NFPA 1961

Standard on Fire Hose

2007 Edition



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NFPA 1961

Standard on

Fire Hose

2007 Edition

This edition of NFPA 1961, *Standard on Fire Hose*, was prepared by the Technical Committee on Fire Hose. It was issued by the Standards Council on December 1, 2006, with an effective date of December 20, 2006, and supersedes all previous editions.

This edition of NFPA 1961 was approved as an American National Standard on December 20, 2006.

Origin and Development of NFPA 1961

Standards on fire hose for both industrial use and fire department use were among the earliest standards issued by NFPA, with the first standard issued in 1898. NFPA 196 was issued in 1934 as *Standard Specification for Cotton Rubber-Lined Fire Hose for Public and Private Fire Department Use*. That standard remained in existence until 1958, when the Fire Hose Committee was again constituted to update the requirements. A tentative standard was issued in 1958 and the official standard was issued in 1960 recognizing the newer synthetic materials that were being used in the manufacture of fire hose. The 1960 standard covered fire hose in the 1 in., 1½ in., 2 in., and 2½ in. sizes for single or multiple jacket hose and 3 in. and 3½ in. sizes for multiple jacket hose.

In the 1972 edition, the concept of single jacket relay supply hose in the trade sizes of 3 in., 4 in., 4½ in., 5 in., and 6 in. was introduced. In 1979 the standard was renumbered from NFPA 196 to NFPA 1961 to coincide with a general renumbering of the fire service standards. In the 1992 edition, the term "rack and reel hose" was changed to "occupant use hose," the requirements for forestry hose were updated, and the requirements for suction hose were added. The 1997 edition was a reconfirmation of the 1992 edition.

The 2002 edition was completely revised to conform to the *Manual of Style for NFPA Technical Committee Documents*, to clean up ambiguous language, and to clarify the requirements. Procurement-related issues were deleted from the requirements of the document, and an equivalency statement and a formal retroactivity statement were added. The minimum trade size requirement was dropped for all but supply hose. The requirements for specific lengths were changed to only require a tolerance on the stated nominal length. Positive pressure requirements for hard suction hose were deleted.

A cold resistance test was added for all hose. Specific requirements were added to test the hose for abrasion resistance, heat resistance, water resistance, degradation from repeated bending, and degradation from alternating pressures. The flexibility and compressibility test method for forestry hose previously referenced to USDA Forest Service specifications was stated in the standard. The chapter on inspection and tests was reorganized around four subject areas: quality control, inspection, testing, and certification.

The 2007 edition is a general update of the 2002 edition, and clarifies ambiguous requirements. The section for testing elongation, twist, warp, and rise has been revised to clarify the four distinct tests. This edition also requires all new fire hose to be marked with the country of origin so that purchasers are informed where the product is manufactured.

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Technical Committee on Fire Hose

Stephen Gilbert, *Chair*
Los Angeles, CA [SE]

Ray K. Farm, City of Corvallis Fire Department, OR [U]
Thomas G. Farruggia, Illinois Fire Extinguisher Company, Inc., IL [IM]
Rep. National Association of Fire Equipment Distributors
Robert M. Harcourt, Snap-tite Hose, Inc., PA [M]
David V. Haston, U.S. Department of Agriculture, CA [RT]
Paul R. Kaveler, Ameren Services, MO [U]
Rep. Edison Electric Institute
Lawrence B. King, FM Global/FM Approvals [I]
Gregory Kozey, Kochek Company, Inc., CT [M]
Duane Leonhardt, Mercedes Textiles Ltd., Canada [M]
Rep. Fire Equipment Manufacturers' Association
Larry Linton, Washington Township Volunteer Fire Department, IN [L]
Terry Powers, San Diego Fire/Rescue Department, CA [U]
David J. Pritchard, Pritchard & Associates (NC), Inc., NC [SE]
John W. Stacey, Bellevue Fire Department, NE [E]
Rep. International Association of Fire Chiefs
Joe Stonecypher, Kidde Fire Fighting, TX [M]
Tim J. Vanderlip, Los Angeles County Fire Department, CA [U]
Richard C. Winton, Underwriters Laboratories Inc., IL [RT]
Rep. Underwriters Laboratories Inc.

Alternates

Paul E. Albinger, Jr., Elkhart Brass Manufacturing Company, Inc., IN [M]
(Alt. to D. Leonhardt)
George E. Laverick, Underwriters Laboratories Inc., IL [RT]
(Alt. to R. C. Winton)
Byron J. Sarago, Detroit Edison Company, MI [U]
(Alt. to P. R. Kaveler)

Laurence J. Stewart, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the 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 size and design of fire hose connections, and the performance, maintenance, and selection of all types of fire hose, couplings, nozzles, and accessory equipment.

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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 Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

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

Chapter 1 Administration

1.1* Scope. This standard shall define the design and construction requirements for new fire hose, the testing required to verify the design and construction, and the inspection and testing required of all new fire hose.

1.2* Purpose. The purpose of this standard shall be to establish the minimum requirements for new fire hose.

1.3 Application. This standard shall apply to new attack hose, occupant use hose, forestry hose, supply hose, and suction hose.

1.4 Retroactivity. This standard shall not be applied retroactively.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices, of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6* Units. In this standard, values for measurement are followed by an equivalent in English pound units, but only the first stated value shall be regarded as the requirement.

Chapter 2 Referenced Publications

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

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

NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose,* 2003 edition.

2.3 Other Publications.

2.3.1 ASQ Publications. American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.

ASQ Z1.4 *Sampling Procedures and Tables for Inspection by Attributes*, 1993.

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

ASTM D 380, *Standard Test Methods for Rubber Hose*, 1994.

ASTM D 412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension*, 2002.

ASTM D 518, *Standard Test Method for Rubber Deterioration — Surface Cracking*, 1999.

ASTM D 573, *Standard Test Method for Rubber — Deterioration in an Air Oven*, 2004.

2.3.3 FM Publications. FM Global, 1301 Atwood Avenue, P.O. Box 7500, Johnston, RI 02919.

FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*, 1999.

2.3.4 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 19, *Lined Fire Hose and Hose Assemblies*, 2001.

UL 219, *Lined Fire Hose for Interior Standpipes*, 1993.

2.3.5 USDA Publications. USDA Forest Service, San Dimas Technology and Development Center, San Dimas, CA 91773.

USDA Specification 5100-186D, *Forest Service Specification for Fire Hose, Cotton-Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch,* October 1996.

2.3.6 Other Publications.

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

2.4 References for Extracts in Mandatory Sections. (Reserved)

Chapter 3 Definitions

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

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

3.3.1 Coating. A protective material impregnated, saturated, or coated on the outside reinforcement layer of the hose to provide additional reinforcement or protection for the hose.

3.3.2 Cover. An additional layer on the outside of a hose consisting of a continuous synthetic rubber or plastic that is usually thicker than a coating.

3.3.3 Elongation. The percent a section of hose increases in length from an initial measurement with the hose pressurized at 10 psi (6.9 kPa) to a final measurement with the hose pressurized at its proof test pressure.

