

NFPA® 25

Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

2008 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, 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 its codes and standards.

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 this document. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this document 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 this document. 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.

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Documents

Users of NFPA codes, standards, recommended practices, and guides should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments.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 asserted in connection with any items which are mentioned in or are the subject of NFPA codes, standards, recommended practices, and guides, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on these documents. Users of these documents are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

NFPA adheres to applicable policies of the American National Standards Institute with respect to patents. For further information contact the NFPA at the address listed below.

Law and Regulations

Users of these 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

This document is copyrighted by the NFPA. It is 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 this document available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to this document.

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 codes, standards, recommended practices, and guides 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.

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

Copyright © 2007 National Fire Protection Association®. All Rights Reserved.

NFPA® 25

Standard for the

Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

2008 Edition

This edition of NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, was prepared by the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems and acted on by NFPA at its June Association Technical Meeting held June 3–7, 2007, in Boston, MA. It was issued by the Standards Council on July 26, 2007, with an effective date of August 15, 2007, and supersedes all previous editions.

This edition of NFPA 25 was approved as an American National Standard on August 15, 2007.

Origin and Development of NFPA 25

The first edition of NFPA 25 was a collection of inspection, testing, and maintenance provisions that helped ensure the successful operation of water-based fire protection systems. NFPA 25 was developed as an extension of existing documents such as NFPA 13A, *Recommended Practice for the Inspection, Testing, and Maintenance of Sprinkler Systems*, and NFPA 14A, *Recommended Practice for the Inspection, Testing, and Maintenance of Standpipe and Hose Systems*, which have successfully assisted authorities having jurisdiction and property owners with routine inspections of sprinkler systems and standpipes. These documents have since been withdrawn from the NFPA standards system. NFPA 25 became the main document governing sprinkler systems as well as related systems, including underground piping, fire pumps, storage tanks, water spray systems, and foam-water sprinkler systems.

This document provides instruction on how to conduct inspection, testing, and maintenance activities. It also stipulates how often such activities are required to be completed. Requirements are provided for impairment procedures, notification processes, and system restoration. This type of information, when incorporated into a building maintenance program, enhances the demonstrated favorable experience of all water-based fire protection systems.

The second edition incorporated several improvements that reflected the initial experience with the standard. A new chapter was added that addresses obstructions in pipe as well as appropriate corrective actions.

The third edition refined testing requirements and frequencies and provided additional guidance for preplanned impairment programs. The document scope was expanded to include marine systems.

The fourth edition continued to refine testing frequencies for water-flow devices and evaluation of the annual fire pump test data. This edition also included additional information regarding evaluation and test methods for microbiologically influenced corrosion (MIC).

This fifth edition increased the requirement for record retention from one year to five years in order to establish sufficient performance, data to determine a performance trend with particular concern for degradation in system or component performance. A section permitting performance-based testing was added, providing guidance on alternative means for determining testing frequencies based on system/component failure rates. Component replacement testing tables were introduced in this edition to provide guidance for the appropriate tests to be performed following replacement of system components. Inspection, testing, and maintenance requirements for water mist systems were extracted from NFPA 750 and were inserted into a new chapter. This action consolidates inspection, testing, and maintenance requirements for all water-based fire protection systems into one document.



Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems

Kenneth W. Linder, *Chair*

Swiss Re, Global Asset Protection Services, CT [I]

Clement J. Adams, Chubb Group of Insurance Companies, PA [I]

Gary S. Andress, Liberty Mutual Property, MA [I]

Kerry M. Bell, Underwriters Laboratories Incorporated, IL [RT]

Michael J. Bosma, The Viking Corporation, MI [M]
Rep. National Fire Sprinkler Association

John K. Bouchard, Wachovia Insurance Services, MA [I]

Eugene A. Cable, U.S. Department of Veterans Affairs, NY [U]

James M. Fantauzzi, North East Fire Protection Systems Incorporated, NY [IM]

