NFPA® 1962

Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances

2013 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® DOCUMENTS
NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA DOCUMENTS

NFPA® codes, standards, recommended practices, and guides ("NFPA Documents"), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Documents.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Documents. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Documents available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Documents. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REMINDER: UPDATING OF NFPA DOCUMENTS

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Documents") should be aware that NFPA Documents may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Document at any point in time consists of the current edition of the document together with any Tentative Interim Amendment and any Errata then in effect.

In order to determine whether an NFPA Document has been amended through the issuance of Tentative Interim Amendments or corrected by Errata, visit the Document Information Pages on NFPA's website. The Document Information Pages provide up-to-date, document specific information including any issued Tentative Interim Amendments and Errata.

To access the Document Information Page for a specific NFPA Document go to http://www.nfpa.org/document for a list of NFPA Documents, and click on the appropriate Document number (e.g., NFPA 101). In addition to posting all existing Tentative Interim Amendments and Errata, the Document Information Page also includes the option to sign-up for an "Alert" feature to receive an email notification when new updates and other information are posted regarding the document.

ISBN: 978-145590606-2 (Print)
ISBN: 978-145590652-9 (PDF)

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® DOCUMENTS

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Documents

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Documents") should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments. An official NFPA Document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Documents

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Document. The users of NFPA Documents bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Documents.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards ("the ANSI Patent Policy"), and hereby gives the following notice pursuant to that policy:

NOTICE: The user's attention is called to the possibility that compliance with an NFPA Document may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Documents should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Documents are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Documents for regulatory purposes should be accomplished through adoption by reference. The term "adoption by reference" means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Documents, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Documents and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA documents during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org

For more information about NFPA, visit the NFPA website at www.nfpa.org.

NFPA® 1962

Standard for the

Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances

2013 Edition

This edition of NFPA 1962, *Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances*, was prepared by the Technical Committee on Fire Hose. It was issued by the Standards Council on November 27, 2012, with an effective date of December 17, 2012, and supersedes all previous editions.

This edition of NFPA 1962 was approved as an American National Standard on December 17, 2012.

Origin and Development of NFPA 1962

NFPA originally developed a recommended practice for the care, maintenance, and use of fire hose in 1936 through its Committee on Field Practices. This document was designated NFPA 198, *Care of Fire Hose*, and was revised extensively through the years. In 1954, the Fire Hose Committee assumed responsibility for the document.

In 1979, NFPA 1962, *Standard for the Care, Use and Maintenance of Fire Hose Including Connections and Nozzles*, was issued as a new standard. The standard was completely rewritten but still contained portions of NFPA 198. The requirements were carefully developed to ensure a reasonable level of reliability for fire hose that is in service.

The 1993 edition recognized the increased use of hose testing machines in the test procedure section. The test requirements for booster and suction hose were revised by incorporating the information in the standard rather than referring to a different standard.

The 1998 edition defined separate test procedures for using a hose testing machine and using a stationary fire pump or pumper as the pressure source. It also required that unlined fire hose be replaced with lined fire hose when the unlined fire hose came due for testing.

In the 2003 edition, the title was changed to *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose.* The requirements for service testing new hose for the first time were revised. Discussion about using supply hose was revised to remove the implication that it can be used in certain attack applications, and the requirements related to the use of relief valves were more closely tied to the service test pressure of the hose. New requirements were added for inspection of the hose liner and attachment of shank-type couplings. Record-keeping requirements for occupant-use hose were revised to reflect that such hose is inspected and serviced similar to a fire extinguisher. The document was completely revised in accordance with the *Manual of Style for NFPA Technical Committee Documents,* and changes were made to improve understanding of the requirements.

The 2008 edition of NFPA 1962 included a new chapter for the use, inspection, and testing of fire hose–connected appliances. NFPA 1965, *Standard for Fire Hose Appliances*, which was issued in 2008, provided for minimum performance and operational requirements for new fire hose appliances, while NFPA 1962 provided testing criteria so that hose appliances could be tested and maintained in an equivalent manner.

In addition to a reorganization, the 2013 edition adds "replacement" to the title of the standard and to the title of Chapter 4. Table 7.1.1.1, the guideline for testing hose manufactured prior to July 1987, has been removed and replaced with language indicating the removal of any hose over 25 years old from service. A new chapter has been created just for nozzles, separating them from gaskets and couplings. Finally, a new annex, Annex B, Specifying and Procuring Fire Hose, has been added.

Technical Committee on Fire Hose

Carl E. Peterson, *Chair*
Hingham, MA [SE]

Jason Goodale, *Secretary*
Loveland Fire Rescue, CO [U]

Thomas G. Farruggia, Illinois Fire & Safety Company, IL [IM]
Rep. National Association of Fire Equipment Distributors
James E. Glatts, FireOne, PA [RT]
William T. Graves, William Graves Associates LLC, NJ [SE]
Paul R. Kaveler, Ameren Services, MO [U]
Rep. Edison Electric Institute
Gregory Kozey, Kochek Company, Inc., CT [M]
Duane Leonhardt, Mercedes Textiles Ltd., Canada [M]
Rep. Fire Equipment Manufacturers' Association
Toby Mathews, Key Fire Hose Corporation, AL [M]
Edward J. O'Kinsky, Waterway Inc., NJ [IM]
David J. Pritchard, Pritchard & Associates (NC), Inc., NC [SE]
Jason D. Riggenbach, Akron Brass Company, OH [M]
John W. Stacey, Bellevue Fire Department, NE [E]
Rep. International Association of Fire Chiefs
Tim Vanderlip, Los Angeles County Fire Department, CA [U]
Richard C. Winton, UL LLC, IL [RT]
Samuel Wu, U.S. Department of Agriculture, CA [RT]

Alternates

Paul E. Albinger, Jr., Elkhart Brass Manufacturing Company, Inc., IN [M]
(Alt. to D. Leonhardt)
Jeffrey L. Benson, Akron Brass Company, OH [M]
(Alt. to J. D. Riggenbach)
Dan Corner, All-American Hose, LLC, PA [M]
(Alt. to All-American Hose Rep.)
George E. Laverick, UL LLC, IL [RT]
(Alt. to R. C. Winton)
Byron J. Sarago, DTE Energy, MI [U]
(Alt. to P. R. Kaveler)

Orlando P. Hernandez, 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.

Contents

NFPA 1962

Standard for the

Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances

2013 Edition

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.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex D. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope. This standard covers the care, use, inspection, service testing, and replacement of fire hose, fire hose couplings, fire-fighting nozzles, and fire hose appliances, and the associated record keeping.

1.2 Purpose. The purpose of this standard is to provide requirements for the care, use, inspection, service testing, and replacement of fire hose, couplings, nozzles, and fire hose appliances so that the reliability of fire hose, nozzles, and fire hose appliances is increased when they are used at an incident.

1.2.1 The purpose of this standard is also to establish that safety is a primary concern for the continued in-service use of fire hose, couplings, nozzles, and fire hose appliances and that safety is the ultimate decision to retire fire hose, couplings, nozzles, and fire hose appliances.

1.3 Application. Unless otherwise noted, this standard shall apply to fire hose, coupling assemblies, nozzles, and fire hose appliances, regardless of year of manufacture, while they are in storage, in service, in use, and after use.

1.4 Equivalency. Nothing in this standard shall 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.

1.5* Units of Measurement. In this standard, inch-pound units for measurement are followed by an equivalent in metric units, but only the value that first appears shall be considered as the requirement, since the value in metric units could be approximate.

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 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2013 edition.

NFPA 1961, *Standard on Fire Hose,* 2013 edition.

NFPA 1963, *Standard for Fire Hose Connections,* 2009 edition.

2.3 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 1901, *Standard for Automotive Fire Apparatus,* 2009 edition.

NFPA 1961, *Standard on Fire Hose,* 2013 edition.

Chapter 3 Definitions

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

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

3.2.3 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

3.3.1 Braided Reinforcement. A hose reinforcement consisting of one or more layers of interlaced spiraled strands of yarn or wire, with a layer of rubber between each braid.

3.3.2* 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. [**1961,** 2013]

3.3.3 Coupling Slippage. Any permanent movement of the hose out of a coupling bowl, movement of an external coupling collar, or movement of the hose under an external coupling collar.

3.3.4 Delamination. The separation of the cover or liner from the textile reinforcement.

3.3.5* Fire Hose Appliance. A piece of hardware (excluding nozzles) generally intended for connection to fire hose to control or convey water.

3.3.6 Fold. A transverse bend (fold) occurring where the hose is lengthwise doubled over on itself, as on a pin rack.

3.3.7 Hose.

3.3.7.1* *Attack Hose.* Hose designed to be used by trained fire fighters and fire brigade members to combat fires beyond the incipient stage. [**1961,** 2013]

3.3.7.2* *Booster Hose.* A noncollapsible hose used under positive pressure having an elastomeric or thermoplastic tube, a braided or spiraled reinforcement, and an outer protective cover.

3.3.7.3 *Covered Hose.* A hose with a jacket covered and lined with a continuous synthetic rubber or plastic. The cover is usually thicker than a coating.

3.3.7.4 *Fire Hose.* A flexible conduit used to convey water. [**1961,** 2013]

3.3.7.5* *Forestry Fire Hose.* A hose designed to meet specialized requirements for fighting wildland fires. [**1961,** 2013]

3.3.7.6 *Large-Diameter Hose.* A hose of 3½ in. (90 mm) or larger size. [**1961,** 2013]

3.3.7.7 *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. [**1961,** 2013]

3.3.7.8* *Soft Suction Hose.* See 3.3.7.10, Supply Hose.

3.3.7.9 *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.).

3.3.7.10* *Supply Hose.* Hose designed for the purpose of moving water between a pressurized water source and a pump that is supplying attack lines. [**1961,** 2013]

3.3.8 Hose Line. One or more lengths of hose coupled together.

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

3.3.10* In Service. The status of hose stored in a hose house, on a rack or reel, or on a fire apparatus that is available and ready for immediate use at an incident.

3.3.11 In Storage. The status of hose not readily available for use because it is not at the scene of an incident and not loaded on a vehicle that can transport it to the scene.

3.3.12 In Use. The status of hose that has actually been deployed at an incident or during training whether or not water is running through the hose.

3.3.13* Leak. The movement of any water through a hose, coupling, nozzle, or appliance in an area that should not permit water to pass.

3.3.14 Multiple Jacket. A construction consisting of a combination of two separately woven reinforcements (double jacket) or two or more reinforcements interwoven.

3.3.15 Proof Test Pressure. A pressure equal to at least two times the service test pressure. [**1961,** 2013]

3.3.16 Service Test. Hydrostatic test conducted by users on in-service hose, couplings, nozzles, or appliances to determine suitability for continued service.

3.3.17 Single Jacket. A construction consisting of one woven jacket.

3.3.18 Slow-Operating Valve. A valve that has a mechanism to prevent movement of the flow-regulating element from the fully closed position to the fully opened position or vice versa in less than 3 seconds. [**1901,** 2009]

3.3.19 Spiral Reinforcement. A hose reinforcement consisting of pairs of layers of yarn spiraled with no interlacing between the individual layers. The layers of yarn in each pair are spirally wound in opposite directions. A layer of rubber separates each pair of spiraled layers.

3.3.20* Water Hammer. The surge of pressure caused when a high-velocity flow of water is abruptly shut off. The pressure exerted by the flowing water against the closed system can be seven or more times that of the static pressure.

Chapter 4 Care, Use, Inspection, Service Testing, and Replacement of Fire Hose

4.1 Attack Hose, Supply Hose, and Forestry Hose.

4.1.1 Hose shall be inspected in accordance with Section 4.5 when it is placed in service.

4.1.2* Hose that is in service shall be service tested as specified in Section 4.8 at least annually.

4.1.3 Hose shall be service tested in accordance with Section 4.8 the later of 1 year after its date of manufacture or before it is placed in service for the first time.

4.1.4 Hose held in storage for longer than 1 year shall be service tested in accordance with Section 4.8 before it is placed in service.

4.1.5* Only clean, dry hose shall be placed in service.

4.1.6* Hose carried on fire apparatus shall be loaded in such a way that air can circulate under the hose load to eliminate or reduce the growth of mildew in the hose jackets and rust and corrosion in the hose compartment.

4.1.7* Hose shall be removed from the apparatus and reloaded so that the folds occur at different positions with sufficient frequency to prevent damage and the setting of permanent folds in the rubber lining.