3.3.4 Hose.

3.3.4.1* *Attack Hose.* Hose designed to be used by trained fire fighters and fire brigade members to combat fires beyond the incipient stage.

3.3.4.2 *Fire Hose.* A flexible conduit used to convey water.

3.3.4.3 *Forestry Fire Hose.* A hose designed to meet specialized requirements for fighting wildland fires.

3.3.4.4 *Large-Diameter Hose.* A hose of 3½ in. (90 mm) or larger size.

3.3.4.5 *Occupant Use Hose.* Fire hose designed to be used by the building's occupants to fight incipient fires prior to the arrival of trained fire fighters or fire brigade members.

3.3.4.6 *Suction Hose.* A hose that is designed to prevent collapse under vacuum conditions so that it can be used for drafting water from below the pump (lakes, rivers, wells, etc.).

3.3.4.7* *Supply Hose.* Hose designed for the purpose of moving water between a pressurized water source and a pump that is supplying attack lines.

3.3.5 Hose Assembly. Hose with couplings attached to both ends.

3.3.6 Hose Size. An expression of the internal diameter of the hose.

3.3.7 Jacket. See 3.3.9, Reinforcement.

3.3.8 Pressure.

3.3.8.1 *Burst Test Pressure.* A pressure equal to at least three times the service test pressure.

3.3.8.2 *Kink Test Pressure.* A pressure equal to at least 1.5 times the service test pressure.

3.3.8.3 *Operating Pressure.* The highest pressure the hose should be used to in regular operation.

3.3.8.4 *Proof Test Pressure.* A pressure equal to at least two times the service test pressure.

3.3.8.5 *Service Test Pressure.* A pressure equal to approximately 110 percent of the operating pressure.

3.3.9* Reinforcement. The structural support for fire hose that is often in the form of woven yarn.

3.3.10 Rise. The maximum distance measured from the surface of a test table to the underside of the hose that a length of hose lifts off that table when it is pressurized at its proof test pressure.

3.3.11 Thread.

3.3.11.1 *Warp Thread.* The threads or yarns of a hose reinforcement that run lengthwise to the hose.

3.3.11.2 *Weft Thread.* The threads or yarns of a hose reinforcement that are helically wound throughout the length of the hose at approximately right angles to the warp threads.

3.3.12 Twist. The number of revolutions the free end of a 50 ft (15 m) length of hose rotates when it is pressurized from an initial pressure at 10 psi (6.9 kPa) to its proof test pressure with one end held stationary and the other end allowed to move freely.

3.3.13 Warp. The maximum distance any portion of a hose deviates from a straight line running from the center of the fitting at one end to a point on the center of the hose 50 ft (15 m) from that fitting, with the hose pressurized at its proof test pressure.

Chapter 4 Design Requirements

4.1 Requirements for Attack Hose.

4.1.1* Attack hose shall have a minimum design service test pressure of 300 psi (20.7 bar).

4.1.2 Attack hose shall withstand a test pressure of two times its design service test pressure without movement of couplings, leakage, or breaking of any thread in the reinforcement when subjected to the proof test specified in Section 6.2.

4.1.3 A test sample of the attack hose shall withstand a test pressure of three times the designed service test pressure without failure when subjected to the burst test specified in Section 6.5.

4.1.4 A full length of hose shall withstand a test pressure of 1.5 times the designed service test pressure without breaking any thread in the reinforcement when subjected to the kink test specified in Section 6.4.

4.1.5 The maximum elongation shall not exceed 8 percent for hose sizes through 2½ in. (65 mm), 10 percent for 3 in. (76 mm) hose size, and 13 percent for 3½ in. (90 mm) or larger hose size when tested as specified in Section 6.3.

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4.1.6 The maximum twist in turns per 50 ft (15 m) shall not exceed 4¼ turns for hose sizes through 2 in. (51 mm), and 1¾ turns for hose sizes of 2½ in. (65 mm) or larger when tested as specified in Section 6.3, and the final twist shall be in a direction that tightens the couplings.

4.1.7 The maximum warp shall not exceed 20 in. (508 mm) when tested as specified in Section 6.3.

4.1.8 There shall be no rise permitted when tested as specified in Section 6.3.

4.2 Requirements for Supply Hose.

4.2.1 The minimum trade size for supply hose shall be 3½ in. (90 mm).

4.2.2* Supply hose shall have a minimum design service test pressure of 200 psi (13.8 bar).

4.2.3 Supply hose shall withstand a test pressure of two times its design service test pressure without movement of couplings, leakage, or breaking of any thread in the reinforcement when subjected to the proof test specified in Section 6.2.

4.2.4 A test sample of the supply hose shall withstand a test pressure of three times the designed service test pressure without failure when subjected to the burst test specified in Section 6.5.

4.2.5 A full length of supply hose shall withstand a test pressure of 1½ times the designed service test pressure without breaking any thread in the reinforcement when subjected to the kink test specified in Section 6.4.

4.2.6 The maximum elongation shall not exceed 10 percent when tested as specified in Section 6.3.

4.2.7 The maximum twist in turns per 50 ft (15 m) shall not exceed 1¾ turns when tested as specified in Section 6.3, and the final twist shall be in a direction that tightens the couplings.

4.2.8 The maximum warp shall not exceed 20 in. (508 mm) when tested as specified in Section 6.3.

4.2.9 There shall be no rise permitted when tested as specified in Section 6.3.

4.3 Requirements for Occupant Use Hose.

4.3.1* Occupant use hose shall have a minimum design service test pressure of 150 psi (10.3 bar).

4.3.2 Occupant use hose shall withstand a test pressure of two times its design service test pressure without movement of couplings, leakage, or breaking of any thread in the reinforcement when subjected to the proof test specified in Section 6.2.

4.3.3 A test sample of the occupant use hose shall withstand a test pressure of three times the designed service test pressure without failure when subjected to the burst test specified in Section 6.5.

4.3.4 A full length of occupant use hose shall withstand a test pressure of 1½ times the designed service test pressure without breaking any thread in the reinforcement when subjected to the kink test specified in Section 6.4.

4.3.5 The maximum elongation shall not exceed 10 percent when tested as specified in Section 6.3.

4.3.6 The maximum twist in turns per 50 ft (15 m) shall not exceed 7½ turns when tested as specified in Section 6.3, and the final twist shall be in a direction that tightens the couplings.

4.3.7 The maximum warp shall not exceed 20 in. (508 mm) when tested as specified in Section 6.3.

4.3.8 There shall be no rise greater than 7 in. (178 mm) permitted when tested as specified in Section 6.3.

4.4 Requirements for Forestry Hose.

4.4.1* The maximum weight of a lined, cotton-synthetic woven reinforcement forestry fire hose assembly shall be the following:

(1) 20.5 lb (9.3 kg) for 100 ft (30 m) of 1 in. (25 mm) hose
(2) 27 lb (12.3 kg) for 100 ft (30 m) of 1½ in. (38 mm) hose
(3) 10.9 lb (4.9 kg) for 50 ft (15 m) of 1 in. (25 mm) hose
(4) 14.8 lb (6.7 kg) for 50 ft (15 m) of 1½ in. (38 mm) hose

4.4.2* The maximum weight of a lined, synthetic woven reinforcement forestry fire hose assembly shall be the following:

(1) 9.5 lb (4.3 kg) for 100 ft (30 m) of 1 in. (25 mm) hose
(2) 16 lb (7.3 kg) for 100 ft (30 m) of 1½ in. (38 mm) hose
(3) 5 lb (2.3 kg) for 50 ft (15 m) of 1 in. (25 mm) hose
(4) 8 lb (3.6 kg) for 50 ft (15 m) of 1½ in. (38 mm) hose

4.4.3* Forestry hose shall have a minimum design service test pressure of 300 psi (20.7 bar).