Rep. American Fire Sprinkler Association

James M. Feld, Feld Engineering, CA [SE]

Gary R. Field, Automatic Protection Systems Corporation, OK [IM]

Rep. National Association of Fire Equipment Distributors

David B. Fuller, FM Global, MA [I]

Gary Gagnon, Alcan, Inc., Canada [U]

Stephen R. Hoover, Stephen R. Hoover Associates, IL [SE]

Daniel P. Jaugstetter, Kidde Fire Fighting USA, GA [M]

Rep. Fire Equipment Manufacturers' Association

Larry Keeping, Vipond Fire Protection, Canada [IM]

Rep. Canadian Automatic Sprinkler Association

John Lake, Marion County Fire Rescue, FL [E]

Russell B. Leavitt, TVA Fire & Life Safety, Incorporated, AZ [U]

Rep. The Home Depot

Frank L. Moore, Moore Pump and Equipment, Inc., MS [IM]

John D. Munno, Dominion Resources Inc., VA [U]

Rep. Edison Electric Institute

Miles Myers, Myers Risk Services, Inc., PA [SE]

Richard Oliver, Oliver Sprinkler Company, Inc., PA [IM]
Rep. National Fire Sprinkler Association

Eric Packard, Local 669 JATC Education Fund, MD [L]

Rep. United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada

Gayle Pennel, Schirmer Engineering Corporation, IL [I]
Rep. TC on Fire Pumps

John F. Saidi, University of California, CA [U]

Bill Sheppard, General Motors Corporation, MI [U]
Rep. NFPA Industrial Fire Protection Section

Gregory R. "Chip" Stein, Tank Industry Consultants, IN [SE]

Terry L. Victor, Tyco/Simplex Grinnell Fire Protection, MD [M]

John Whitney, Clarke Fire Protection Products, Incorporated, OH [M]

Rep. Engine Manufacturers Association

Alternates

John A. Beukema, Reliable Automatic Sprinkler Company, NY [M]

(Alt. to M. J. Bosma)

Bruce H. Clarke, Swiss Re, Global Asset Protection Services, NC [I]

(Alt. to K. W. Linder)

Matthew G. Drysdale, E. I. duPont de Nemours & Company, Incorporated, DE [U]

(Alt. to B. Sheppard)

Russell P. Fleming, National Fire Sprinkler Association, NY [IM]

(Alt. to R. Oliver)

Ronald J. Huggins, American Fire Sprinkler Association, Inc., TX [IM]

(Alt. to J. M. Fantauzzi)

Peter A. Larrimer, U.S. Department of Veterans Affairs, PA [U]

(Alt. to E. A. Cable)

George E. Laverick, Underwriters Laboratories Incorporated, IL [RT]

(Alt. to K. M. Bell)

Matthew Osburn, Canadian Automatic Sprinkler Association, Canada [IM]

(Alt. to L. Keeping)

Ronald Rispoli, Entergy Corporation, AR [U]

(Alt. to J. D. Munno)

Peter W. Thomas, Tyco Fire Products, RI [M]

(Alt. to T. L. Victor)

Ralph Tiede, Liberty Mutual Property, MA [I]

(Alt. to G. S. Andress)

Barry J. Waterman, Acme Sprinkler Service Co., IL [M]

(Alt. to IFPA Rep.)

Nonvoting

Rohit Khanna, U.S. Consumer Product Safety Commission, MD [C]

Thomas F. Norton, Norel Service Company, Inc., MA [M]
Rep. National Fire Alarm Code Committee

David R. Hague, 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 inspection, testing, and maintenance of systems utilizing water as a method of extinguishment. These include sprinkler systems, standpipe and hose systems, fire service piping and appurtenances, fire pumps, water storage tanks, fixed water spray systems, foam-water systems, valves, and allied equipment. This Committee shall also develop procedures for the conduct and reporting of routine system impairments.