4.1.8 Large-diameter hose used to supply a pump from a hydrant shall be protected from chafing with chafing blocks or similar protection where it comes in contact with pavement or curbing.

4.1.9 When connecting a pump to a hydrant, the hose shall be bent slightly to avoid kinks when the water is turned on.

4.1.10 Supply Hose.

4.1.10.1* Hose marked SUPPLY HOSE shall not be used at operating pressures exceeding 185 psi (12.8 bar or 1275 kPa).

4.1.10.2* Discharge Relief Devices.

4.1.10.2.1 A relief device that discharges to atmosphere shall be used on the discharge side of the pump when pumping into supply hose.

4.1.10.2.2 The relief device shall be set so that the discharge pressure does not exceed the service test pressure of the hose being used.

4.1.10.2.3 The relief device shall be capable of dumping enough water to atmosphere to prevent the pressure in the discharge hose from exceeding the service test pressure of the hose if the flow is shut off downstream of the device.

4.1.10.3 Only slow-operating valves shall be used with supply hose.

4.1.10.4 Relay Operations.

4.1.10.4.1 Where supply hose is used in relay operations between pumps on fire department apparatus, the intake of each receiving pump shall be equipped with a relief valve.

4.1.10.4.2 The maximum pressure setting of the relief valve(s) shall be not more than 10 psi (0.7 bar or 69 kPa) over the static pressure of the water source to which it is connected or not more than 10 psi (0.7 bar or 69 kPa) over the discharge pressure of the supply pump in the relay.

4.1.10.4.3 In no event shall the relief valve be set to relieve at a pressure that exceeds 90 percent of the service test pressure of the hose used with the system.

4.1.11 Damage Prevention.

4.1.11.1* Hose, while in use, shall be positioned to minimize mechanical damage and heat exposure.

4.1.11.2* Vehicles shall not be driven over charged or uncharged fire hose unless the hose is bridged and the vehicle has sufficient ground clearance to cross the bridged hose.

4.1.11.3* Nozzles and valves shall be opened and closed slowly to prevent pressure surges and water hammer that can burst the hose and in turn cause injury to people or damage to the pump.

4.1.11.4 Care shall be taken to prevent the hose from chafing.

4.1.11.5 Care shall be taken to avoid dragging large-diameter fire hose, but if the hose must be dragged, it shall be dragged when flat.

4.1.11.6* When hose is in use during subfreezing weather, care shall be taken to prevent water from freezing inside the hose.

4.1.11.6.1 To help prevent freezing once the water is turned on, some water shall be left running through the hose.

4.1.11.6.2 When the hose line is no longer needed, it shall be uncoupled and drained before the water freezes.

4.1.12* Hose that has frozen during use shall be thawed and service tested as specified in Section 4.8 before being put back in service or in storage.

4.1.13* After each use and before being placed in storage or back in service, the hose shall be drained, cleaned, dried, and inspected as specified in Sections 4.5 and 4.6.

4.2* Occupant-Use Hose.

4.2.1 Occupant-use hose shall be inspected in accordance with Section 4.5 when it is placed in service.

4.2.2 In-service hose designed for occupant use only shall be removed and service tested as specified in Section 4.8 at intervals not exceeding 5 years after the date of manufacture and every 3 years thereafter.

4.2.3 When hose is taken out of service for testing, replacement hose shall be installed on the rack, on the reel, or in the storage area until the tested hose is returned to service.

4.2.4 In-service hose shall be unracked, unreeled, or unrolled and physically inspected as specified in Section 4.5 at least annually. The hose shall be reracked, rereeled, or rerolled so that any folds do not occur at the same position on the hose.

4.2.5 Damage Prevention.

4.2.5.1* Hose stored on racks or reels shall be protected from the weather and any local environmental condition potentially harmful to the hose.

4.2.5.2 Hose shall be protected from mechanical damage and exposure to heat.

4.2.5.3* Enclosures for occupant-use hose shall be constructed and the hose stored in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

4.2.6 In areas where rodents can pose a problem, the hose shall be visually inspected more frequently for rodent damage.

4.2.7 After each use and before being placed back in service, the hose shall be inspected as specified in Section 4.5, service tested as specified in Section 4.8, and cleaned and dried as specified in Section 4.6.

4.3 Booster Hose.

4.3.1 Booster hose shall be inspected in accordance with Section 4.5 when it is placed in service.

4.3.2 Booster hose that is in service shall be service tested as specified in Section 4.9 at least annually.

4.3.3 Booster hose shall be service tested in accordance with Section 4.9 the later of 1 year after its date of manufacture or before it is placed in service for the first time.

4.3.4 Booster hose held in storage for longer than 1 year shall be service tested in accordance with Section 4.9 before it is placed in service.

4.3.5* Hose shall be stored out of direct sunlight and as recommended by the manufacturer.

4.3.6 Hose shall not be stored kinked and, if stored on a reel, care shall be taken to avoid twisting the hose when rolling it onto the reel.

4.3.7 Covered hose that has exposed reinforcement either shall be removed from service, repaired, and service tested or shall be condemned.

4.4 Suction Hose.

4.4.1 Suction hose shall be inspected in accordance with Section 4.5 when it is placed in service.

4.4.2 Suction hose that is in service shall be service tested as specified in Section 4.10 at least annually.

4.4.3* Hose shall be stored out of direct sunlight and as recommended by the manufacturer.

4.4.4 Hose that has exposed or damaged reinforcement either shall be removed from service, repaired, and service tested or shall be condemned.

4.4.5 Foreign objects of any kind, including items of equipment, shall not be carried inside the hose.

4.4.6* Suction hose shall not be used under positive pressure unless it has been specifically designed for such use.

4.5 Hose Inspection.

4.5.1 Physical inspection shall determine if the hose and couplings have been vandalized, are free of debris, and exhibit no evidence of mildew, rot, or damage by chemicals, burns, cuts, abrasion, and vermin.

4.5.2 During the inspection, a check shall be made to determine if the service test of the hose is current.

4.5.3 Liner Inspection.

4.5.3.1 The interior of the hose at each end shall be visually inspected for any physical signs of liner delamination.

4.5.3.2* If the liner shows signs of delamination, the hose shall be condemned.

4.5.4 If the hose fails the physical inspection *(see 4.5.1)*, it shall be removed from service and either repaired as necessary and service tested as specified in Section 4.8, Section 4.9, or Section 4.10, as appropriate, or condemned.

4.5.5 The couplings shall be inspected as specified in 7.1.3 and 7.1.4.

4.5.6 Where nozzles are required on occupant-use hose, they shall be inspected as specified in Section 5.2.

4.6 Cleaning and Drying.

4.6.1* After each use, all hose shall be cleaned.

4.6.2 If dirt cannot be thoroughly brushed from the hose or if the hose has come in contact with harmful materials, the hose shall be washed.

4.6.3 If, during use, the hose has been exposed to hazardous materials, it shall be decontaminated by the method approved for the contaminant.

4.6.4 Covered hose shall be permitted to be wiped dry.

4.6.5* Hose shall not be dried on hot pavements or under intense sunlight.

4.7* Storage.

4.7.1 Hose shall be kept out of direct sunlight and in a well-ventilated location.

4.7.2 All hose shall be drained and thoroughly dried before being placed in storage.

4.7.3 Hose shall be stored only after it has been inspected in accordance with Section 4.5 and has been cleaned and dried.

4.7.4 Hose that is out of service for repair shall be tagged as specified in 4.11.1.6 and 4.11.3.6 and kept separated from any hose in storage that is ready for service.

4.8 Service Testing Attack, Supply, and Forestry Hose.

4.8.1 Hose manufactured prior to July 1987 to meet the requirements of the 1979 and previous editions of NFPA 1961, *Standard on Fire Hose*, shall be removed from service.

4.8.2* Hose manufactured during July 1987 or after that date to the 1987 or subsequent editions of NFPA 1961 shall be service tested as specified in Section 4.8.

4.8.2.1 Attack fire hose shall be service tested to a minimum of 300 psi (20.7 bar or 2070 kPa) or a pressure not to exceed the service test pressure marked on the hose.

4.8.2.2 Supply fire hose shall be service tested to a minimum of 200 psi (13.8 bar or 1380 kPa) or a pressure not to exceed the service test pressure marked on the hose.

4.8.2.3 Forestry fire hose shall be service tested to a minimum of 300 psi (20.7 bar or 2070 kPa) or a pressure not to exceed the service test pressure marked on the hose.

4.8.2.4 Occupant-use hose shall be tested to the service test pressure marked on the hose.

4.8.2.5 Proof pressure tests for hoses shall be conducted only at the point of manufacture or at a facility equipped to perform those tests.

4.8.2.6 Tests in the field shall not subject the hose to its proof test pressure.

4.8.3 After the correct service test pressure has been determined for each length of hose to be tested, the service test shall be conducted as specified in Section 4.8.4.

4.8.4 Service Test Procedure.

4.8.4.1 Each length of hose to be service tested shall be inspected as specified in Section 4.5.

4.8.4.2 Any length of hose that fails the inspection shall be removed from the service test area and repaired as necessary or condemned.

4.8.4.3 All lengths of hose in the same hose line shall be of the same service test pressure.

4.8.4.4* The total length of any hose line in the hose test layout to be service tested shall not exceed 300 ft (91 m).

4.8.4.5 The hose test layout shall be straight, without kinks or twists.

4.8.4.6* All 3½ in. (89 mm) and larger diameter hose shall be service tested while lying on a horizontal surface.

4.8.4.7* A test location shall be selected that allows connection of the hose testing apparatus (pressure source) to a water source.

4.8.4.8* A hose testing machine, a stationary pump, or a pump on a fire department apparatus shall be used as a pressure source.

4.8.4.8.1 If a hose testing machine is used, the procedure defined in 4.8.5 shall be used.

4.8.4.8.2 If a stationary pump or a pump on a fire department apparatus is used, the procedure defined in 4.8.6 shall be used.

4.8.4.9 At the conclusion of the test, the hose records specified in Section 4.11 shall be updated to indicate the results of the service test for each length of hose tested.

4.8.4.10* Any hose that fails the inspection defined in Section 4.5, bursts or leaks during the service test, or has couplings that leak or are otherwise found defective as defined in 7.1.3 shall be tagged as required in 4.11.1.6 or 4.11.3.6 and removed from service.

4.8.4.10.1 If the hose leaks or the hose jacket fails inspection, a distinguishing mark noting the location of the defect(s) shall be placed on the hose.

4.8.4.10.2 If the couplings fail or are defective, they shall be repaired or replaced.

4.8.4.10.3* If the hose cannot be repaired, the couplings shall be removed from both ends.

4.8.4.11 If the hose is repaired, or the couplings are repaired or replaced, the hose shall be service tested in accordance with Section 4.8 before being placed back in service.

4.8.4.12 After testing, all hose shall be thoroughly cleaned, drained, and dried as specified in Section 4.6 before being placed in service or in storage.

4.8.5 Service Test Using a Hose Testing Machine. The procedure defined in this subsection shall be used when hose is service tested using a hose testing machine.

> **WARNING:** Because there is a potential for catastrophic failure during the service testing of fire hose, it is vital that safety precautions be taken to prevent exposure of anyone to this danger. Do not deviate from the procedures prescribed herein.

4.8.5.1 Hose Testing Machine Integrity. The condition of the hose testing machine shall be thoroughly checked daily before each testing session and before the machine is used after being transported to a new testing site.

4.8.5.1.1 The hose testing machine shall be carefully examined for damaged components that might fail during the test.

4.8.5.1.2 If any damage is discovered, the hose testing machine shall not be used until the damaged component(s) is repaired or replaced.

4.8.5.1.3 A pressure leak integrity test shall be performed on the machine to determine whether the pressurized outlet side of the machine and its related components are leak-free.

4.8.5.1.3.1 The fire hose outlet connection(s) of the machine shall be capped or otherwise closed.

4.8.5.1.3.2 Pressure shall be applied through the machine using the integral pump to a level that is 10 percent higher than the highest service test pressure needed for the hose to be tested.

4.8.5.1.3.3 The pressure shall be held for 3 minutes with the pump turned off.

4.8.5.1.3.4 If leaks are detected, the testing machine shall not be used until the leaking component(s) is repaired or replaced.

4.8.5.1.4 The test gauge that is used to read the test pressure shall have been calibrated within the previous 12 months.

4.8.5.1.5 If the hose machine incorporates elevated outlets for water supply that are higher than the inflated diameter of the hose from the testing surface, a means to vent trapped air shall be provided between the hose and the outlet valve.