4.4.4 Forestry hose shall withstand a test pressure of two times its design service test pressure without movement of couplings, leakage, or breaking of any thread in the reinforcement when subjected to the proof test specified in Section 6.2.

4.4.5 A test sample of the forestry hose shall withstand a test pressure of three times the designed service test pressure without failure when subjected to the burst test specified in Section 6.5.

4.4.6 A full length of forestry hose shall withstand a test pressure of 1½ times the designed service test pressure without breaking any thread in the reinforcement when subjected to the kink test specified in Section 6.4.

4.4.7 The maximum elongation shall not exceed 10 percent when tested as specified in Section 6.3.

4.4.8 The maximum twist in turns per 50 ft (15 m) shall not exceed 12 turns for 1 in. (25 mm) hose and 8 turns for 1½ in. (38 mm) hose when tested as specified in Section 6.3, and the final twist shall be in a direction that tightens the couplings.

4.4.9 The maximum warp shall not exceed 25 in. (635 mm) when tested as specified in Section 6.3.

4.4.10 There shall be no rise greater than 8 in. (203 mm) permitted when tested as specified in Section 6.3.

4.4.11 Flexibility and Compressibility.

4.4.11.1 For cotton-synthetic woven reinforcement fire hose, the load required to compress the hose shall not exceed 100 lb (45.4 kg) for 1 in. (25 mm) hose and 125 lb (56.75 kg) for 1½ in. (38 mm) hose when two samples are tested for flexibility and compressibility in accordance with Section 6.13.

4.4.11.2 For synthetic woven reinforcement fire hose, the load required to compress the hose shall not exceed 40 lb (18.1 kg) for 1 in. (25 mm) hose and 55 lb (24.9 kg) for 1½ in. (38 mm) hose when two samples are tested for flexibility and compressibility in accordance with Section 6.13.

4.5 Requirements for Suction Hose. The requirements of Chapters 5, 6, and 7 shall not apply to suction hose except as specified herein.

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4.5.1 The internal diameter of the suction hose shall comply with Section 5.1.

4.5.2 The internal surface of the suction hose shall be smooth and free of corrugations.

4.5.3 If a lining is provided, it shall meet the requirements of 5.4.5.1.

4.5.4 If a cover is provided, it shall meet the requirements given in 5.4.6.

4.5.5 The suction hose shall be constructed to withstand an internal vacuum of at least 23 in. Hg (0.78 bar) without failure, including the collapse of the liner or the cuffed (soft) ends, when applicable in the coupling bowl area.

4.5.6 The hose shall be designed for use in ambient conditions ranging from –30°F to 140°F (–34°C to 60°C).

4.5.7 The tensile strength of any elastomeric material shall not decrease by more than 20 percent of the original value, and the elongation shall not decrease by more than 50 percent of the original value when tested in accordance with Section 6.8.

4.5.7.1 The tensile strength and ultimate elongation shall meet the requirements of 5.4.7.1 and 5.4.7.2.

4.5.8 The material used for the tube and the cover, if provided, shall pass the Low-Temperature Test on Tube and Cover of ASTM D 380, *Standard Test Methods for Rubber Hose*, when subjected to the cold chamber for 5 hours at –30°F (–34°C).

4.5.9 All elastomeric material shall show no visible signs of cracking when subjected to the ozone test specified in Section 6.9.

4.5.10 If the suction hose is designed for use under vacuum only, the hose assembly shall be indelibly marked in letters no less than 3⁄16 in. (4.8 mm) high with the words "for vacuum use only."

4.5.11 After the hose has been coupled, it shall be subjected to a vacuum of 23 in. Hg (0.78 bar).

4.5.11.1 Once the vacuum has been established, the hose shall maintain that vacuum for 10 minutes with no loss of vacuum.

4.5.11.2 The vacuum pump shall not be used to maintain the vacuum during the 10-minute period.

4.5.11.3 After the test has been completed, the hose and any component shall be visually inspected for any sign of collapse or failure.

4.5.12 Suction hose shall comply with the requirements of Sections 7.1 and 7.2.

Chapter 5 Construction Requirements

5.1* Diameter. The hose shall have an internal diameter of not less than the trade size of the hose.

5.2 Length.

5.2.1 The length of the hose shall be between –2 percent and +4 percent of the nominal stated length of the hose.

5.2.1.1 The length of hose from which the burst sample has been taken shall be permitted to be 3 ft (0.9 m) shorter than the required length as stated in 5.2.1.

5.2.2 Each length shall be measured as specified in 6.2.6.

5.3 Reinforcement.

5.3.1* Hose reinforcement shall be made from one of the following materials, and the material shall be approved:

(1) Natural fiber
(2) Synthetic fiber
(3) Combination of natural and synthetic fiber

5.3.2 Reinforcements shall be evenly and firmly woven and shall be as free from defects, dirt, knots, lumps, and irregularities that might affect the serviceability of the hose as is consistent with good manufacturing practice.

5.3.3 If the hose has a woven reinforcement, all knots shall be tucked under the warp threads.

5.3.4* If the hose has a fabric reinforcement, each layer of reinforcement shall be seamless and shall have the filling woven around the hose throughout its length and the warps interwoven with and substantially covering the filling.

5.3.5 The hose shall be designed and manufactured such that, in the event of a burst, the weft threads shall fail first.

5.3.6 When mildew treatment for the reinforcement is provided, the hose manufacturer shall certify that the mildew treatment meets the requirements of USDA Specification 5100-186D, *Forest Service Specification for Fire Hose, Cotton-Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch.*

5.4 Linings and Covers.

5.4.1* All fire hose shall be lined.

5.4.2 Liners and covers, if provided, shall be made from one of the following materials, and the material shall be approved:

(1) Rubber compound
(2) Thermoplastic material
(3) Blends of rubber compounds and thermoplastic material
(4) Natural rubber-latex-coated fabric

5.4.3 The lining shall be of uniform thickness.

5.4.4 The waterway surface of the lining shall be free from pitting, irregularities, or other imperfections that might affect the serviceability of the hose.

5.4.5 Lining Adhesion.

5.4.5.1 The adhesion between the lining and the reinforcement shall be such that the rate of separation of a 1½ in. (38 mm) strip of the lining from the reinforcement shall not be greater than 1 in. (25 mm) per minute with a weight of 12 lb (5.4 kg) when tested in accordance with 6.6.1 through 6.6.6.

5.4.5.2 If a rubber backing is used between the lining and the reinforcement, the adhesion between the lining and the backing and between the backing and the reinforcement shall be such that the rate of separation of a 1½ in. (38 mm) strip shall not be greater than 1 in. (25 mm) per minute with a weight of 12 lb (5.4 kg), as specified in 6.6.7 and 6.6.8.