Contents

Chapter 1 Administration	25- 5	7.4 Maintenance	25-22
1.1 Scope	25- 5	7.5 Component Action Requirements	25-22
1.2 Purpose	25- 5	Chapter 8 Fire Pumps	25-23
1.3 Application	25- 5	8.1 General	25-23
1.4 Units	25- 5	8.2 Inspection	25-23
Chapter 2 Referenced Publications	25- 5	8.3 Testing	25-24
2.1 General	25- 5	8.4 Reports	25-25
2.2 NFPA Publications	25- 5	8.5 Maintenance	25-25
2.3 Other Publications	25- 6	8.6 Component Replacement Testing Requirements	25-26
2.4 References for Extracts in Mandatory Sections	25- 6	Chapter 9 Water Storage Tanks	25-29
Chapter 3 Definitions	25- 6	9.1 General	25-29
3.1 General	25- 6	9.2 Inspection	25-29
3.2 NFPA Official Definitions	25- 6	9.3 Testing	25-31
3.3 General Definitions	25- 6	9.4 Maintenance	25-31
3.4 Deluge Foam-Water Sprinkler and Foam-Water Spray Systems Definitions	25- 9	9.5 Automatic Tank Fill Valves	25-31
3.5 Valve Definitions	25- 9	9.6 Component Action Requirements	25-31
3.6 Water-Based Fire Protection System Definitions	25- 9	Chapter 10 Water Spray Fixed Systems	25-32
Chapter 4 General Requirements	25-10	10.1 General	25-32
4.1 Responsibility of the Property Owner or Occupant	25-10	10.2 Inspection and Maintenance Procedures	25-34
4.2 Impairments	25-11	10.3 Operational Tests	25-35
4.3 Corrective Action	25-11	10.4 Ultra-High-Speed Water Spray System (UHSWSS) Operational Tests	25-35
4.4 Records	25-11	10.5 Component Action Requirements	25-36
4.5 Inspection	25-11	Chapter 11 Foam-Water Sprinkler Systems	25-37
4.6 Testing	25-11	11.1 General	25-37
4.7 Maintenance	25-11	11.2 Inspection	25-38
4.8 Safety	25-11	11.3 Operational Tests	25-39
4.9 Electrical Safety	25-11	11.4 Maintenance	25-40
Chapter 5 Sprinkler Systems	25-11	11.5 Component Action Requirements	25-41
5.1 General	25-11	Chapter 12 Water Mist Systems	25-42
5.2 Inspection	25-12	12.1 Responsibility of the Owner or Occupant	25-42
5.3 Testing	25-13	12.2 Inspection and Testing	25-42
5.4 Maintenance	25-14	12.3 Maintenance	25-45
5.5 Component Action Requirements	25-15	12.4 Training	25-45
Chapter 6 Standpipe and Hose Systems	25-17	Chapter 13 Valves, Valve Components, and Trim	25-45
6.1 General	25-17	13.1 General	25-45
6.2 Inspection	25-17	13.2 General Provisions	25-47
6.3 Testing	25-17	13.3 Control Valves in Water-Based Fire Protection Systems	25-47
6.4 Maintenance	25-19	13.4 System Valves	25-48
6.5 Component Action Requirements	25-19	13.5 Pressure Reducing Valves and Relief Valves	25-50
Chapter 7 Private Fire Service Mains	25-20	13.6 Backflow Prevention Assemblies	25-51
7.1 General	25-20	13.7 Fire Department Connections	25-51
7.2 Inspection	25-20		
7.3 Testing	25-21		