4.8.5.2 Conducting the Test.

4.8.5.2.1 The test layout shall be connected to the outlet side of the water supply valve on the hose testing machine.

4.8.5.2.2 A test cap with a bleeder valve shall be attached to the far end of each hose line in the test layout. If a test cap is not available, a nozzle with a nontwist shutoff shall be permitted to be used.

4.8.5.2.3 With the test cap valve or the nozzle open, the pressure shall be raised gradually to 45 psi ± 5 psi (3.1 bar ± 0.35 bar or 310 kPa ± 35 kPa).

4.8.5.2.4* After the hose test layout is full of water, all the air in each hose line shall be exhausted by raising the discharge end of each hose line above the highest point in the system.

> **WARNING:** All air must be removed from the hose before the valve in the test cap or the nozzle is closed and the pressure raised. The development of test pressures introduces the potential for a serious accident if air remains in the system.

4.8.5.2.5 If the hose testing machine incorporates elevated outlets for water supply that are higher than the inflated diameter of the hose from the testing surface, air shall be vented next to the water input end.

4.8.5.2.6 The nozzle or test cap valve shall be closed slowly, and then the outlet water supply valve shall be closed.

4.8.5.2.7* The hose directly in back of the test cap or the nozzle shall be secured to avoid possible whipping or other uncontrolled reactions in the event of a hose burst.

4.8.5.2.8 With the hose at 45 psi ± 5 psi (3.1 bar ± 0.35 bar or 310 kPa ± 35 kPa), it shall be checked for leakage at each coupling and the couplings tightened with a spanner wrench where necessary.

4.8.5.2.9* Each hose shall then be marked around its full circumference at the end or back of each coupling or collar to determine, after the hose has been drained, if the coupling or collar has slipped during the test.

4.8.5.2.10 All personnel other than those persons required to perform the remainder of the procedure shall clear the area.

4.8.5.2.11 The pressure shall be raised slowly at a rate not greater than 15 psi (1 bar or 103 kPa) per second until the service test pressure is attained and then maintained, by pressure boosts if necessary, for the duration of the stabilization period.

4.8.5.2.12 The stabilization period shall be not less than 1 minute per 100 ft (30 m) of hose in the test layout.

4.8.5.2.13 After the stabilization period, the hose test layout shall hold the service test pressure for 3 minutes without further pressure boosts.

4.8.5.2.14 While the hose test layout is at the service test pressure, the hose shall be inspected for leaks.

4.8.5.2.14.1 If the inspecting personnel walk the test layout to inspect for leaks, they shall be at least 15 ft (4.5 m) to the left

side of the nearest hose line in the test layout. The left side of the hose line shall be defined as that side that is to the left when facing the free end from the pressure source.

4.8.5.2.14.2 Personnel shall never stand in front of the free end of the hose, on the right side of the hose, or closer than 15 ft (4.5 m) on the left side of the hose, or straddle a hose in the test layout during the test.

4.8.5.2.15 If the hose test layout does not hold the service test pressure for the 3-minute duration, the service test shall be terminated.

4.8.5.2.15.1 The length(s) of hose that leaked shall have failed the test.

4.8.5.2.15.2 The test layout shall be drained and the defective hose removed from the test layout.

4.8.5.2.15.3 The service test shall be restarted beginning with the procedures required in 4.8.5.2.1.

4.8.5.2.16 After 3 minutes at the service test pressure, each test cap or nozzle shall be opened to drain the test layout.

4.8.5.2.17 Coupling Slippage.

4.8.5.2.17.1 The hose and any marks placed on the hose at the back of the couplings or at external collars shall be observed for coupling slippage after completion of the service test and after the hose has been drained.

4.8.5.2.17.2 If the hose assembly shows any sign of coupling slippage, the hose assembly shall have failed the test.

4.8.6 Service Test Using a Stationary Pump or a Pump on a Fire Department Apparatus. The procedure given in 4.8.6.1 through 4.8.6.16.2 shall be used when hose is to be service-tested using a stationary pump or a pump on a fire department apparatus.

> **WARNING:** Because there is a potential for catastrophic failure during the service testing of fire hose, it is vital that safety precautions be taken to prevent exposure of anyone to this danger. Do not deviate from the procedures prescribed herein.

4.8.6.1 The test gauge that is used to read the test pressure shall have been calibrated within the previous 12 months.

4.8.6.2* A hose test valve consisting of a fire department gate valve with a ¼ in. (6.4 mm) opening drilled through the gate and designed to withstand the service test pressures shall be used between the pump and the hose test layout.

4.8.6.3 The test layout shall be connected to the hose test valve.

4.8.6.3.1 If a pump on a fire apparatus is used, the hose test valve shall not be attached to any discharge outlet at or adjacent to the pump operator's position.

4.8.6.3.2 The hose test valve end of the hose line shall be secured with a belt tie-in or rope hose tool at a point 10 in. to 15 in. (250 mm to 400 mm) from the coupling.

4.8.6.4 A test cap with a bleeder valve shall be attached to the far end of each hose line in the test layout. If a test cap is not available, a nozzle with a nontwist shutoff shall be permitted to be used.

4.8.6.5 With the hose test valve open and the test cap valve or nozzle open, the pressure shall be gradually raised to 45 psi ± 5 psi (3.1 bar ± 0.35 bar or 310 kPa ± 35 kPa).

4.8.6.6* After the hose test layout is full of water, all air in each hose line shall be exhausted by raising the discharge end of each hose line above the highest point in the system.

> **WARNING:** All air must be removed from the hose before the valve in the test cap or the nozzle is closed and the pressure raised. The development of test pressures introduces the potential for a serious accident if air remains in the system.

4.8.6.7 The nozzle or test cap valve shall be closed slowly, and then the hose test valve shall be closed.

4.8.6.8* The hose directly in back of the test cap or the nozzle shall be secured to avoid possible whipping or other uncontrolled reactions in the event a hose bursts.

4.8.6.9 With the hose at 45 psi ± 5 psi (3.1 bar ± 0.35 bar or 310 kPa ± 35 kPa), it shall be checked for leakage at each coupling and the couplings tightened with a spanner wrench where necessary.

4.8.6.10* Each hose shall then be marked around its full circumference at the end or back of each coupling or collar to determine, after the hose has been drained, if the coupling or collar has slipped during the test.

4.8.6.11 All personnel other than those persons required to perform the remainder of the procedure shall clear the area.

4.8.6.12 The pressure shall be raised slowly at a rate not greater than 15 psi (1 bar or 103 kPa) per second until the service test pressure is attained and then maintained for 3 minutes.

4.8.6.13 While the test layout is at the service test pressure, the hose shall be inspected for leaks.

4.8.6.13.1 If the inspecting personnel walk the test layout to inspect for leaks, they shall be at least 15 ft (4.5 m) from either side of the nearest hose line in the test layout.

4.8.6.13.2 Personnel shall never stand in front of the free end of the hose, stand closer than 15 ft (4.5 m) on either side of the hose, or straddle a hose in the test layout during the test.

4.8.6.14 If, during the test, a section of hose is leaking or a section bursts, the service test shall be terminated.

4.8.6.14.1 The length(s) of hose that leaked or burst shall have failed the test.

4.8.6.14.2 The test layout shall be drained and the defective hose removed from the test layout.

4.8.6.14.3 The service test shall be restarted beginning with the procedures required in 4.8.6.3.

4.8.6.15 After 3 minutes at the service test pressure, the pump shall be shut down, the hose test valve opened, the pressure allowed to equalize with the source, the pump discharge gates closed, and each test cap valve or nozzle opened to drain the test layout.

4.8.6.16 Coupling Slippage.

4.8.6.16.1 The hose and any marks placed on the hose at the back of the couplings or at external collars shall be observed for coupling slippage after completion of the service test and after the hose has been drained.

4.8.6.16.2 If the hose assembly shows any sign of coupling slippage, the hose assembly shall have failed the test.

4.9 Service Testing Booster Hose.

4.9.1* Booster hose shall be tested in accordance with 4.8.4 to 110 percent of its maximum working pressure.

4.9.2 If a maximum working pressure cannot be determined for the hose, it shall be tested to 110 percent of the normal highest working pressure as used in the system.

4.10* Service Testing Suction Hose.

4.10.1 Suction hose shall be dry-vacuum tested using the following procedure:

(1) The hose shall be attached to a suction source.
(2) The free end shall be sealed with a transparent disk and connected to an accurate vacuum measuring instrument.
(3) A 22 in. mercury (0.75 bar or 74.5 kPa) vacuum shall be developed.
(4) While holding the vacuum for 10 minutes, the interior of the hose shall be inspected through the transparent disk.
(5) There shall be no signs of physical damage or collapse of the lining into the waterway.

4.11 Hose Records.

4.11.1 Attack Hose and Supply Hose Records.

4.11.1.1* Accurate hose records shall be established and maintained.

4.11.1.2* Each length of hose shall be assigned an identification number for use in recording its history throughout its service life.

4.11.1.2.1* The identification number shall be stenciled on the jacket or cover using an ink or paint that is not harmful to the hose.

4.11.1.2.2* The identification number shall be permitted to be stamped on the bowl or swivel of the female coupling in a manner that prevents damage to the coupling.

4.11.1.3* Records of hose used by fire departments shall be kept as part of the department's or individual company's complete equipment inventory.

4.11.1.4 Records for hose on racks or reels or in enclosures shall be kept at the hose location or at a control location on the premises where the hose is located.

4.11.1.5* The following information, if applicable, shall be included for each length of hose:

(1) Assigned identification number
(2) Manufacturer and part number
(3) Vendor
(4) Size (internal diameter of waterway)
(5) Length
(6) Type of hose
(7) Construction
(8) Date received and date put in service
(9) Date of each service test and the service test pressure
(10) Repairs and new length if shortened
(11) Actual damage
(12) Exposure to possible damage
(13) Reason removed from service
(14) Reason condemned
(15) Indication that the hose has been removed from service or condemned within the warranty period because of an in-warranty failure

4.11.1.6* Hose removed from service for repair or because it has been condemned shall be tagged with a distinctive tag with the reason for removal from service noted on the tag.

4.11.1.7 Personnel responsible for the repair and maintenance of fire hose shall ensure that a report of the work performed to repair each length is recorded on the permanent hose record.

4.11.2* Forestry Hose Records. The authority having jurisdiction shall determine the records necessary to achieve an effective hose management program for forestry hose and implement such a record-keeping system.

4.11.3 Occupant-Use Hose Records.

4.11.3.1 A record for each length of occupant-use hose, whether on a rack or reel or in an enclosure, shall be kept on a tag attached near the female end of the hose.

4.11.3.2 The tag shall be fastened in a manner that does not restrict the hose from deploying properly and will not damage the hose.

4.11.3.3* The tag shall contain at least the following information for each length of hose:

(1) Manufacturer and part number
(2) Date put in service
(3) Date of each inspection and person/agency performing the inspection
(4) Date of each service test and person/agency performing the service test

4.11.3.4* An inspection checklist maintained on file or in an electronic method (e.g., bar coding) that provides a permanent record shall be permitted to be used in place of a tag to track inspection and service test data, provided each length of hose is assigned a unique identification number that is fastened to or recorded on the hose or female coupling and the information required by 4.11.3.3 is recorded.

4.11.3.5* Where records are kept electronically, the electronic record shall be available at the facility where the hose is in service.

4.11.3.6* Hose removed from service for repair or because it has been condemned shall be tagged with a distinctive tag, with the reason for removal from service noted on the tag.

4.11.4 Booster Hose Records.

4.11.4.1 Accurate hose records shall be established and maintained.

4.11.4.2 Each length of booster hose shall be assigned an identification number for use in recording its history throughout its service life.

4.11.4.2.1 The identification number shall be stenciled on the jacket or cover using an ink or paint that is not harmful to the hose.

4.11.4.2.2 The identification number shall be permitted to be marked on the bowl or swivel of the female coupling in a manner that prevents damage to the coupling.

4.11.4.3 Records of booster hose used by fire departments shall be kept as part of the department's or individual company's complete equipment inventory.

4.11.4.4 Records for booster hose on racks or reels or in enclosures shall be kept at the hose location or at a control location on the premises where the hose is located.