5.4.5.3 The requirement of 5.4.5.1 shall not exclude a construction that provides no adhesion between the reinforcement and lining along the fold if the surface where there is no adhesion is not greater than 35 percent of the total surface.

5.4.6 If the hose has a woven reinforcement and is equipped with a cover, the adhesion between the cover and the woven reinforcement shall be such that the rate of separation of a 1½ in. (38 mm) strip of the cover from the reinforcement

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shall not be greater than 1 in. (25 mm) per minute with a weight of 10 lb (4.5 kg) as specified in 6.6.1 through 6.6.6.

5.4.7 Tensile Strength and Ultimate Elongation.

5.4.7.1 The tensile strength and ultimate elongation of specimens taken from the elastomer material shall not be less than as stated in Table 5.4.7.1 when tested as specified in Section 6.7.

Table 5.4.7.1 Tensile Strength and Ultimate Elongation for Elastomer Materials in Fire Hose

Material	Tensile Strength		Ultimate Elongation (%)
	psi	kPa	
Natural and synthetic rubber	1,200	8,275	400
Latex rubber	1,800	12,410	700
Thermoplastic	2,000	13,790	400
PVC	1,200	8,275	400
Other	1,200	8,275	400

5.4.7.2 If the hose is equipped with oil-resistant liners or covers, the ultimate elongation shall not be less than 250 percent provided that the tensile strength and ultimate elongation do not decrease more than 50 percent when tested in accordance with Section 6.12.

5.4.7.3 The tensile strength of liners for forestry hose shall not be less than 1800 psi (12,410 kPa).

5.4.7.4 The tensile strength and ultimate elongation of specimens subjected to the oven aging test, as specified in Section 6.8, shall not be less than 75 percent of the tensile strength and ultimate elongation of specimens not subjected to this test.

5.4.8 Ozone Resistance.

5.4.8.1 For hose intended to be ozone-resistant, the elastomer components shall show no visible signs of cracking when subjected to the ozone test specified in Section 6.9.

5.4.8.2 Hose that meets the requirements of 5.4.8.1 shall be marked "ozone resistant" in letters and figures at least 1 in. (25 mm) high.

5.4.9 Cold Resistance.

5.4.9.1 All hose except suction hose shall show no apparent damage to the reinforcement or lining when subjected to the cold bending test specified in Section 6.10.

5.4.9.2 The hose shall not leak or show breakage of any thread in the reinforcement or slippage of couplings when subjected to the proof test pressure as specified in 6.10.5.

5.4.9.3 Special Cold-Resistant Hose.

5.4.9.3.1 If the hose is designed for use down to –65°F (–54°C), it shall show no apparent damage to the reinforcement or lining when subjected to the cold bending test specified in Section 6.10.

5.4.9.3.2 The hose shall not leak or show breakage of any thread in the reinforcement or slippage of couplings when subjected to the proof test pressure as specified in 6.10.5.

5.4.9.3.3 It shall be possible for one person to uncoil and lay out a 50 ft (15 m) length of hose immediately after it has been subjected to the cold flexibility test as specified in Section 6.11.

5.4.9.3.4 Hose that meets the requirements of 5.4.9.3.1, 5.4.9.3.2, and 5.4.9.3.3 shall be marked "for use down to –65°F (–54°C)" in letters and figures at least 1 in. (25 mm) high.

5.5 Hose Characteristics.

5.5.1 The material selected in 5.3.1 and 5.4.2 for the construction of attack hose shall be capable of being manufactured into a hose that has all of the following qualities:

(1) Abrasion resistance and can pass the Abrasion Test in UL 19, *Lined Fire Hose and Hose Assemblies*, and the Abrasion Test defined in FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*
(2) Heat resistance and can pass the Heat-Resistance Test in UL 19, *Lined Fire Hose and Hose Assemblies*, and the Heat Resistance Test in FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*
(3) Resistance to degradation from moisture when soaked in water for 48 hours
(4) Withstands 100,000 cycles of repeated bending [hose size of 3½ in. (90 mm) or less nominal size]
(5) Withstands 2000 cycles of alternating pressures between 0 psi (0 bar) and the service test pressure of the fire hose

5.5.2 The material selected in 5.3.1 and 5.4.2 for the construction of supply hose shall be capable of being manufactured into a hose that has all of the following qualities:

(1) Abrasion resistance and can pass the Abrasion Test in UL 19, *Lined Fire Hose and Hose Assemblies*, and the Abrasion Test defined in FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*
(2) Heat resistance and can pass the Heat-Resistance Test in UL 19, *Lined Fire Hose and Hose Assemblies*, and the Heat Resistance Test in FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*
(3) Resistance to degradation from moisture when soaked in water for 48 hours
(4) Withstands 2000 cycles of alternating pressures between 0 psi (0 bar) and the service test pressure of the fire hose

5.5.3 The material selected in 5.3.1 and 5.4.2 for the construction of occupant use hose or forestry fire hose shall be capable of being manufactured into a hose that has all of the following qualities:

(1) Abrasion resistance and can pass the Abrasion Test in UL 219, *Lined Fire Hose for Interior Standpipes*
(2) Heat resistance and can pass the Heat Resistance Test defined in UL 219, *Lined Fire Hose for Interior Standpipes*
(3) Resistance to degradation from moisture when soaked in water for 48 hours
(4) Withstands 10,000 cycles of repeated bending

5.6 Marking.

5.6.1* Each length of fire hose shall be indelibly marked in letters and figures at least 1 in. (25 mm) high with the manufacturer's identification, the country of origin, the month and the year of manufacture, and the words "service test to [the service test pressure the hose is designed to] psi (bar) per NFPA 1962 [*Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose*]."

5.6.2 These markings shall be in a minimum of two places on each length of hose, beginning 5 ft ± 6 in. (1.5 m ± 152 mm) from the ends of the hose unless the hose is marked at continuous intervals not exceeding 12 ft (3.7 m).

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5.6.3 Marking Large-Diameter Hose.

5.6.3.1 Each length of large-diameter supply hose meeting the requirements of Section 4.2 shall be indelibly marked lengthwise in letters at least 2 in. (51 mm) high with the words "supply hose."

5.6.3.2 Each length of large-diameter attack hose meeting the requirements of Section 4.1 shall be indelibly marked lengthwise in letters at least 2 in. (51 mm) high with the words "attack hose."

5.6.3.3 The marking shall be centered in the first 5 ft ± 6 in. (1.5 m ± 150 mm) from each end of the hose and shall be marked in two places, 180 degrees apart.

5.6.4 No markings referring to pressure, other than the service test pressure specified in 5.5.1, shall appear on the hose.

Chapter 6 Test Methods for Manufacturers' Hose Certification

6.1 General.

6.1.1 The test procedures defined in this chapter shall be performed only under controlled laboratory conditions by the hose manufacturer, its designated agent, or by an approved testing facility designated by the manufacturer.