Chapter 14 Obstruction Investigation	25-52	15.6 Emergency Impairments	25-53
14.1 General	25-52	15.7 Restoring Systems to Service	25-53
14.2 Obstruction Investigation and Prevention	25-52	Annex A Explanatory Material	25-53
14.3 Ice Obstruction	25-52	Annex B Forms for Inspection, Testing, and Maintenance	25-80
Chapter 15 Impairments	25-52	Annex C Possible Causes of Pump Troubles	25-80
15.1 General	25-52	Annex D Obstruction Investigation	25-83
15.2 Impairment Coordinator	25-52	Annex E Informational References	25-90
15.3 Tag Impairment System	25-52	Index	25-92
15.4 Impaired Equipment	25-52		
15.5 Preplanned Impairment Programs	25-53		

NFPA 25**Standard for the****Inspection, Testing, and Maintenance
of Water-Based Fire Protection Systems****2008 Edition**

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Documents." They can also be obtained on request from NFPA or viewed at www.nfpa.org/disclaimers.

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 E. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. 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 E.

Chapter 1 Administration

1.1* Scope. This document establishes the minimum requirements for the periodic inspection, testing, and maintenance of water-based fire protection systems, including land-based and marine applications.

1.1.1 This standard does not address all of the inspection, testing, and maintenance of the electrical components of the automatic fire detection equipment for preaction and deluge systems that are addressed by *NFPA 72, National Fire Alarm Code*. The inspection, testing, and maintenance required by this standard and *NFPA 72, National Fire Alarm Code*, shall be coordinated so that the system operates as intended.

1.1.2 The types of systems addressed by this standard include, but are not limited to, sprinkler, standpipe and hose, fixed water spray, and foam water. Included are the water supplies that are part of these systems, such as private fire service mains and appurtenances, fire pumps and water storage tanks, and valves that control system flow. The document also addresses impairment handling and reporting. This standard applies to fire protection systems that have been properly installed in accordance with generally accepted practices. Where a system

has not been installed in accordance with generally accepted practices, the corrective action is beyond the scope of this standard. The corrective action to ensure that the system performs in a satisfactory manner shall be in accordance with the appropriate installation standard.

1.1.3 This standard shall not apply to sprinkler systems designed and installed in accordance with *NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*.

1.2* Purpose. The purpose of this document is to provide requirements that ensure a reasonable degree of protection for life and property from fire through minimum inspection, testing, and maintenance methods for water-based fire protection systems. In those cases where it is determined that an existing situation involves a distinct hazard to life or property, the authority having jurisdiction shall be permitted to require inspection, testing, and maintenance methods in excess of those required by the standard.

1.3* Application. It is not the intent of this document to limit or restrict the use of other inspection, testing, or maintenance programs that provide an equivalent level of system integrity and performance to that detailed in this document. The authority having jurisdiction shall be consulted and approval obtained for such alternative programs.

1.4* Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

1.4.1 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated shall be regarded as the requirement. A given equivalent value shall be considered to be approximate.

1.4.2 SI units have been converted by multiplying the quantity by the conversion factor and then rounding the result to the appropriate number of significant digits. Where nominal or trade sizes exist, the nominal dimension has been recognized in each unit.

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 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2005 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2007 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2007 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2007 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2007 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2007 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2007 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2003 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2007 edition.

NFPA 72®, *National Fire Alarm Code*®, 2007 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2005 edition.

NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*, 2006 edition.

NFPA 409, *Standard on Aircraft Hangars*, 2004 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2006 edition.

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

2.3 Other Publications.

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

ASTM D 3359, *Standard Test Methods for Measuring Adhesion by Tape Test*, 1997.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2005 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2007 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2007 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2007 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2007 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2007 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2007 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2008 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2006 edition.

NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities*, 2008 edition.

NFPA 1071, *Standard for Emergency Vehicle Technician Professional Qualifications*, 2006 edition.

NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas*, 2008 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* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

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

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

3.3 General Definitions.

3.3.1 Alarm Receiving Facility. The place where alarm or supervisory signals are received. This can include proprietary supervising stations, central supervising stations, remote supervising stations, or public fire service communications centers.

3.3.2* Automatic Detection Equipment. Equipment that automatically detects heat, flame, products of combustion, flammable gases, or other conditions likely to produce fire or explosion and cause other automatic actuation of alarm and protection equipment.