4.11.4.5 The following information, if applicable, shall be included for each length of booster hose:

(1) Assigned identification number
(2) Manufacturer and part number
(3) Vendor
(4) Size (internal diameter of waterway)
(5) Length
(6) Type of hose
(7) Construction
(8) Date received and date put in service
(9) Date of each service test and the service test pressure
(10) Repairs and new length if shortened
(11) Actual damage
(12) Exposure to possible damage
(13) Reason removed from service
(14) Reason condemned
(15) Indication that the hose has been removed from service or condemned within the warranty period because of an in-warranty failure

4.11.4.6 Hose removed from service for repair or because it has been condemned shall be tagged with a distinctive tag with the reason for removal from service noted on the tag.

4.11.4.7 Personnel responsible for the repair and maintenance of fire hose shall ensure that a report of the work performed to repair each length is recorded on the permanent hose record.

4.11.5 Suction Hose Records.

4.11.5.1 Accurate hose records shall be established and maintained.

4.11.5.2 Each length of suction hose shall be assigned an identification number for use in recording its history throughout its service life.

4.11.5.2.1 The identification number shall be stenciled on the jacket or cover using an ink or paint that is not harmful to the hose.

4.11.5.2.2 The identification number shall be permitted to be marked on the bowl or swivel of the female coupling in a manner that prevents damage to the coupling.

4.11.5.3 Records of suction hose shall be kept as part of the fire department's or individual company's complete equipment inventory.

4.11.5.4 The following information, if applicable, shall be included for each length of suction hose:

(1) Assigned identification number
(2) Manufacturer and part number
(3) Vendor
(4) Size (internal diameter of waterway)
(5) Length
(6) Type of hose
(7) Construction
(8) Date received and date put in service
(9) Date of each service test and the service test pressure
(10) Repairs and new length if shortened
(11) Actual damage
(12) Exposure to possible damage
(13) Reason removed from service
(14) Reason condemned
(15) Indication that the hose has been removed from service or condemned within the warranty period because of an in-warranty failure

4.11.5.5 Hose removed from service for repair or because it has been condemned shall be tagged with a distinctive tag with the reason for removal from service noted on the tag.

4.11.5.6 Personnel responsible for the repair and maintenance of fire hose shall ensure that a report of the work performed to repair each length is recorded on the permanent hose record.

4.12* Fire Hose Replacement. Fire hose users and the authority having jurisdiction shall establish a replacement schedule for their fire hose that takes into consideration the use and age of the hose and testing results.

Chapter 5 Care, Use, Inspection, Service Testing, and Replacement of Nozzles

5.1 Care and Use of Nozzles.

5.1.1 Nozzle valves attached to in-service hose shall be kept in the closed position.

5.1.2 If during use there is an obstruction that cannot be removed by flushing the nozzle, the nozzle shall be taken from the hose line and the obstruction removed through the connection end as soon as is practicable, since any further attempt to force the obstruction out through the tip can damage the nozzle.

5.1.3 Care shall be taken to avoid dents or nicks in nozzle tips, because they can seriously affect the reach of the stream.

5.1.4 To prevent mechanical damage, nozzles shall not be dropped or thrown.

5.1.5 Nozzle control valves shall be opened and closed slowly to eliminate unnecessary strain on the hose and couplings and reduce pressure surges.

5.1.6* After each use, all nozzles shall be thoroughly washed and inspected in accordance with Section 5.2 before being placed back in service.

5.1.7 All nozzles shall be maintained in accordance with the nozzle manufacturer's instructions.

5.2 Inspection of Nozzles.

5.2.1 All nozzles shall be inspected after each use and at least annually.

5.2.2 The nozzle inspection shall verify the following:

(1) The waterway is clear of obstructions.
(2) There is no damage to the tip.
(3) All controls and adjustments operate as designed.
(4)*The shutoff valve, if so equipped, operates as designed and closes off the flow completely.
(5) There are no missing or broken parts.
(6) The thread gasket is in good condition in accordance with Section 7.2.

5.2.3 If the nozzle fails the inspection for any reason, it shall be removed from service, repaired and service tested, or replaced.

5.3 Service Testing of Nozzles. Each nozzle shall be tested at least as frequently as the hose with which it is used.

5.3.1 Hydrostatic Test. Each nozzle with a shutoff mechanism shall be hydrostatically tested as specified in 5.3.1.1 through 5.3.1.5.

5.3.1.1 The nozzle being tested shall be mounted in a device capable of holding the nozzle, and the shutoff mechanism shall be closed.

5.3.1.2 A device capable of exerting a hydrostatic pressure of 300 psi (2070 kPa) or 1.5 times the manufacturer's maximum operating pressure, whichever is higher, shall be attached to the nozzle.

5.3.1.3 All air shall be bled from the system.

5.3.1.4 The gauge pressure shall be increased by 50 psi (3.5 bar or 345 kPa) increments, held for 30 seconds at each pressure up to the maximum pressure for which the nozzle is being tested, and then held for 1 minute without leakage.

5.3.1.5 There shall be no sign of leakage through the valve or the shutoff.

5.3.2 Flow Test.

5.3.2.1 The nozzle shall be mounted such that the flow rate through the nozzle and the pressure at the inlet to the nozzle can be accurately measured.

5.3.2.2 With the shutoff fully open, the inlet pressure shall be adjusted to the rated pressure, ±2 percent.

5.3.2.3 Basic spray nozzles shall flow no less than the rated flow and no more than 10 percent over the rated flow at the rated pressure in both straight stream and wide-angle spray pattern settings.

5.3.2.4 Constant and select gallonage spray nozzles shall flow no less than the rated flow at the rated pressure and no more than 10 percent over the rated flow at the rated pressure when tested at each predetermined flow selection.

5.3.2.5 Constant pressure (automatic) spray nozzles shall be tested as specified in 5.3.2.5.1 through 5.3.2.5.3.

5.3.2.5.1 The flow shall be increased to the minimum rated flow, and the pressure at that flow shall be recorded.

5.3.2.5.2 The flow rate shall continue to be slowly increased to the maximum rated flow, and the minimum and maximum pressures throughout the flow range shall be recorded.

5.3.2.5.3 Constant pressure (automatic) spray nozzles shall maintain their rated pressure ±15 psi (±1 bar or ±100 kPa) throughout the rated flow range.

5.3.2.6 The valve or shutoff and the pattern adjustment shall be operated through their full range of motion at 100 psi (6.9 bar or 690 kPa) and shall exhibit no signs of leakage, binding, or other problems.

5.3.2.7 If the nozzle does not meet any of the test requirements of Section 5.3, it shall be removed from service, repaired, and retested upon completion of repair.

5.4 Nozzle Replacement. Nozzle users and the authority having jurisdiction shall establish a replacement schedule for their nozzle that takes into consideration the use and age of the nozzles and testing results.

5.5 Nozzle Records.

5.5.1 A record for each nozzle shall be maintained from the time the nozzle is purchased until it is discarded.

5.5.2 Each nozzle shall be assigned an identification number for use in recording its history throughout its service life.

5.5.3 The identification number shall be marked on the nozzle in a manner that prevents damage to the nozzle or appliance.

5.5.4 The following information, if applicable, shall be included on the record for each nozzle:

(1) Assigned identification number
(2) Manufacturer
(3) Product or model designation
(4) Vendor
(5) Warranty
(6) Hose connection size
(7) Maximum operating pressure
(8) Flow rate or range
(9) Date received and date put in service
(10) Date of each service test and service test results
(11) Damage and repairs, including who made the repairs and the cost of repair parts
(12) Reason removed from service

Chapter 6 Care, Use, Inspection, Service Testing, and Replacement of Fire Hose Appliances

6.1 Care and Use of Fire Hose Appliances.

6.1.1 All appliances shall be used only for their designed purpose.

6.1.2* No appliance shall be operated at a pressure above its maximum operating pressure as marked on the appliance by the manufacturer.

6.1.2.1* Where an operating pressure is not marked on the appliance and the manufacturer cannot be located, the appliance shall be service tested to 300 psi (20.7 bar or 2070 kPa).

6.1.2.2 If the appliance passes the service test, it shall be permanently marked "Max operating pressure 200 psi (13.8 bar or 1380 kPa)."

6.1.3 All appliances shall be operated as recommended by the manufacturer.

6.1.4 To prevent mechanical damage, appliances shall not be dropped or dragged.

6.1.5 Valves shall be opened and closed slowly to eliminate unnecessary strain on connecting hose and couplings and to reduce pressure surges (water hammer).

6.1.6 If the appliance is not continuously connected to the fire apparatus, the appliance shall be rinsed with clear water and visually inspected for obvious damage in accordance with 6.2.1(1) through 6.2.1(5) after each use.

6.1.7* Where appliances are left continuously connected to the fire apparatus or other devices or are used where standing water is trapped inside the appliance (e.g., inlet elbows and valves), the appliance shall be flushed to the extent possible with fresh water following each use and visually inspected for obvious damage in accordance with 6.2.1(1) through 6.2.1(5).

6.1.8 Maintenance. All appliances shall be maintained in accordance with the appliance manufacturer's instructions.

6.2 Inspection of Fire Hose Appliances.

6.2.1 All appliances shall be visually inspected at least quarterly to verify the following:

(1) All valves open and close smoothly and fully.
(2) The waterway is clear of obstructions.
(3) There is no damage to any thread or other type connection.
(4) The pressure setting of the relief valve, if any, is set correctly.
(5) All locks and hold-down devices work properly.
(6) Internal gaskets are in accordance with Section 7.2.
(7) There is no damage to the appliance (e.g., dents, cracks, or other defects that could impair operation).
(8) All swiveling connections rotate freely.
(9) There are no missing parts or components.
(10) There is no corrosion on any surface.
(11) The marking for maximum operating pressure is visible.
(12) There are no missing, broken, or worn lugs on couplings.

6.2.2* If the appliance fails an inspection for any reason, the appliance shall be removed from service and the problem corrected or repaired in accordance with the manufacturer's instructions and service tested in accordance with Section 6.3 before it is placed back in service.

6.2.2.1 If the appliance requires repair to correct a problem identified in 6.2.1(7) through 6.2.1(9), the appliance shall be service tested in accordance with Section 6.3 before it is placed back in service.

6.2.2.2 If the appliance fails inspection because corrosion is found, the appliance shall be cleaned to remove all corrosion, service tested in accordance with Section 6.3, and lubricated with an anticorrosive lubricant acceptable to the appliance manufacturer on all surfaces that showed corrosion.

6.3 Service Testing of Fire Hose Appliances.

6.3.1 Hydrostatic Test. Each fire hose appliance with the exception of elbows shall be service tested in accordance with this section at least annually.

6.3.1.1* The appliance being tested shall be positioned in a protective device or cover capable of holding the appliance and tested to a minimum hydrostatic pressure of 300 psi (20.7 bar or 2070 kPa).

6.3.1.2 Test caps capable of withstanding the required hydrostatic pressure shall be attached to openings, and a device capable of exerting the required hydrostatic pressure shall be attached to the appliance.

6.3.1.2.1 Appliances with relief valves shall have the relief valve outlet blanked off or otherwise closed during the test.

6.3.1.2.2 All air shall be bled from the system.

6.3.1.3 The gauge pressure shall be increased by 50 psi (3.45 bar or 345 kPa) increments and held for 30 seconds at each pressure up to the maximum pressure for which the appliance is being tested and held for 1 minute without leakage.

6.3.2 Relief Valve Test.

6.3.2.1 Hydrostatic testing of the appliance shall be conducted prior to testing the relief valve.

6.3.2.2 The relief valve shall be tested separately from any device it is connected to.

6.3.2.3 The relief valve shall be set to its lowest setting and pressurized.

6.3.2.4 If the relief valve does not operate at or below a pressure 10 percent over the setting, the test shall be discontinued and the relief valve repaired or replaced.

6.3.2.5 A calibrated test gauge shall be used to verify the setting.

6.3.2.6 After successful completion of the relief valve test, the relief valve shall be reset to the pressure designated by the authority having jurisdiction.

6.3.2.7 The final setting of the relief valve shall be confirmed by pressure testing.

6.3.3 Shutoff Valve Test.

6.3.3.1 If the appliance has a shutoff valve, the intake side of the shutoff valve shall be hydrostatically pressurized to the maximum working pressure of the appliance with the valve in the shutoff position.

6.3.3.2 There shall be no leakage through the valve.

6.3.3.3 A water flow through the fire hose appliance at 100 psi (6.9 bar or 690 kPa) shall be established.

6.3.3.4 The valve shall be closed and reopened twice and shall operate smoothly without evidence of binding or other problems.

6.3.4 Check Valve Test.

6.3.4.1 If the appliance has a check valve, and the check valve can be pressurized by valves being closed downstream of the check valve, the output side of the check valve shall be hydrostatically pressurized to the maximum working pressure of the appliance.