6.1.2 The tests shall not be performed by users in uncontrolled, non-laboratory situations.

6.2 Proof Test.

6.2.1 The test shall be conducted on a test table that shall have a clear space of at least 20 in. (508 mm) on each side of a line drawn through the center of the supply connection parallel to the edges of the test table.

6.2.2 To facilitate the complete removal of air from the hose, the surface of the test table shall be inclined with the supply at the low end.

6.2.3 The hose shall be filled with water until all air has been exhausted.

6.2.4 The valve shall be closed and the pressure adjusted to 10 psi (70 kPa).

6.2.5 While at 10 psi (70 kPa), the hose shall be straightened out.

6.2.6 The length of the hose shall be measured between the inside edges of the couplings and recorded to the nearest 1 in. (25 mm).

6.2.7 The hose shall be marked behind the coupling.

6.2.8 The pressure in the hose shall be increased at a rate of not less than 300 psi (20.7 bar) or more than 1000 psi (69 bar) per minute until the required test pressure is reached.

6.2.9 Proof test pressure shall be held for at least 15 seconds and not more than 1 minute.

6.2.10 The hose shall be examined for movement of the couplings after the test.

6.3 Elongation, Twist, Warp, and Rise Tests.

6.3.1* The elongation test, twist test, warp test, and rise test shall be permitted to be run at the same time the proof test is being run.

6.3.2 If the tests are to be run at a different time than while the proof test is being run, the hose shall be set up for testing as required by 6.2.1 through 6.2.5.

6.3.3 Elongation Test.

6.3.3.1 The length of the hose shall be measured between the inside edges of the couplings and recorded to the nearest 1 in. (25 mm).

6.3.3.2 The pressure in the hose shall be raised as described in 6.2.8 from the initial pressure of 10 psi (70 kPa) to the proof test pressure.

6.3.3.3* The measurement shall be taken parallel to the edge of the test table.

6.3.3.4 All measurements shall be taken from the inside edges of the fittings.

6.3.3.5 The elongation of the hose shall be calculated as the percent change from the initial measurement taken at 10 psi (70 kPa) to the final measurement taken at the proof test pressure.

6.3.4 Twist Test.

6.3.4.1 The pressure in the hose shall be raised as described in 6.2.8 from the initial pressure of 10 psi (70 kPa) to the proof test pressure.

6.3.4.2 The amount of twist shall be measured by following a color line in the hose or by noting, in the period during which the pressure is being raised, the turns of the fitting at the free end of the hose.

6.3.4.3 The amount of twist shall be recorded to the nearest one-eighth turn or 45 degrees.

6.3.4.4 The direction of twist shall be reported as right or left with a right twist being in the direction that would tend to tighten the couplings.

6.3.5 Warp Test.

6.3.5.1 The pressure in the hose shall be raised as described in 6.2.8 from the initial pressure of 10 psi (70 kPa) to the proof test pressure.

6.3.5.2 For hose having a nominal length of 50 ft (15 m), the amount of warping shall be the maximum deviation of any portion of the hose from a straight line running from the center of the fitting at one end to the center of the fitting at the other end of the hose.

6.3.5.3* For hose having a nominal length greater than 50 ft (15 m) and up to 100 ft (30 m), the amount of warping shall be the maximum deviation of a 50 ft (15 m) portion of the hose from a straight line starting from the center of the fitting at one end and running to a point on the center of the hose 50 ft (15 m) from that fitting.

6.3.5.4 The warp shall be measured as the distance from the referenced straight line to the center line of the hose at the point of maximum deviation.

6.3.6 Rise Test.

6.3.6.1 The pressure in the hose shall be raised as described in 6.2.8 from the initial pressure of 10 psi (70 kPa) to the proof test pressure.

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6.3.6.2 The distance that the hose rises above the test table shall be measured to the nearest 1 in. (25 mm) and recorded as the rise.

6.3.7 If the first measurement of warping is excessive, the position of the hose relative to the water supply shall be permitted to be reversed, end for end, and the test for warping repeated.

6.3.8 Rise shall be measured to the nearest 1 in. (25 mm) and is the distance that the hose rises above the test table when the hose is subjected to the proof test pressure.

6.4 Kink Test.

6.4.1 The test shall be conducted on a test table that shall have a clear space of at least 20 in. (508 mm) on each side of a line drawn through the center of the supply connection parallel to the edges of the test table.

6.4.2 To facilitate the complete removal of air from the hose, the surface of the test table shall be inclined with the supply at the low end.

6.4.3 The hose shall be filled with water until all air has been exhausted.

6.4.4 The valve shall be closed and the pressure adjusted to 10 psi (70 kPa).

6.4.5 The hose shall be sharply kinked 18 in. (457 mm) from the free end by tying the hose back against itself as close to the fittings as practicable.

6.4.6 The pressure shall be raised as described in 6.2.8 to the test pressure and immediately released.

6.5* Burst Test.

6.5.1 One 3 ft (0.9 m) sample shall be cut from the end of two lengths of hose and submitted for testing before the hose is subjected to the proof test.

6.5.2 One of the samples shall be tested while lying straight and the other while lying curved on a surface having a radius of 27 in. (685 mm).

6.5.3* The test shall be conducted within a protective enclosure.

6.5.4 The 3 ft (0.9 m) samples shall be connected to the water supply, the air expelled, and the pressure raised until the specified burst pressure is reached.

6.6 Adhesion Test.

6.6.1 The apparatus required for this test shall consist of a supporting frame, clamps, weights, weight holders, and a timer.

6.6.2 The supporting frame shall be of such design that specimens with weights attached can be suspended vertically and hang freely during the progress of the test.

6.6.3 The specimen for the adhesion test shall be cut transversely.

6.6.3.1 The specimen shall be 2 in. (51 mm) wide and shall be cut through so as to give a rectangular sample 2 in. (51 mm) wide and the full circumference of the hose in length.

6.6.3.2 A strip of lining, or cover if provided, 1½ in. (38 mm) wide shall be cut out accurately, with the cut extending through the rubber but not entirely through the woven reinforcement.

6.6.4 The lining or cover and the woven reinforcement shall be separated for about 1½ in. (38 mm), and a reference mark shall be placed on the reinforcement at the juncture of the reinforcement and the lining.

6.6.4.1 The free end of the woven reinforcement shall be gripped in a stationary clamp.

6.6.4.2 The separated rubber shall be gripped in a freely suspended clamp hanging vertically, to which the prescribed weight shall be attached.

6.6.4.3 Provision shall be made for supporting and releasing the weight slowly without jerking.

6.6.5 The distance through which separation takes place shall be noted for a period of 10 minutes or until complete separation occurs.

6.6.6 The adhesion to the reinforcement shall be taken as the rate obtained by dividing the total distance separated by inches (millimeters), to the nearest 0.1 in. (2.54 mm), by the elapsed time in minutes.

6.6.7 If a rubber backing is used between the lining and the reinforcement, the adhesion between the lining and the backing and the adhesion between the backing and the reinforcement shall be determined using the methods specified in 6.6.1 through 6.6.6.

6.6.8 If the adhesion between the lining and the backing or between the backing and the reinforcement cannot be determined because the backing has a tendency to tear during the test, the rate of separation between the separating members shall be considered the adhesion.

