-service Definition ..... 1-3 Service testing ..... Table 5-1.8 Metal ..... 3-3 Inspection and maintenance ..... 4-1.9 Service testing ..... 5-1.10, 5-2.1.2, 5-4 Hardness ..... 5-4, A-5-4 Use ..... 3-3 Mounting ..... Chap. 2 Wood ..... 3-4 Inspection and maintenance ..... 4-1.10, A-4-1.10.3 Service testing ..... 5-1.11, 5-2.1.3 Use ..... 3-4
<b>-C-</b>	<b>-H-</b>
<b>Collapsible ladders</b> ..... see Folding ladders <b>Combination ladders</b> Definition ..... 1-3	<b>Halyards</b> Definition ..... 1-3 Inspection ..... 4-3.6, 4-3.7
<b>-D-</b>	
<b>Damage, visible</b> Definition ..... 1-3 <b>Deformation, permanent</b> Definition ..... 1-3 <b>Design verification tests</b> Definition ..... 1-3 <b>Dogs</b> ..... see Pawls	
<b>-E-</b>	
<b>Extension ladders</b> ..... 3-2, A-3-2.3 Definition ..... 1-3 Inspection and maintenance ..... 4-3, A-4-3 Service testing ..... 5-2.3 Use ..... 3-2, A-3-2	

Use ..... 3-2.3, A-3-2.3  
**Hardness testing** ..... 5-4, A-5-1.2.1, A-5-4  
**Horizontal bending test** ..... 5-2.1, 5-5.1, A-5-2.1

**-I-**

**Inspection** ..... Chap. 4  
 Extension ladders ..... 4-3  
 Ground ladders, requirements for all ..... 4-1, A-4-1  
 Roof ladders ..... 4-2  
 Visual  
 Definition ..... 1-3

**-L-**

**Labels**  
 Heat sensor  
 Definition ..... 1-3  
**Ladder**  
 Definition ..... 1-3  
**Ladder nesting**  
 Definition ..... 1-3  
**Length**  
 Designated  
 Definition ..... 1-3  
 Maximum extended  
 Definition ..... 1-3  
 Working  
 Definition ..... 1-3  
**Liquid penetrant test** ..... A-5-1.2.1  
**Loading ground ladders** ..... 3-1.1, A-3-1.1

**-M-**

**Maintenance** ..... Chap. 4  
 Extension ladders ..... 4-3  
 Ground ladders, requirements for all ..... 4-1, A-4-1  
 Roof ladders ..... 4-2  
**Metal ground ladders** ..... see Ground ladders, Metal  
**Mounting ground ladders** ..... Chap. 2

**-N-**

**Non-destructive tests (NDT)**  
 Definition ..... 1-3

**-P-**

**Pawls** ..... 4-3.3, 4-3.4, A-4-3.3, A-4-3.4  
 Definition ..... 1-3  
**Pitch**  
 Definition ..... 1-3  
**Pompier ladders**  
 Definition ..... 1-3

Strength service testing ..... 5-1.7.2, 5-3  
**Purpose of standard** ..... 1-2, A-1-2

**-R-**

**Roof hook test** ..... 5-2.2  
**Roof ladders**  
 Definition ..... 1-3  
 Inspection and maintenance ..... 4-2  
 Roof hook test ..... 5-2.2  
**Rungs**  
 Definition ..... 1-3

**-S-**

**Scaling ladders** ..... see Pompier ladders  
**Scope of standard** ..... 1-1, A-1-1  
**Service tests** ..... Chap. 5, A-5  
 Definition ..... 1-3  
 Hardness, for metal ground ladders ..... 5-4, A-5-4  
 Requirements for all ground ladders ..... 5-1, A-5-1  
 Strength ..... 5-2, A-5-2  
 For folding ladders ..... 5-5  
 For pompier ladders ..... 5-3  
**Set** ..... see Deformation, Permanent  
**Side rail** ..... see Beam  
**Single ladders**  
 Definition ..... 1-3  
**Staypoles**  
 Definition ..... 1-3  
**Strength service testing** ..... 5-2, 5-3

**-T-**

**Tested**  
 Definition ..... 1-3  
**Tests** ..... see specific type such as Roof hook test  
**Tormentors or tormentor poles** ..... see Staypoles

**-U-**

**Use of ground ladders** ..... Chap. 3  
 Requirements for all ..... 3-1, A-3-1.10

**-W-**

**Width**  
 Inside ladder  
 Definition ..... 1-3  
 Outside ladder  
 Definition ..... 1-3  
**Wood ground ladders** ..... see Ground ladders, Wood

## **SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS**

**Contact NFPA Standards Administration for final date for receipt of proposals  
on a specific document.**

### **INSTRUCTIONS**

**Please use the forms which follow for submitting proposed amendments.  
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1. For each document on which you are proposing amendment indicate:
  - (a) The number and title of the document
  - (b) The specific section or paragraph.
2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.
3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.
4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.
5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.
6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

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- (b) identification of the document, paragraph of the document to which the proposal is directed, and
- (c) a statement of the problem and substantiation for the proposal, and
- (d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.