6.3.4.2 There shall be no leakage through the check valve.

6.4 Fire Hose Appliance Records.

6.4.1 A record for each fire hose appliance shall be maintained from the time the fire hose appliance is purchased until it is discarded.

6.4.2 Each fire hose appliance shall be assigned an identification number for use in recording its history throughout its service life.

6.4.3 The identification number shall be marked on the fire hose appliance in a manner that prevents damage to the appliance.

6.4.4 The following information, if applicable, shall be included on the record for each fire hose appliance:

(1) Assigned identification number
(2) Manufacturer
(3) Product or model designation
(4) Vendor
(5) Warranty
(6) Hose connection size
(7) Maximum operating pressure
(8) Flow rate or range
(9) Date received and date put in service
(10) Date of each service test and service test results

(11) Damage and repairs including who made the repairs and the cost of repair parts
(12) Reason removed from service

6.5 Fire Hose Appliance Replacement. Fire hose appliance users and the authority having jurisdiction shall establish a replacement schedule for their fire hose appliances that takes into consideration the use and age of the fire hose appliance and testing results.

Chapter 7 Care and Inspection of Couplings and Gaskets

7.1 Couplings.

7.1.1 Couplings shall be kept in serviceable condition.

7.1.2 A lubricant specified by the coupling manufacturer shall be permitted to be used on coupling swivels and threads.

7.1.3* After each use and during each hose service test, couplings shall be visually inspected for the following defects:

(1) Damaged threads
(2) Corrosion
(3) Slippage on the hose
(4) Out-of-round
(5) Connections not rotating freely
(6) Missing lugs
(7) Loose external collar
(8) Internal gasket not in accordance with Section 7.2
(9) Other defects that could impair operation
(10) Any locking device operating improperly

7.1.4 Hose with defective couplings shall be removed from service and the couplings repaired or replaced.

7.1.5 All nonthreaded 4 in. (100 mm) and 5 in. (125 mm) hose connections shall be provided with locks that meet NFPA 1963, *Standard for Fire Hose Connections*.

7.1.6* Care shall be taken not to drop the couplings on pavement or other hard surfaces, which can cause damage to the swivel section or exposed threads.

7.1.7 Care shall be taken to prevent vehicles from driving over couplings.

7.1.8 Special care shall be taken where couplings of dissimilar metals are connected, as corrosion can occur due to this difference and moisture tends to accelerate this corrosion.

7.1.8.1 Where couplings of dissimilar metals are left connected, they shall be disconnected and inspected at least quarterly.

7.1.8.2 If corrosion exists, the couplings shall be cleaned and an anticorrosive lubricant specified by the coupling manufacturer shall be applied to the threads.

7.1.8.3 Anticorrosive lubricant shall be applied at the time of each service test.

7.1.9 When new or used bowl couplings are being attached, care shall be taken to have the hose fit correctly in the bowl.

7.1.9.1* The outside diameter of the hose shall fit snugly in the internal diameter of the bowl of the coupling.

7.1.9.2* The expansion ring shall be of the correct size and length for the coupling used.

7.1.9.3* A new tail gasket shall be used.

7.1.10* When new or used shank-type couplings are being attached, care shall be taken to have the hose fit properly on the shank.

7.1.10.1 The inside diameter of the hose shall fit snugly on the external diameter of the shank of the coupling.

7.1.10.2 The collar shall be compatible with the shank and shall be sized for the hose used.

7.1.10.3 The socket head cap screws on shank-type couplings shall be torqued to the manufacturer's specified tolerance.

7.1.11* When couplings are attached or reattached to hose, the hose shall be tested at its service test pressure in accordance with Section 4.8, 4.9, or 4.10 as appropriate.

WARNING: Because there is a potential for catastrophic failure during these tests, it is vital that safety precautions be taken to prevent exposure of anyone to this danger. Do not deviate from the procedures prescribed in 4.8.5 and 4.8.6.

7.1.12 The date and nature of the repair or recoupling and the identity of the person performing the repair shall be recorded for each length of hose as specified in Section 4.11.

7.1.13 The socket head cap screws on shank-type couplings shall be checked at least annually to ensure that they are torqued to the manufacturer's specified tolerance and shall be replaced at any sign of wear.

7.2 Gaskets.

7.2.1* The thread gasket in couplings, nozzles, and hose appliances shall be inspected for presence, tight fit, and lack of deterioration.

7.2.2* Gaskets shall not protrude into the waterway.

7.2.3 Any gasket that is defective or misfits shall be replaced with a new gasket that meets the requirements of NFPA 1963, *Standard for Fire Hose Connections*.

Chapter 8 System Tests

8.1* General.

8.1.1 Each preconnected hose line or any attack line used for interior fire-fighting operations on a fire apparatus together with the nozzle or hose connected appliance it supplies shall be flow tested as a system at least annually.

8.1.2 Before this test is performed, the nozzle on the hose line or the hose-connected appliance shall have been flow tested as required by 5.3.2.

8.1.3* A flow gauge shall be installed within the selected hose line.

8.1.4 The pump discharge pressure shall be raised until the flow gauge reads the desired flow of the selected hose line as set by the authority having jurisdiction.

8.1.5 The authority having jurisdiction shall verify that the pump discharge pressures and flows are consistent with their pump charts or standard operating procedures (SOPs) for interior fire fighting.

8.1.6 If the nozzle is changed on the hose line, the length of the hose line is changed, or a different type or diameter of hose is installed, the test shall be repeated.

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.1.5 Metric units of measurement shown in this standard are in accordance with the modernized metric system known as the International System of Units (SI). The liter unit is outside of but recognized by SI and commonly is used in international fire protection. Table A.1.5(a) provides the conversion factors to be used if more precision is desired. IEEE/ASTM SI-10, *Standard for Use of the International System of Units (SI): The Modern Metric System*, provides additional information. Table A.1.5(b) provides a list of abbreviations for units of measure.

Table A.1.5(a) Conversion Factors

Metric to inch-pound	Inch-pound to metric
1 bar = 14.492 psi	1 psi = 0.0690 bar
1 kPa = 0.145 psi	1 psi = 6.895 kPa
1 kg = 2.205 lb	1 lb = 0.454 kg
1 mm = 0.039 in.	1 in. = 25.40 mm
1 m = 3.281 ft	1 ft = 0.305 m
1 m^2 = 10.764 ft^2	1 ft^2 = 0.0929 m^2
1 m^3 = 35.32 ft^3	1 ft^3 = 0.028 m^3
1 slug = 14.594 kg	1 kg = 0.0685 slugs

Table A.1.5(b) Abbreviations for Units of Measure

Abbreviation	Unit
ft^2	square foot
ft^3	cubic foot
in.	inch
kg	kilogram
kPa	kilopascal
lb	pound
m	meter
mm	millimeter
m^2	square meter
m^3	cubic meter
psi	pound per square inch

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.3.3.2 Coating. Color can be added to the coating for the purpose of identification.

A.3.3.5 Fire Hose Appliance. Fire hose appliances include such devices as monitors, ladder pipes, wyes, siameses, and hydrant valves.

A.3.3.7.1 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 fire departments. It is designed with a minimum service test pressure of 300 psi (20.7 bar or 2070 kPa) for a normal highest operating pressure of 275 psi (19 bar or 1895 kPa).

A.3.3.7.2 Booster Hose. Booster hose is manufactured in sizes up to 1½ in. (38 mm).

A.3.3.7.5 Forestry Fire Hose. Forestry fire hose is designed with a minimum design service test pressure of 300 psi (20.7 bar or 2070 kPa) for a normal highest operating pressure of 250 psi (17.25 bar or 1723 kPa).

A.3.3.7.8 Soft Suction Hose. Hose used to connect between a fire hydrant and a pump intake is sometimes called soft suction hose. In reality, this is generally a short length of supply hose with female couplings on both ends, one end with the local fire hydrant connection size and thread, the other end with the pump intake size and thread.

A.3.3.7.10 Supply Hose. Supply hose is designed with a minimum acceptance test pressure of 200 psi (13.8 bar or 1380 kPa) to provide a normal highest operating pressure of 185 psi (12.8 bar or 1275 kPa).

A.3.3.10 In Service. Hose in storage where it is not readily available to be put into service at an incident is not considered as in service.

A.3.3.13 Leak. For fire hose, water should not escape through the hose jacket in any quantity during the service testing process. However, a leak should not be confused with condensation on the hose. If the area of concern is wiped and additional water appears immediately, the hose is leaking.

A.3.3.20 Water Hammer. The formula for water hammer is as follows:

$$\Delta p = cd\Delta v$$

where:
Δp = change in pressure [lb/ft^2 (kg/m^2)]
c = velocity of pressure wave traveling back toward the water sources [ft/sec (m/sec)]
d = mass density of water [1.9 slugs/ft^3 (979.2 kg/m^3)]
Δv = change in water velocity [ft/sec (m/sec)]

Note: For 2½ in. (65 mm) double-jacket rubber-lined hose, c is approximately 800 to 1000 ft/sec (240 to 300 m/sec). *(See Purington, Fire Fighting Hydraulics.)*

A.4.1.2 Attack-grade hose can be used in applications designed for occupant-use hose. It is not the intent of this standard to require the testing of attack-grade hose used in an occupant-use hose application any more frequently than is required by Section 4.2. It is the intent of this standard that attack-grade hose installed on racks or reels or in hose houses and designed to be used by a fire department or fire brigade be tested in conformance with Section 4.1.

A.4.1.5 Wet hose accelerates mildew growth and rusting.

A.4.1.6 The use of 100 percent synthetic yarn–reinforced hose has increased rapidly. This type of hose should be thoroughly drained and dried before being reloaded on the apparatus hose bed, because if damp or wet, it will form mildew. Although being loaded damp or wet will not affect the hose itself, it does cause undue rusting of the apparatus body and increases the potential of dry rot in the wood flooring under the hose.

The use of a protective hose bed cover is recommended to protect the hose load from unintentional deployment, weather damage, and other physical damage. Where covers are provided, care needs to be taken to permit free circulation of air under the cover to reduce mildew growth. Covers should be made from flame-resistant materials and secured to the apparatus in a manner that prevents them from blowing off while the apparatus is in motion.

Where the humidity is 70 percent or greater or where hose is for municipal use, jackets with cotton yarns should be treated with water repellents and against mildew.

A.4.1.7 Excessive edge wear can occur when 100 percent synthetic yarn–reinforced hose is loaded on the apparatus in the conventional manner (horseshoe load, accordion load, or skid load). To prevent this edge wear, hose manufacturers recommend that if 100 percent synthetic yarn–reinforced hose is used, it should be loaded on the apparatus in the flat load manner.

Best fire department and forestry practice is to remove the hose from the apparatus at least once a month. Water should be run through the hose quarterly and the hose thoroughly dried before being replaced on the apparatus.

The user should contact the manufacturer of the hose for advice on how often the hose should be removed from the hose bed and repacked.

Failures in short lengths of supply hose, also called soft suction hose, generally occur when this hose is carried on the apparatus folded and either tied down or placed in a small compartment. Where hose is constantly folded at the same points, the folds place considerable stress on the warp threads. If space limitations prevent varying folding positions, the hose should be carried in a roll on a step or running board. Many fire departments keep one end of the hose preconnected to the suction side of the pump, which decreases the time for hydrant hookup.

A.4.1.10.1 Supply hose should not be used to directly supply attack lines, master stream appliances, portable hydrants, manifolds, and standpipe and sprinkler systems because the operating pressures often exceed 185 psi (12.8 bar or 1275 kPa). Furthermore, many of these applications have valves in the line that could be closed rapidly, creating water hammer.

Since 1987, all hose built to the requirements in NFPA 1961, *Standard on Fire Hose*, for supply hose has been required to be at least 200 psi (13.8 bar or 1380 kPa) service test [185 psi (12.8 bar or 1275 kPa) operating pressure]. Some 6 in. (150 mm) and larger hose might not be built to that standard and, therefore, might have a lower maximum operating pressure.

A.4.1.10.2 Relief valves normally installed on fire department pumps to control discharge pressures are not adequate to perform this function.

A.4.1.11.1 When attack hose is being hoisted, damage can be avoided and the task made easier by use of hose rollers. Synthetic yarn–reinforced hose is more susceptible than cotton yarn–reinforced hose to damage from hot embers and radiant heat.

A.4.1.11.2 If hose must be crossed, vehicles should have sufficient clearance to cross without contacting the hose.