3.3.3 Automatic Operation. Operation without human intervention. This operation includes, but is not limited to, heat, rate of heat rise, smoke, or pressure change.

3.3.4 Deficiency. A condition in which the application of the component is not within its designed limits or specifications. [1071, 2006]

3.3.5 Discharge Device. A device designed to discharge water or foam-water solution in a predetermined, fixed, or adjustable pattern. Examples include, but are not limited to, sprinklers, spray nozzles, and hose nozzles. [16, 2003]

3.3.6 Double Check Valve Assembly (DCVA). This assembly consists of two internally loaded check valves, either spring-loaded or internally weighted, installed as a unit between two tightly closing resilient-seated shutoff valves as an assembly, and fittings with properly located resilient-seated test cocks.

3.3.7 Drain.

3.3.7.1 Main Drain. The primary drain connection located on the system riser and also utilized as a flow test connection.

3.3.7.2 Sectional Drain. A drain located beyond a sectional control valve that drains only a portion of the system (e.g., a drain located beyond a floor control valve on a multi-story building).

3.3.8 Fire Department Connection. A connection through which the fire department can pump supplemental water into the sprinkler system, standpipe, or other system furnishing water for fire extinguishment to supplement existing water supplies.

3.3.9* Fire Hydrant. A valved connection on a water supply system having one or more outlets and that is used to supply hose and fire department pumpers with water. [1141, 2008]

3.3.9.1* Dry Barrel Hydrant (Frostproof Hydrant). This is the most common type of hydrant; it has a control valve below the frost line between the footpiece and the barrel. A drain is located at the bottom of the barrel above the control valve seat for proper drainage after operation.

3.3.9.2* Monitor Nozzle Hydrant. A hydrant equipped with a monitor nozzle capable of delivering more than 250 gpm (946 L/min).

3.3.9.3* Wall Hydrant. A hydrant mounted on the outside of a wall of a building, fed from interior piping, and equipped with control valves located inside the building that normally are key-operated from the building's exterior.

3.3.9.4* Wet Barrel Hydrant. A type of hydrant that sometimes is used where there is no danger of freezing weather. Each outlet on a wet barrel hydrant is provided with a valved outlet threaded for fire hose.

3.3.10* Foam Concentrate. A concentrated liquid foaming agent as received from the manufacturer. [11, 2005]

3.3.11 Foam Discharge Device. Any device that, when fed with a foam-water solution, produces foam. These devices shall be permitted to be non-air-aspirating (e.g., sprinklers, water nozzles) or air-aspirating (e.g., foam-water sprinklers, directional foam-water nozzles, foam nozzles). All discharge devices have a special pattern of distribution peculiar to the particular device.

3.3.12 Hose Connection. A combination of equipment provided for connection of a hose to the standpipe system that includes a hose valve with a threaded outlet. [14, 2007]

3.3.13* Hose House. An enclosure located over or adjacent to a hydrant or other water supply designed to contain the necessary hose nozzles, hose wrenches, gaskets, and spanners to be used in fire fighting in conjunction with and to provide aid to the local fire department.

3.3.14 Hose Nozzle. A device intended for discharging water for manual suppression or extinguishment of a fire.

3.3.15 Hose Station. A combination of a hose rack, hose nozzle, hose, and hose connection. [14, 2007]

3.3.16 Hose Storage Devices.

3.3.16.1* Conventional Pin Rack. A hose rack where the hose is folded vertically and attached over the pins.

3.3.16.2* Horizontal Rack. A hose rack where the hose is connected to the valve, then stack-folded horizontally to the top of the rack.

3.3.16.3* Hose Reel. A circular device used to store hose.

3.3.16.4* Semiautomatic Hose Rack Assembly. The same as a "conventional" pin rack or hose reel except that, after the valve is opened, a retaining device holds the hose and water until the last few feet are removed.