6.7 Tensile Strength and Elongation.

6.7.1 Tensile strength and elongation shall be determined in accordance with the test methods specified in ASTM D 412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension*, Method A.

6.7.2 Three dumbbell specimens shall be die-cut to the dimensions given in 6.7.3.

6.7.3 The constricted portion of the specimen shall be 0.25 in. × 1.30 in. (6.35 mm × 33 mm) and the enlarged ends shall be 1 in. (25 mm) wide.

6.7.4 The constricted portion of each specimen shall be permitted to be buffed to remove fabric impressions or other surface irregularities.

6.7.4.1 Samples shall be buffed prior to cutting with the die.

6.7.4.2 If the nature or thickness of the lining is such that buffing cannot be accomplished without damaging the lining, unbuffed specimens shall be permitted to be used for the tensile strength and elongation tests.

6.7.5 Specimens shall be cut transversely from the sample.

6.7.6 Three measurements for thickness shall be made in the constricted portion of each specimen.

6.7.6.1 The minimum value obtained shall be used as the thickness of the specimen in calculating the tensile strength.

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6.7.6.2 The average tensile strength of the three specimens shall be considered the tensile strength of the rubber lining or cover.

6.7.7 Two benchmarks 1 in. (25 mm) apart shall be stamped centrally on the constricted portion of each specimen.

6.7.8 If a dumbbell test specimen breaks outside the benchmarks, or if the result of either tensile strength or elongation based on the average of three specimens is not acceptable, another set of three specimens shall be tested, and the results from this set shall be considered final.

6.7.9 Results of tests of specimens that break in the curved portion just outside the benchmarks shall be permitted to be accepted if within the minimum requirements.

6.8 Oven Aging Test.

6.8.1 Three specimens shall be prepared as described in 6.7.2 through 6.7.6.

6.8.2 The specimens shall be conditioned in an oven for 96 hours at 158°F ± 3.6°F (70°C ± 2°C) following the procedures described in ASTM D 573, *Standard Test Method for Rubber — Deterioration in an Air Oven.*

6.8.3 Two benchmarks 1 in. (25 mm) apart shall be stamped centrally on the constricted portion of each specimen after the conditioning.

6.8.4 The specimens shall then be tested in accordance with ASTM D 412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension*, Method A.

6.9 Ozone Resistance.

6.9.1 Three specimens, sized 3¾ in. × 1 in. (85 mm × 25 mm), or as close to 1 in. (25 mm) wide as possible from small-diameter hose, shall be cut longitudinally from the liner and cover, if provided, of the sample and mounted in the specimen holder in a looped position in accordance with the procedures outlined in ASTM D 518, *Standard Test Method for Rubber Deterioration — Surface Cracking*, Procedure B.

6.9.2 The ozone test chamber shall be regulated to give an ozone concentration of 100 pphm ± 10 pphm and a temperature of 104°F ± 1.8°F (40°C ± 1°C).

6.9.3 When constant test conditions have been obtained in the ozone test chamber, and after the mounted specimens have remained in an ozone-free atmosphere for 24 hours, the mounted specimens shall be placed in the test chamber and allowed to remain for 70 hours.

6.9.4 After the test exposure, the specimens shall be removed from the test chamber and examined with a 7-power magnifying glass.

6.10 Cold Bending Test.

6.10.1 A 3 ft (0.9 m) sample of the hose shall be provided with test fittings and immersed in a water bath at room temperature for 24 hours.

6.10.2 The hose shall be removed from the water bath and exposed to room atmosphere for 15 minutes.

6.10.3 The hose shall be placed in a cold box for 24 hours with the temperature maintained at –4°F ± 1.8°F (–20°C ± 1°C) unless the hose is being tested for special cold resistance, in which case the temperature shall be maintained at –65°F ± 3.6°F (–54°C ± 2°C).

6.10.4 After 24 hours in the cold box, the hose shall be removed from the box and immediately bent double on itself, 180 degrees, first one way and then the other.

6.10.5 The hose shall then be allowed to thaw at room temperature for 24 hours and then be subjected to the proof test pressure as specified in Section 6.2.

6.11 Cold Flexibility Test.

6.11.1 A 50 ft (15 m) length of dry hose shall be tightly coiled and placed in a cold box for 24 hours with the temperature maintained at –65°F± 3.6°F (–54°C ± 2°C).

6.11.2 After 24 hours in the cold box, the hose shall be removed from the box and an attempt shall be made immediately by one operator to uncoil and lay out the hose.

6.12 Oil Immersion Test.

6.12.1 A sample of the liner shall be immersed in a petroleum-based oil at 250°F ± 1.8°F (121°C ± 1°C) for 18 hours and the tensile strength and elongation determined as specified in Section 6.7.

6.12.2 The oil used in this test shall be a medium-swelling petroleum-based oil with a viscosity of 100 ± 5 Saybolt Universal seconds at 210°F (98.9°C), an aniline point of 199.4°F ± 5.4°F (93°C ± 3°C), and an open cup flash point of 475°F ± 10°F (246.1°C ± 5.6°C).

6.13 Flexibility and Compressibility Testing.

6.13.1 The flexibility and compressibility test apparatus shall consist of a compression tester with plates of a nominal 6 in. (152 mm) length and a nominal 4 in. (102 mm) width.

6.13.2 The compression tester shall be an accepted laboratory instrument having a rate of travel of approximately 0.25 in. (6.35 mm) per minute.

6.13.3 Two lengths of hose each 20 in. (508 mm) shall be obtained from the uncoupled hose coil, using the hose following the sample taken for the burst pressure test.

6.13.4 The 20 in. (508 mm) test sample shall be prepared with a small pinprick every 1 in. (25 mm) longitudinally and parallel to the fold on each side to allow air to escape during compression of the test sample.

6.13.4.1 The pinpricks shall be located 0.4 in. ± 0.1 in. (10 mm ± 2.5 mm) from each fold on each side of the hose.

6.13.4.2 Each pinprick shall penetrate at least 1 thickness and shall be permitted to penetrate both thicknesses of hose.

6.13.5 Each sample shall be folded in an "S" shape and flattened manually so that the overall dimension of the "S" loop is 5 in. ± 0.25 in. (127 mm ± 6.35 mm) and the hose test sample is placed between compression plates of the tester, parallel to the 6 in. (152 mm) axis, as shown in Figure 6.13.5.

6.13.6 If the hose being tested is cotton-synthetic woven reinforcement fire hose, the test sample shall be compressed until there is a distance of 1 in. (25.4 mm) between the plates and the amount of load required to achieve this compression recorded.

6.13.7 If the hose being tested is synthetic woven reinforcement fire hose, the test sample shall be compressed until there is a distance of 0.63 in. (16 mm) between the plates and the amount of load required to achieve this compression recorded.

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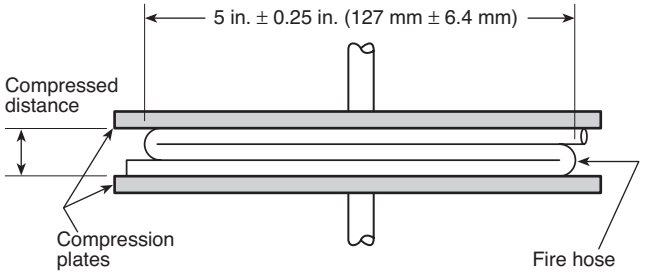

FIGURE 6.13.5 Compression and Flexibility Test Apparatus.