A.4.1.11.3 To control water hammer when opening a water supply controlled by a quick-acting valve, such as a ball valve, to the valve and should be "cracked" and water allowed to fill the system before the valve is opened completely.

A.4.1.11.6 During freezing weather, it is common practice to place the nozzle out a window and, by "cracking" the valve, keep water moving through the hose while overhaul is in process.

A.4.1.12 Avoid sharply bending hose in or on which ice has formed, as frozen hose can easily be damaged by a sharp bend. Use care in removing hose from ice after a fire. Steam is useful in removing ice from hose.

A.4.1.13 At structural fires, fire hose is exposed not only to heat from fires but to burning embers and broken glass, nails, and other sharp objects.

A.4.2 Figure A.4.2 shows a Class II standpipe system with 1½ in. (38 mm) occupant-use hose.

A.4.2.5.1 When the humidity is 70 percent or greater, hose jackets with cotton yarns should be treated with water repellents and against mildew growth.

A.4.2.5.3 Typical hose houses are shown in Figure A.4.2.5.3(a) and Figure A.4.2.5.3(b). The hose house in Figure A.4.2.5.3(b) is shown closed. The top lifts up and the doors on the front open for complete accessibility.

A.4.3.5 To maximize the life of hose, it should be stored in a ventilated area at temperatures between 32°F and 100°F (0°C and 38°C).

A.4.4.3 To maximize the life of hose, it should be stored in a ventilated area at temperatures between 32°F and 100°F (0°C and 38°C).

FIGURE A.4.2 Typical Standpipe and Fire Hose Rack Arrangement. *(Courtesy of National Aeronautics and Space Administration.)*

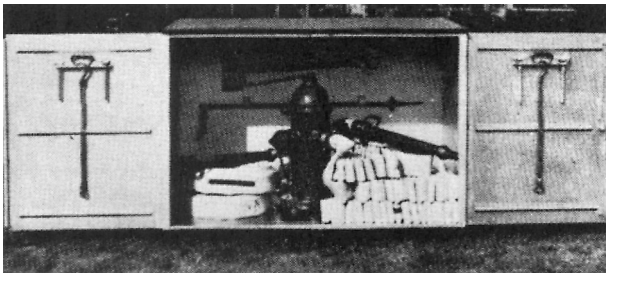

FIGURE A.4.2.5.3(a) Hose House of Compact Dimensions for Installation over a Yard Hydrant. Construction can be steel or aluminum.

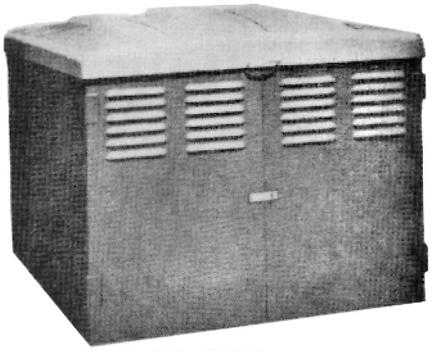

FIGURE A.4.2.5.3(b) Steel House of Compact Dimensions for Installation over a Yard Hydrant.

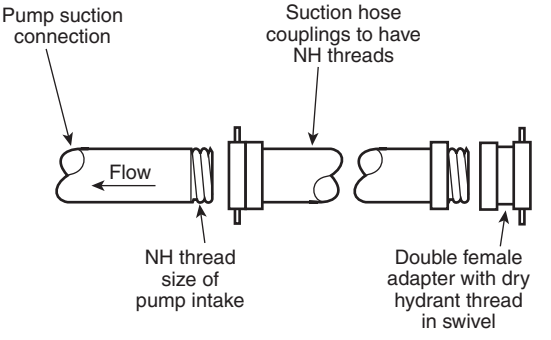

FIGURE A.4.4.6 Intake Connections from Dry Hydrant to Pump.

A.4.4.6 If the fire department responds to areas where water is obtained from dry hydrants, a double female adapter with threads used on the dry hydrant on one side and NH standard thread on the other should be provided *(see Figure A.4.4.6)*. Suction hose should not be used to connect to municipal hydrants, because much of the suction hose is not intended for use under positive pressure and such use can also damage the water system.

A.4.5.3.2 Liner delamination and degradation can occur as fire hose ages. Delaminated liners can cause plugged nozzles or can cut off water supply to pumps, which are potentially serious fireground problems.

Even if a hose passes the annual service test, liner delamination can be present. Some signs of possible liner delamination include the following: hose leaks without obvious exterior hose damage, hose leaks throughout an extended portion of the hose length, the appearance of water droplets on the outer surface of a pressurized hose, and lumps or irregularities in a drained hose. To verify attack and supply hose liner integrity, reach inside each end of the hose and try to pinch the liner. If it can be pinched, delamination has begun. To further confirm liner delamination, cut through the hose a few inches from the couplings and examine the liner's adhesion to the hose jacket. Remove the hose from service if there is any sign of delamination. When liner delamination is found, it is highly probable that all other hose of the same age and from the same lot will also have liner delamination. If so, the entire lot of such hose should be removed from service and inspected.

A.4.6.1 For washing, use a scrub brush, mild soap or detergent, and water. A mechanical washer can be used where hose is used frequently or a large number of hose lengths need to be washed. Avoid constant washing of cotton jacket hose treated for mildew resistance, as this will remove the treatment. Commercial hose washers are available, although many fire departments have constructed their own.

A.4.6.5 There are a number of ways to dry hose. Tower drying has proved successful, but care should be taken to properly

ventilate and control the temperature of the tower so the hose will not be damaged by excessive heat. It is poor practice to suspend hose from couplings.

The design of hose towers should meet all applicable building, electrical, and safety codes and requirements. Fire fighters should be made aware of the hazards associated with hose-drying towers, the protective equipment they should wear while working in a hose tower, and the correct method for raising and hanging wet fire hose, as well as retrieving dry hose.

Commercial hose dryers that force warm air through a cabinet in which hose is loosely coiled on wire racks are also available. However, while this process dries the outside jacket, it might not allow for thorough draining of the inside of the hose.

Inclined hose racks are often used, and most existing stations can accommodate such racks. The racks should be located where the sun or excessive heat will not damage the hose. The rack has the advantage of allowing the hose to drain internally while providing a drying area from which fire fighters can easily load and unload hose.

A.4.7 Storage racks are commercially available, but many users have built their own to fit their particular needs.

A.4.8.2 The service test pressure for hose manufactured in July 1987 and after to meet the requirements of the 1987 and subsequent editions of NFPA 1961, *Standard on Fire Hose*, is stenciled on each length of hose as follows: "Service Test to ____ psi per NFPA 1962" or "Service Test to ____ bar per NFPA 1962."

A.4.8.4.4 Hose is tested in lengths not exceeding 300 ft (91 m) to allow the hose to untwist and be straightened out. As the pressure rises, the shorter length will allow the hose to assume a natural elongation, creating less warp in the hose.

It is also important that all the air in the hose be removed. If any point in the hose layout is elevated, air will be trapped at that point. Excessive lengths make it difficult to exhaust all the air. The ideal hose test area will have a slight upward incline from the pressure source to the capped end. This allows the air to flow to the capped end and be bled off. There should be no humps or valleys in the hose between the ends, as these will trap air.

A.4.8.4.6 The surface on which the hose is laid out should be as smooth as possible. Rough surfaces will accelerate abrasion and hinder proper movement of the hose line.

A.4.8.4.7 A short length of smaller diameter hose with the same or higher proof pressure should be used to connect the pressure source to the hose being tested.

A.4.8.4.8 Stationary pumps and pumps on fire apparatus are designed for pumping substantial flow volumes at moderate pressures. The use of such pumps when testing hose at moderate to high pressures with very little flow, or possibly no flow, can cause overheating of the water in the pumps as well as recirculation cavitation operating conditions. Both the overheating and the recirculation cavitation operating conditions are known to cause permanent damage to the pumps. In addition, the hot water inside the pumps (which could be superheated steam) creates a safety hazard to personnel operating the pump or testing the fire hose.

A.4.8.4.10 Damaged fire hose should not be patched unless such repair is recommended by the manufacturer of the hose and is performed by properly trained and equipped personnel.

A.4.8.4.10.3 Removing the couplings from the hose will ensure that damaged hose that has been condemned does not accidentally get intermixed with serviceable hose.

A.4.8.5.2.4 Air under pressure becomes greatly compressed, and the hose can whip violently if the pressure is suddenly released by a hose burst. A blown-off coupling propelled by the compressed air will act like a high-velocity missile.

A.4.8.5.2.7 Hose can be expected to stretch when the pressure is increased to the test pressure. Allowance should be made for this stretch when the hose is secured.

A.4.8.5.2.9 The hose should be marked with a thin reference line located on the hose close to the coupling or collar so there is no gap between the mark and the coupling or collar.

A.4.8.6.2 The use of the hose test valve prevents a volume surge from the pump in the event a hose bursts during the test. The ¼ in. (6.4 mm) opening drilled through the gate permits the pressure to be raised to the test pressure after the hose has been filled, the air completely removed, and the hose test valve closed.

A.4.8.6.6 Air under pressure becomes greatly compressed, and the hose can whip violently if the pressure is suddenly released by a hose burst. A blown-off coupling propelled by the compressed air will act like a high-velocity missile.

A.4.8.6.8 Hose can be expected to stretch when the pressure is increased to the test pressure. Allowance should be made for this stretch when the hose is secured.

A.4.8.6.10 The hose should be marked with a thin reference line located on the hose close to the coupling or collar so there is no gap between the mark and the coupling or collar.

A.4.9.1 If booster hose is manufactured in accordance with UL 92, *Fire Extinguisher and Booster Hose,* the maximum working pressure will be shown on the cover of the hose.

A.4.10 The suction hose vacuum test can be run in conjunction with the annual pump suction test. In Figure A.4.10, one line runs to the pump vacuum and the other to a test gauge. A clear plastic disk at the other end used with light makes it possible to observe if the internal lining is drawn into the waterway.

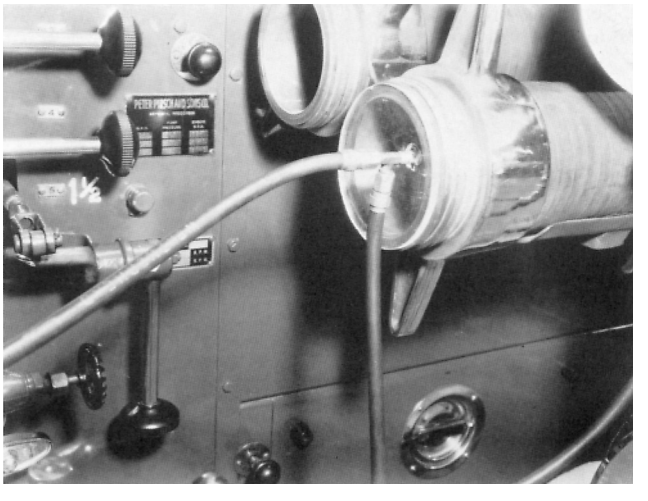

FIGURE A.4.10 Plastic Test Disk for Pump Suction Hose. *(Courtesy of San Diego Fire Department, Inc.)*

If the suction hose is designed for use under positive pressure, it might be marked with the positive service test pressure.

PVC suction hose is not designed for use under positive pressure. If unmarked suction hose is to be used under positive pressure, the user should check with the manufacturer to be sure the hose is designed for such applications and test it in accordance with the manufacturer's recommended service test pressure.

A.4.11.1.1 Records are essential and necessary data to determine hose performance and ensure safe use in fire fighting. Cost effectiveness can also be determined. This recorded information should be used for effective hose management.

A.4.11.1.2 Where hose repairs are frequent, couplings and hose lengths can become intermingled; therefore, either stenciling the hose or changing the couplings should be employed.

A.4.11.1.2.1 Paints with a petroleum solvent base can cause the bond between the liner and the jacket to fail. Water-based latex paint is not harmful to hose.

Some fire departments color-code couplings as well as various tools to identify the company to which the equipment is assigned. This enables each company to readily identify and pick up its hose and equipment at a fire. Where mutual aid operations are frequent, each length of hose should be appropriately stenciled or marked to identify the fire department owning it.

A.4.11.1.2.2 Coupling bowls can be damaged by improper stamping. The proper procedure is to insert a special steel plug with round edges into the end of the expansion ring. One sharp blow from a steel numbering die will then clearly stamp the coupling. Aluminum couplings should be stamped before they are hardcoated.

A.4.11.1.3 Because the safe use of hose requires continuous, accurate, up-to-date records, records should be maintained and stored at the company level in addition to being part of a central file. Conditions, repairs, changes, problems, and so on, should be recorded immediately for each length of hose. *(See Figure A.4.11.1.3.)*

A.4.11.1.5 Other information recorded might include coupling threads, manufacturer of coupling and part number, length of warranty, label number, and cost.

A.4.11.1.6 The tag might also include information required for inclusion on the permanent hose record. *(See Figure A.4.11.1.6.)*

A.4.11.2 Forestry hose is often moved from one location to another in large quantities. Many times forestry fire apparatus leaves the scene of a fire with a different complement of hose from that with which it arrived. Therefore, maintaining individual recorders of each length of hose can be impractical. As a minimum, records on stored hose should be kept at stations and fire warehouses to ensure proper inventory rotation.

A.4.11.3.3 The owner of the hose might want to keep some or all of the following information as a separate record to assist in tracking the performance of the hose:

(1) Assigned identification number
(2) Manufactured and part number
(3) Vendor from which hose was purchased
(4) Size (internal diameter of waterway)
(5) Length
(6) Type of hose

Hose Record Card

ID No. _____ City _____ Engine Co. _____

Size (dia.) _____ Length _____ Type hose _____ Const. _____ Cost _____

Mfr. _____ Part no. _____ Date rcd. _____ Date in service _____

Vendor _____ Cplg. mfr. _____ Type cplgs. _____

Repairs

Date	Kind	Cost	New length	New ID no.

Remarks: _____

Test Record

Service test to _____ psi

Date	Service test pres. psi	Test OK	Reason failed	Date	Service test pres. psi	Test OK	Reason failed

Date	Exposed to possible damage		Date	Reason
		Removed from service		
		Condemned		
		Sold		
		Wrnty. failure		

FIGURE A.4.11.1.3 Example Showing Front and Back of a Hose Record Card. *(Courtesy of Scandia Industries, Inc.)*

(7) Construction
(8) Date received
(9) Repairs and new length if shortened
(10) Actual damage
(11) Exposure to possible damage
(12) Reason removed from service
(13) Reason condemned
(14) Indication that the hose has been removed from service or condemned within the warranty period because of an in-warranty failure

A.4.11.3.4 Because occupant-use hose does not get the same type of use as other fire hose, methods of recording the identification number can include using bar-coded labels on the coupling, fastening metal tags to the hose, stamping couplings, or painting on the hose.

In stamping couplings, the proper procedure is to insert a special steel plug with round edges into the end of the expansion ring. One sharp blow from a steel numbering die will then clearly stamp the coupling. Coupling bowls can be damaged by improper stamping. Aluminum couplings should be stamped before they are hardcoated.

A water-based latex paint is not harmful to hose. Paints with a petroleum solvent base can cause the bond between the liner and the jacket to fail.

Hose Repair Tag
Hose to be repaired must be tagged

ID number:	Company number
Picked up by:	Date picked up
Delivered by:	Date delivered

Repairs Needed:

Repairs Made:

Repaired by:	Date repaired
Service tested psi	Date tested

☐ Hose is not repairable.
ID no. of replacement hose

Note: This tag must be filled out and returned with hose.
Enter repairs on hose record card.

****

FIGURE A.4.11.1.6 Example of a Hose Repair Tag. *(Courtesy of Memphis Fire Department.)*

A.4.11.3.5 It is important that a fire inspector have ready access to records of hose inspection and tests.

A.4.11.3.6 It is important that hose that has been damaged not become intermixed with hose in storage such that the damaged hose could accidentally be put in service.

A.4.12 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 this standard. That program should also address the retirement of fire hose.

One of the reasons for keeping good records of fire hose as required by this standard 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 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 indicates an increased risk of failure after 10 years. The testing looked at the reduction in burst pressure, ozone degradation, linear adhesion and degradation, hose strength, normal wear patterns, and UV degradation of fibers.

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

A.5.1.6 Nozzles should be washed in a solution of soap and warm water. The nozzle should be submerged and the adjustable controls operated until there is free movement. The nozzle should then be rinsed in water. The nozzle should be lubricated in accordance with the manufacturer's instructions. Cracked rubber-covered handles on nozzles can cause accidents and should be replaced.

A.5.2.2(4) It should never be necessary to hammer a shutoff valve to make it operate.

A.6.1.2 Many large-diameter appliances are designed for use with large-diameter supply hose, which typically has a service test pressure of 200 psi (13.8 bar or 1380 kPa). Such appliances should not be used in attack hose layouts that will require pressures above the designed operating pressure of the appliance. Hose layouts supplying elevated master streams from aerial ladders, elevated platforms, or water towers will generally be operated at pressures exceeding 250 psi (17.3 bar or 1725 kPa).

A.6.1.2.1 Extreme care should be taken the first time an appliance is service tested, particularly when the original operating pressure is unknown; the appliance could fail catastrophically and cause serious injury. It is recommended that adequate shielding be provided between the appliance and the tester to prevent injury in the event of failure.

A.6.1.7 All appliances that meet the requirements of NFPA 1965, *Standard for Fire Hose Appliances*, have been subjected to a corrosion exposure test. The purpose of this test is to ensure that the appliance will perform under normal exposure to corrosive conditions, such as those found in the atmosphere near oceans or caused by chemicals used to treat road surfaces in icy conditions. When the appliance is exposed to corrosive conditions on a long-term basis or is to be used where strong corrosives are present, the user should ensure that the appliance is designed for such exposure. Hard-coated aluminum is recommended to help prevent corrosion. Chrome-plated aluminum does not offer the same protection.

A.6.2.2 Repairs to appliances should be performed by the manufacturer or a person qualified by the manufacturer.

A.6.3.1.1 A protective device can be a container designed to contain shrapnel in case of a failure or a heavy duty tarp and blast mat that will cover the appliance.

A.7.1.3 In most cases, a machine shop with the proper facilities can repair damaged threads. One way to detect any slippage of the coupling on the hose is to inspect the area where the expansion ring is located for any appreciable gap between the expansion ring and the coupling waterway. Ordinarily, the swivels can be freed satisfactorily by immersion in warm, soapy water.

A.7.1.6 On some couplings, such abuse can cause the hose bowl and swivel to go "out-of-round"; as a result, the swivel will not turn.

A.7.1.9.1 Usually, an improper fit between the internal bowl diameter and the outside diameter of the hose of more than ± 1/32 in. (±0.79 mm) will require the use of special hose attachment techniques and should be avoided.

A.7.1.9.2 The length of the expansion ring needs to be consistent with the length of the coupling bowl. *(See Figure A.7.1.9.2.)*

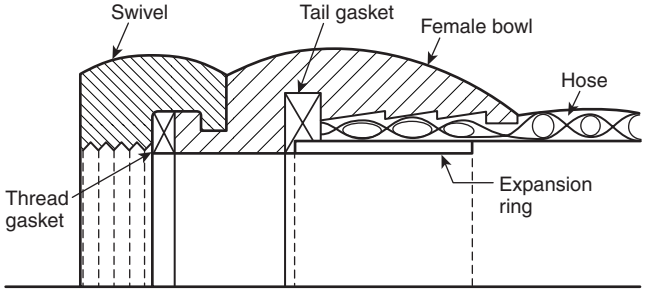

FIGURE A.7.1.9.2 Female Coupling Assembly.

A.7.1.9.3 The tail gasket is the gasket placed in the coupling at the end of the hose to prevent leakage and to keep the fabric of the hose jacket dry. When ordering couplings and tail gaskets for recoupling hose with expansion ring couplings, it is important that the appropriate tail gasket be provided. The coupling manufacturer needs to know the outside diameter of the hose and the wall thickness of the hose to provide the proper coupling and gasket.

A.7.1.10 Multiple-piece collars or compression-type hose couplings attached with a shank and external binding method might not be interchangeable from manufacturer to manufacturer and among different hose constructions. The user should verify that the binding is designed for the hose and shank with which it is being used. Check with the coupling or hose manufacturer for proper assembly instructions and bolt torque settings where necessary.

A.7.1.11 A degree of skill and experience is required to properly attach couplings to hose. It is necessary to have good equipment and a mechanic skilled and experienced in attaching couplings. If not, this work should be done by the hose manufacturer. Testing of repaired or recoupled fire hose is undertaken to confirm its suitability for continued use.

A.7.2.1 A high-quality synthetic gasket with antioxidants or neoprene should be used, because natural rubber gaskets can deteriorate with age and will harden and break away from the gasket seat.

A thread gasket with a smaller diameter than that of the recess can cause a leaky connection when pressure is applied. *(See* NFPA 1963, *Standard for Fire Hose Connections.)*

A.7.2.2 If the gasket protrudes at the nozzle connection, it can cause a ragged stream, reducing the effective reach of the nozzle; at a coupling, it can cause increased friction loss.

A.8.1 The purpose of the system test is to get accurate pump discharge pressures correlating to the desired flow rate on all interior attack lines used on the fire apparatus. Friction loss in hose varies with the brand and age of the hose, and it is only through a system test that the pump operator will accurately know what pressures are needed at the pump to get a proper flow from the nozzle.

A.8.1.3 It does not matter where the flow gauge is placed in the hose line being tested. If it is placed on the apparatus discharge, the pump operator can read the flow and the engine discharge pump pressure at the same time.

Annex B Specifying and Procuring Fire Hose

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General. Fire hose is one of the most important tools that a fire fighter uses. Fire hose must provide many years of reliable service along with the couplings, nozzles, adapters, and appliances that are used with fire hose. The purchase of new fire hose involves an important investment and should be treated as such. A purchase should be made only after a detailed study of the fire department's needs, taking into consideration other equipment the department uses or plans to acquire.

B.2 Determining the Qualities and Characteristics Needed for Fire Hose.

B.2.1 The first consideration in planning the purchase of fire hose is determining the characteristics desired of the new hose. Desired characteristics should be identified and then prioritized *(for a guide, see Figure B.2.1)*. Those characteristics can include the following:

(1) *Size/diameter.* The hose size or diameter will affect the flow capabilities of the hose. If the hose is going to be used for handheld hose lines, it is important to match the size of the hose with the flow of the nozzle. A nozzle that flows 200 gpm attached to a hose line that has friction loss of 60 psi/100 ft when flowing 200 gpm is not a good match.

(2) *Length.* In what lengths is the hose to be coupled? Hose is typically coupled in either 50 ft (15 m) or 100 ft (30 m) lengths but can be coupled in any length, which will affect the number of couplings required.

(3) *Application.* How is the hose to be used? For example, a fire department might want attack hose to be used in a standpipe pack to have characteristics different from those of attack hose that will be carried preconnected on a pumper. Large-diameter hose that will be supplying a pumper from a hydrant is different from large-diameter hose that will be supplying elevated stream fire apparatus or a standpipe system in a building.

(4) *Color.* Hose is available in a variety of jacket colors. Fire departments often like to color code hose to specific applications. If specific colors are desired, the purchaser needs to specify the amount of hose to be purchased in each color.

(5) *Construction.* Fire hoses use a variety of natural and synthetic fabrics and elastomers in their construction. These materials allow the hoses to be stored wet without rotting and to resist the damaging effects of exposure to sunlight and chemicals. Modern hoses are also lighter weight than older designs, which has helped reduce the physical strain on firefighters. The synthetic fibers provide additional strength and better resistance to abrasion, and the fiber yarns can be dyed various colors or left natural. Coatings and liners include synthetic rubbers such as styrene butadiene, ethylene propylene, chloroprene, polyurethane, and nitrile butadiene. These compounds provide various degrees of resistance to chemicals, temperature, ozone, ultraviolet (UV) radiation, mold, mildew, and abrasion. Different coatings and liners are chosen for specific applications.

(6) *Packability.* Fire apparatus has limited space for the storage of fire hose, whether that hose is stored preconnected to the pump for initial attack or in a hose bed

where the amount needed can be deployed and the remainder left on the apparatus. Some hose is packed lying flat while other hose is packed standing on its edge. It is important to consider the space on the apparatus where the hose will be carried and how a specific type of hose will pack into that space. Does it fold tightly at the ends of the hose bed? Is it easily deployed? A hose bed with a rigid hose bed cover could limit how the hose can be packed or how much hose can be packed in the hose bed and still allow quick and easy deployment. The coupling on the fire hose can affect the packability of the hose into a given space. Hose can be purchased in longer lengths to reduce the number of couplings that must be accommodated in a given space. If preconnected hose lines are in multiples of 100 ft (30 m), consider buying 100 ft (30 m) lengths of hose rather than 50 ft (15 m) lengths.