Chapter 7 Sampling, Inspection, and Tests

7.1 Quality Control.

7.1.1 The hose manufacturer shall have a quality control program in place that assures fire hose manufactured to this standard complies with the requirements of this standard.

7.1.2 The manufacturer shall keep documentation of all design tests that show compliance with the requirements of this standard.

7.1.3 Records of hydrostatic tests required by this standard shall be kept complete and available to the purchaser when requested at the time of purchase.

7.1.4 When requested at the time of purchase, the manufacturer shall provide the purchaser with certification that the fire hose or fire hose assembly furnished has been tested and is in compliance with the requirements of this standard.

7.2 Inspection.

7.2.1 The manufacturer shall be responsible for performing all inspections required by this standard. Manufacturers shall be permitted to utilize their own facilities or any approved laboratory.

7.2.2 Samples of the hose ready for delivery shall be selected in accordance with ASQ Z1.4, *Sampling Procedures and Tables for Inspection by Attributes,* for inspection of visual and dimensional characteristics.

7.3 Testing.

7.3.1 All hose shall be tested to its proof pressure in accordance with Section 6.2 after it has been coupled for delivery and shall show no signs of coupling slippage.

7.3.2 All hose shall be subjected to elongation, twist, warp, and rise tests performed in accordance with Section 6.3.

7.3.3 Samples shall be selected in accordance with ASQ Z1.4, *Sampling Procedures and Tables for Inspection by Attributes*, and tested for kink, burst, adhesion, and tensile strength and elongation.

7.3.4 Design Verification. The design of fire hose manufactured with reinforcement from fibers specified in 5.3.1 or linings and covers manufactured with materials specified in 5.4.2 shall be verified as specified in 7.3.4.1 through 7.3.4.5.

7.3.4.1 Abrasion Resistance.

7.3.4.1.1 The abrasion resistance of attack hose and supply hose shall be verified using the test procedures defined in UL 19, *Lined Fire Hose and Hose Assemblies*, Abrasion Test; FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*, Abrasion Test; or equivalent.

7.3.4.1.2 The abrasion resistance of occupant use hose and forestry fire hose shall be verified using the test procedures defined in UL 219, *Lined Fire Hose for Interior Standpipes*, Abrasion Test, or equivalent.

7.3.4.2 Heat Resistance.

7.3.4.2.1 The ability of attack hose and supply hose to resist heat shall be verified using the test procedures defined in UL 19, *Lined Fire Hose and Hose Assemblies*, Heat-Resistance Test; FM Class Number 2111, *Factory Mutual Approval Standard for Fire Hose*, Heat Resistance; or equivalent.

7.3.4.2.2 The ability of occupant use hose and forestry fire hose to resist heat shall be verified using the test procedures defined in UL 219, *Lined Fire Hose for Interior Standpipes*, Heat-Resistance Test, or equivalent.

7.3.4.3 Repeated Bending.

7.3.4.3.1 The ability of attack hose 3½ in. (90 mm) or less nominal size to sustain repeated bending shall be verified using the test procedures defined in UL 19, *Lined Fire Hose and Hose Assemblies*, Repeated Bending Test, or equivalent.

7.3.4.3.2 The ability of occupant use hose and forestry fire hose to sustain repeated bending shall be verified using the test procedures defined in UL 219, *Lined Fire Hose for Interior Standpipes*, Repeated Bending Test, or equivalent.

7.3.4.4 Alternating Pressure. The ability of attack hose and supply hose to withstand alternating pressures shall be verified using the test procedures defined in UL 19, *Lined Fire Hose and Hose Assemblies*, Alternating Pressure Test, or equivalent.

7.3.4.5 Moisture Resistance.

7.3.4.5.1 The ability of attack hose and supply hose to resist moisture shall be verified using the test procedures defined in UL 19, *Lined Fire Hose and Hose Assemblies*, Wet Hose Test, or equivalent.

7.3.4.5.2 The ability of occupant use hose and forestry fire hose to resist moisture shall be verified using the test procedures defined in UL 219, *Lined Fire Hose for Interior Standpipes*, Wet Hose Test, or equivalent.

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Annex A Explanatory Material

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

A.1.1 All fire hose has an expected service life. That life will depend on a number of factors, such as the initial quality of the hose, the type of service to which it is subjected, and the care it receives during its life. Users should develop a fire hose inspection and care program based on NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose.* That program should also address the retirement of fire hose.

One of the reasons for keeping good records of fire hose as required by NFPA 1962 is to evaluate how different fire hoses perform over time. This will provide the experience the users need to help them determine what a useful service life is for

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different types of hose and make decisions on when fire hose should be retired.

Limited testing of in-service fire hose by the Fire Equipment Manufacturers Association indicated an increased risk of failure after a 10-year time period. The testing looked at the reduction in burst pressure, ozone degradation, liner adhesion and degradation, hose strength, normal wear patterns, and UV degradation of fibers.

While all users should establish their own retirement schedule, fire departments should give careful consideration to a 10-year maximum service life under normal operating conditions.

A.1.2 This standard is not a detailed manufacturing or purchasing specification but can be referenced in purchase specifications as minimum requirements.

A.1.6 Table A.1.6 provides conversion factors if more precision is required.

Table A.1.6 Conversion Factors

1 psi	=	6.895 kPa	1 kPa	=	0.145 psi
1 psi	=	0.0690 bar	1 bar	=	14.492 psi
1 in. Hg	=	3.386 kPa	1 kPa	=	0.3 in. Hg
1 in.	=	25.4 mm	1 mm	=	0.039 in.
1 ft	=	0.305 m	1 m	=	3.28 ft

A.3.2.1 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.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, 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.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.4.1 Attack Hose. Attack hose is designed to convey water to handline nozzles, distributor nozzles, master stream appliances, portable hydrants, manifolds, standpipe and sprinkler systems, and pumps used by the fire department. Attack hose is designed for use at operating pressures up to at least 275 psi (19 bar).

A.3.3.4.7 Supply Hose. Supply hose is designed to be used at operating pressures not exceeding 185 psi (12.8 bar).

A.3.3.9 Reinforcement. The reinforcement is often referred to as the jacket when it is the exterior layer of the hose construction, and hose can have more than one layer of reinforcement. The reinforcement is sometimes coated or covered with protective materials.

A.4.1.1 A minimum design service test pressure of 300 psi (20.7 bar) for attack hose provides a normal highest operating pressure of 275 psi (19 bar). If a higher operating pressure is needed, a hose having a service test pressure of at least 10 percent greater than the highest operating pressure should be used.

A.4.2.2 Whenever supply hose is being used to supply attack lines, master stream appliances, portable hydrants, manifolds, and standpipe and sprinkler systems, a pressure relief device with a maximum setting of 200 psi (13.8 bar) should be used.

A minimum design service test pressure of 200 psi (13.8 bar) for supply hose provides a normal highest operating pressure of 185 psi (12.8 bar). If a higher operating pressure is needed, a hose having a service test pressure of at least 10 percent greater than the highest operating pressure should be used.

A.4.3.1 A minimum design service test pressure of 150 psi (10.3 bar) for occupant use hose provides a normal highest operating pressure of 135 psi (9.3 bar). If a higher operating pressure is needed, a hose having a service test pressure of at least 10 percent greater than the highest operating pressure should be used.

A.4.4.1 This requirement is consistent with USDA Specification 5100-186D, *Forest Service Specification for Fire Hose, Cotton-Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch.*

A.4.4.2 This requirement is consistent with USDA Specification 5100-187D, *Forest Service Specification for Fire Hose, Lightweight Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch.*

A.4.4.3 A minimum design service test pressure of 300 psi (20.7 bar) for forestry hose provides a normal highest operating pressure of 275 psi (19 bar). If a higher operating pressure is needed, a hose having a service test pressure of at least 10 percent greater than the highest operating pressure should be used.

A.5.1 The friction loss characteristics of fire hoses are not included in this standard but are an important consideration in the selection of hose. Friction loss varies considerably depending on the construction and design of the hose, the roughness of the lining, and its internal diameter, which may be different for different grades of hose. The type of couplings can also affect the friction loss.

Where friction loss is important, side-by-side comparisons are recommended. The following test is recommended.

All comparative tests should use 300 ft (90 m) of each type of hose to be tested laid side-by-side on a level surface. Commercially available line pressure gauges should be installed at the inlet and the outlet of the first 300 ft (90 m) of hose to be tested.

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A smooth bore nozzle of the size shown in Table A.5.1 should be used for the tests. Pressurize the test hose while the nozzle is fully open until a pitot gauge reading of the discharge reads 50 psi (3.5 bar). Read the pressure shown on the inlet and outlet line gauges. Subtract the outlet pressure from the inlet pressure and divide by 3 to determine the friction loss per 100 ft (30 m) of hose. Repeat the test for the next type hose to be tested. The hose with the lowest friction loss will flow the most amount of water for a given inlet pressure.

Table A.5.1 Recommended Smooth Bore Nozzle Size for Testing Friction Loss in Fire Hose

Hose Size		Recommended Smooth Bore Nozzle Size	
in.	mm	in.	mm
1	25	½	13
1½	38	⅞	22
1¾	44	⅞	22
2	51	⅞	22
2½	65	1⅛	29
3	76	1⅛	29
3½	90	1¼	32
4	100	2	51
4½	113	2	51
5	125	2¼	57
6	150	2¼	57

A.5.3.1 Hose with a reinforcement of all-synthetic fibers is much lighter in weight than the cotton-synthetic reinforcement hose and is considerably more flexible; therefore, a greater amount can be stored in a given space.

A.5.3.4 In areas where the hose could be subjected to rough usage, two layers of reinforcement (double-jacketed) or rubber-covered hose should be considered.

A.5.4.1 Fire hose should not be used for the conveyance of potable water. There are hoses specifically designed for this purpose, such as hoses designed to Federal Specifications A-A 59226, *Hose Assembly, Nonmetallic, Fire Fighting, with Couplings*; MIL-H-24606, *Hose, Fire, Synthetic Fiber, Double Jacketed, Treated for Abrasion Resistance, with Couplings, Fire Fighting and Other Water Service*; and MIL-PRF53207, *Hose Assembly, Rubber: Lightweight Collapsible, 6-inch; for Drinking (Potable) Water.*

Linings for these hoses should be approved to NSF 61, *Drinking Water System Components — Health Effects*, or 21 CFR 177.2600, "Rubber Articles Intended for Repeated Use."

A.5.6.1 Hose manufactured before 1987 will not have the service test pressure stenciled on the hose. Users wishing to mark their existing hose should contact the hose manufacturer for the correct designation prior to marking their hose.

A.6.3.1 As the elongation test, twist test, warp test, and rise test all require the hose to be pressurized to its proof pressure, these four tests are generally done concurrently with the proof test.

A.6.3.3.3 For this purpose, an edge of the table should be marked off in feet and inches (meters and centimeters).

A.6.3.5.3 Where hose lengths exceed 50 ft (15 m), measurement of two segments of the hose will be required to determine the maximum warp, one from the fitting on one end to a point 50 ft (15 m) from that fitting and a second from the fitting on the other end to a point 50 ft (15 m) from that fitting. If the length of the hose is greater than 50 ft (15 m) but less than 100 ft (30 m), some of the hose near its longitudinal center will be included in each segment.

A.6.5 CAUTION: Hose meeting the requirements of this standard can be supplied with a coupling that will not be capable of complying with the burst test requirements of the hose. The purchaser should request information on the failure point of couplings supplied with the hose.

A.6.5.3 The burst test is potentially hazardous as the hose can rupture catastrophically. A protective enclosure should be used to prevent injury if there is a hose rupture or other failure.

Annex B Informational References

B.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

B.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose*, 2003 edition.

B.1.2 Other Publications.

B.1.2.1 Military and Federal Specifications. Naval Publications and Forms Center, 5801 Tabor Avenue, Attn: NPODS, Philadelphia, PA 19120-5094.

A-A 59226, *Hose Assembly, Nonmetallic, Fire Fighting, with Couplings*, June 11, 2003.

MIL-H-24606, *Hose, Fire, Synthetic Fiber, Double Jacketed, Treated for Abrasion Resistance, with Couplings, Fire Fighting and Other Water Service*, Revision B, August 12, 1994.

MIL-PRF53207, *Hose Assembly, Rubber: Lightweight Collapsible, 6-inch; for Drinking (Potable) Water*, Revision B, March 14, 1996.

B.1.2.2 NSF Publications. NSF International, 789 Dixboro Road, P.O. Box 130140, Ann Arbor, MI 48113-0140.

NSF 61, *Drinking Water System Components — Health Effects*, October 22, 2003.

B.1.2.3 USDA Publications. USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

USDA Specification 5100-186D, *Forest Service Specification for Fire Hose, Cotton-Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch.*

USDA Specification 5100-187D, *Forest Service Specification for Fire Hose, Lightweight Synthetic, Lined, Woven Jacket, 1 inch and 1½ inch.*

B.1.2.4 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 21, Code of Federal Regulations, Part 177.2600, "Rubber Articles Intended for Repeated Use."

B.2 Informational References. (Reserved)

B.3 References for Extracts in Informational Sections. (Reserved)

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Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion"* are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
- Standards Council decides, based on all evidence, whether or not to issue Document or to take other action, including hearing any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE *Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES;
1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
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1. (a) NFPA Document Title National Fuel Gas Code **NFPA No. & Year** 54, 200X Edition

(b) Section/Paragraph 3.3

2. Proposal Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

Revise definition of effective ground-fault current path to read:

3.3.78 Effective Ground-Fault Current Path. An intentionally constructed, permanent, low impedance electrically conductive path designed and intended to carry ~~underground~~ electric fault current ~~conditions~~ from the point of a ground fault on a wiring system to the electrical supply source.

4. Statement of Problem and Substantiation for Proposal: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Proposal, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

Change uses proper electrical terms.

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