(7) *Friction loss.* The friction loss per 100 ft (30 m) of fire hose can vary tremendously for the same diameter hose. While a fire department may want a hose with as low a friction loss as possible, other desired characteristics can affect the availability of hose with all the desired characteristics. As part of the planning, the department should look at how the hose will be used and the importance of reducing the friction loss on that application. The effects of various friction loss on the application should be taken into account when considering what is an acceptable friction loss.

(8) *Weight.* If the weight of the hose is a factor, the maximum weight per 50 ft (15 m) or 100 ft (30 m) needs to be considered. Does that weight include the couplings? Weight is especially critical in two areas. If large-diameter hose is to be carried on older fire apparatus, the gross vehicle weight rating (GVWR) of the apparatus can limit the amount of hose that can be carried. Also, if hose is to be carried by fire fighters in bundles such as high-rise or standpipe packs, lighter is better as long as the hose meets the requirements for the operating pressure at which it will be used.

(9) *Kink resistance.* Layflat fire hose has a tendency to fold, or "kink," when used at low pressures. This is common in operational use, an example being a hose dragged around a doorway. When a hose kinks, two things happen. First, the waterflow through the hose is throttled and therefore reduced. Second, at the point of kinking, a high spot is formed that leads to excessive abrasion and early failure of the hose. Fire hose should be flexible when there is no water in it to allow easy packing but resist bending to the point of kinking when charged with water.

(10) *Cost.* The amount of money budgeted is always part of the purchasing process, but other costs also should be considered, such as higher quality or longer service life relative to the long-term cost of the purchase. Spending a little more money initially can save money in the future because of a less frequent replacement schedule.

(11) *Expected service life.* The expected service life is how long the purchaser expects to be able to use the hose before its scheduled or planned replacement. Fire departments should have an established replacement schedule for fire hose. The characteristics of fire hose can change as new materials and methods of construction are introduced. The improved characteristics of newer hose could warrant replacement of existing hose on an accelerated schedule.

(12) *Warranty.* The expected service life and the warranty period are not the same. The warranty is an assurance by the manufacturer to the buyer that specific facts or conditions are true or will happen for a specified period of time; the buyer is permitted to rely on that assurance and seek some type of remedy if it is not true or not followed. The purchaser should evaluate what the warranty covers and what it does not cover and for what periods of time.

(13) *Manufactured in accordance with NFPA standards.* At a minimum, any hose purchased should meet the edition of NFPA 1961, *Standard on Fire Hose*, that is in effect at the time of purchase. However, it is important to recognize that the standard establishes minimum requirements. The purchaser should carefully review the standard and determine if requirements that go beyond the minimum are desired.

(14) *Independent third-party listing or approval.* Currently, NFPA 1961 does not require fire hose manufacturers to have an independent third-party test or to certify the test results of fire hose. However, such services are available and should be considered, particularly if the purchaser does not have a good program for checking new fire hose before it is placed in service.

(15) *Normal operating pressure.* NFPA 1961 establishes minimum service test pressures for different types of fire hose. These service test pressures are about 110 percent of the expected normal operating pressure. If the hose will be used at pressures above the minimum service test pressure, the hose should be required to have a higher service test pressure and thus a higher operating pressure.

(16) *Service test pressure.* Fire hose often has a designed service test pressure higher than the user plans to operate the hose at or service test it to. NFPA 1961 allows fire hose to be marked with a service test pressure lower than the manufacturer's design service test pressure as long as it is not below the minimum specified in the standard.

B.2.2 The second consideration in the purchase of a fire hose is the associated equipment and components. These components include new and existing couplings, nozzles, adapters, and appliances. Are all components compatible in terms of operating pressure, connection, weight limits (GVWR and carrying capacity of the apparatus), and storage space?

It is important that all components in the water delivery system are compatible and that it is understood what the limitations are. The system is only as robust as its weakest link. Many components can be connected together, but that does not mean they can all be used at the same operating pressure. Today, the fire hose may be the strongest component in the system. All components need to have an operating pressure rated at or above the needed fireground pressures to deliver their capacity.

B.3 Writing the Specifications.

B.3.1 Once the desired characteristics have been identified and prioritized, the purchaser needs to write a specification that defines the characteristics needed and the quality desired. NFPA 1961, *Standard on Fire Hose*, provides the minimum technical requirements that new fire hose is expected to meet. Specifications should take into consideration the existing, proposed, and future use of the hose and the components.

QUALITIES AND CHARACTERISTICS NEEDED FOR FIRE HOSE

Desirable Qualities and Characteristics	Order of Importance	Notes
Abrasion resistance		
Application		
Certification to NFPA standards		
Chalking		
Chemical resistance		
Cold resistance		
Color		
Component compatibility		
Construction		
Cost		
Couplings		
Ease of advancement		
Expected life until replacement		
Flexibility		
Folds		
Friction loss		
Heat resistance		
Kink resistance		
Length		
Lining and cover properties		
Normal operating pressure and service test pressure		
Ozone resistance		
Packability		
Repairability		
Size/diameter		
Third-party listing or approval		
Warranty		
Weight		

FIGURE B.2.1 Guide to Determining Qualities and Characteristics Needed for Fire Hose.

B.3.2 The purchaser should also define in the specifications the warranty desired for the hose. The warranty is a written guarantee of the integrity of the hose that defines the manufacturer's responsibility within a given time period. If a second party, such as a dealer, is involved in modifying hose that is warranted by the original manufacturer, the responsibility for warranty work should be clearly understood by the original manufacturer, the second party, and the purchaser.

Annex C History of Fire Hose Coupling Thread Standardization in the United States

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 The need for securing uniformity and interchangeability of fire hose coupling threads was demonstrated by the Boston conflagration of November 1872. The following year, standardization was proposed by the International Association of Fire Engineers (IAFE), now the International Association of Fire Chiefs (IAFC). In subsequent years, various suggested standard threads were considered. A special committee of the IAFE prepared a report adopted at its 1891 convention in which the present principal dimensions for 2½ in. fire hose coupling screw threads were suggested, but no specifications for the shape of thread were included.

Little more was done toward standardization until difficulties with nonstandard threads were encountered by fire departments called to assist at the Baltimore conflagration of 1904. The following year, the National Fire Protection Association (NFPA) actively took up the project, appointing the Committee on Standard Thread for Fire Hose Couplings. The committee developed general screw thread specifications covering the 2½ in., 3 in., 3½ in., and 4½ in. sizes, using as a basis the earlier report of the IAFE committee and working with the active cooperation of the American Water Works Association (AWWA). The principal dimensions for the 2½ in. couplings of 7½ threads per inch and 3$^{1}/_{16}$ in. outside diameter of the external thread (ODM) were selected to facilitate conversion of existing couplings, the majority of which had either 7 or 8 threads per inch and 3 in. or 3⅓ in. ODM.

During the years that followed, until 1917, the committee worked diligently to secure recognition of those specifications as a "National Standard" and their adoption by cities and towns throughout the United States. Its efforts were rewarded with considerable success, and, in addition, as many as 20 organizations officially approved and adopted the standard. It was also published by the National Board of Fire Underwriters (NBFU) in 1911, the American Society of Mechanical Engineers (ASME) in 1913, the U.S. Bureau of Standards as Circular No. 50 (1914 and 1917), and the AWWA. Between 1920 and 1923, a series of conferences was held, attended by representatives of the manufacturers of fire hose couplings, the NFBU, the National Screw Thread Commission (NSTC), and the ASME. These conferences resulted in an agreement concerning the standardization of screw thread tolerances, allowances, and methods of gauging. Efforts to bring about the general adoption of the standard throughout the country were continued. In October 1923, NBFU, NFPA, and ASME asked the American Standards Association (ASA) to approve and designate this standard as an "American Standard." Shortly afterward, ASA assigned joint sponsorship for the project to NBFU, AWWA, and ASME. At that time, through the cooperation of a group of gauging experts, including members of NSTC, the limiting dimensions were added to the original specifications, and the standard for fire hose coupling screw threads for sizes 2½ in. and larger was approved by the ASA in May 1925.

In 1917, by mutual agreement, the field work of the NFPA committee concerned with encouraging adoption and application of the standard was taken over by the Committee on Fire Prevention and Engineering Standards of the NBFU. At the same time, NFPA organized the Committee on Small Hose Couplings to develop standards on fire hose screw threads in sizes from ½ in. to 2 in. nominal diameters. A standard covering these sizes was developed and adopted by NFPA in 1922. These smaller-size couplings had the same general characteristics of thread design as the standard couplings for 2½ in. and larger hose. The NFPA *Standard for Small Hose Coupling Screw Threads* was submitted to the ASA for approval in 1926 and is the basis for the current fire hose screw thread dimensions included in this standard.

The National Screw Thread Commission also had prepared dimensions for the screw threads of small-hose couplings ½ in. to 2 in., inclusive, which were published in 1921, 1924, and 1928 reports. The pitches and other dimensions of these threads, except for the garden hose size, varied from those proposed by the NFPA for use on fire hose, which requires a heavier thread that can be connected quickly in the field.

In January 1927, the ASME requested that the ASA authorize the organization of a sectional committee to complete the standardization of fire hose couplings and to attempt to unify and complete the dimensions of small hose couplings. A sectional committee was organized in October 1928, under the sponsorship of the ASME, to prepare specifications for screw threads for small-hose couplings ranging from ½ in. to 2 in. nominal size. Data on these smaller threads were published by ASA.

Subsequently, it was found that almost every pump manufacturer was using different threads on 4 in., 5 in., and 6 in. supply hose and fittings required on certain sizes of fire department pumping engines, so the supply hose from one pumper could not be used on another pumper at the same time. Accordingly, in 1955, NFPA adopted standards for threads on these three sizes of fire hose. In 1956, NFPA adopted dimensions for gaskets for standard fire hose couplings of all sizes from ¾ in. to 6 in. couplings, as well as data on the required gasket seat dimensions. Gaskets were felt to be an essential feature of a fire hose coupling standard because hose connections feature swivel or "female" fittings that must provide a tight waterway when connected to the opposing thread. NFPA also prepared a text showing the suggested application of the standard to various items of fire-fighting equipment because experience had shown that the wrong size of standard thread was sometimes used, limiting the effectiveness of the equipment.

In 1961, the duties of the ASA sectional committee were transferred to a newly established subcommittee of the ASA Sectional Committee on the Standardization of Pipe Threads, for which the ASME and the American Gas Association (AGA) were joint sponsors. The subcommittee was organized to deal with threads for fire hose couplings and fittings. New material from the ASA subcommittee was subsequently included in the NFPA document. A survey conducted by NFPA in 1965 showed that 65 percent of the fire departments serving U.S. communities with populations greater than 20,000 used standard fire hose coupling screw threads on all sizes of hose. The percentage of fire departments using standard threads on each of the

sizes were as follows: ¾ in. and 1 in. threads, 95 percent standard; 1½ in. threads, 84 percent standard; 2½ in. threads, 73 percent standard. The degree of standardization is believed to be considerably higher in smaller communities, many of which organized their fire departments subsequent to the adoption of the standard. Approximately half of the U.S. states have laws supporting fire hose thread standardization.

In 1965, at its 69th annual meeting, NFPA passed a resolution to intensify its efforts to accomplish complete standardization of fire hose screw threads throughout the country by asking for assistance from all fire chiefs, fire organizations, industrial organizations, manufacturers, and governmental agencies.

NFPA, International Association of Fire Chiefs (IAFC), the International Association of Fire Fighters (IAFF), the American National Standards Institute (ANSI), American Water Works Association (AWWA), and many others have assisted on the standardization program.

Annex D Informational References

D.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.

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

NFPA 1961, *Standard on Fire Hose*, 2013 edition.

NFPA 1963, *Standard for Fire Hose Connections*, 2009 edition.

NFPA 1965, *Standard for Fire Hose Appliances*, 2014 edition.

D.1.2 Other Publications.

D.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

IEEE/ASTM SI-10, *Standard for Use of the International System of Units (SI): The Modern Metric System*, 2002.

D.1.2.2 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 92, *Fire Extinguisher and Booster Hose*, 1993, Revised 2008.

D.1.2.3 Other Publications.

Purington, R. G., *Fire Fighting Hydraulics*, 1st edition, McGraw-Hill, New York, 1974, pp. 371–373.

D.2 Informational References. (Reserved)

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