3.3.17* Impairment. A condition where a fire protection system or unit or portion thereof is out of order, and the condition can result in the fire protection system or unit not functioning in a fire event.

3.3.17.1 Emergency Impairment. A condition where a water-based fire protection system or portion thereof is out of order due to an unexpected occurrence, such as a ruptured pipe, an operated sprinkler, or an interruption of the water supply to the system.

3.3.17.2 Preplanned Impairment. A condition where a water-based fire protection system or a portion thereof is out of service due to work that has been planned in advance, such as revisions to the water supply or sprinkler system piping.

3.3.18 Inspection. A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage. [820, 2008]

3.3.19 Inspection, Testing, and Maintenance Service. A service program provided by a qualified contractor or qualified property owner's representative in which all components unique to the property's systems are inspected and tested at the required times and necessary maintenance is provided. This program includes logging and retention of relevant records.

3.3.20 Maintenance. In water-based fire protection systems, work performed to keep equipment operable or to make repairs.

3.3.21 Manual Operation. Operation of a system or its components through human action.

3.3.22 Nozzles.

3.3.22.1* Monitor Nozzle. A device specifically designed with large, clear waterways to provide a powerful, far-reaching stream for the protection of large amounts of combustible materials, aircraft, tank farms, and any other special hazard locations where large amounts of water need to be instantly available without the delay of laying hose lines. The nozzle is normally fitted with one of three interchangeable tips that measure 1½ in., 1¾ in., and 2 in. (40 mm, 45 mm, and 50 mm) in diameter.

3.3.22.2* Water Spray Nozzle. An open or automatic water discharge device that, when discharging water under pressure, will distribute the water in a specific, directional pattern.

3.3.23 Orifice Plate Proportioning. This system utilizes an orifice plate(s) through which passes a specific amount of foam concentrate at a specific pressure drop across the orifice plate(s).

3.3.24* Pressure Regulating Device. A device designed for the purpose of reducing, regulating, controlling, or restricting water pressure. [14, 2007]

3.3.25 Pressure Restricting Device. A valve or device designed for the purpose of reducing the downstream water pressure under flowing (residual) conditions only. [14, 2007]

3.3.26* Pressure Vacuum Vent. A venting device mounted on atmospheric foam concentrate storage vessels to allow for concentrate expansion and contraction and for tank breathing during concentrate discharge or filling. At rest (static condition), this device is closed to prevent free breathing of the foam concentrate storage tank.

3.3.27* Proportioners.

3.3.27.1* Bladder Tank Proportioner. This system is similar to a standard pressure proportioner, except the foam concentrate is contained inside a diaphragm bag that is contained inside a pressure vessel. Operation is the same as a standard pressure proportioner, except that, because of the separation of the foam concentrate and water, this system can be used with all foam concentrates, regardless of specific gravity.

3.3.27.2* In-Line Balanced Pressure Proportioner. This system is similar to a standard balanced pressure system, except the pumped concentrate pressure is maintained at a fixed preset value. Balancing of water and liquid takes place at individual proportioners located in the system riser or in segments of multiple systems.

3.3.27.3* Line Proportioner. This system uses a venturi pickup-type device where water passing through the unit creates a vacuum, thereby allowing foam concentrate to be picked up from an atmospheric storage container.

3.3.27.4* Standard Balanced Pressure Proportioner. This system utilizes a foam concentrate pump. Foam concentrate is drawn from an atmospheric storage tank, is pressurized by the pump, and passes back through a diaphragm balancing valve to the storage tank. Water- and foam concentrate-sensing lines are directed to the balancing valve and maintain the foam liquid at a pressure equal to that of the water pressure. The two equal pressures are fed to the proportioner proper and are mixed at a predetermined rate.

3.3.27.5* Standard Pressure Proportioner. This system uses a pressure vessel containing foam concentrate. Water is supplied to the proportioner, which directs an amount of the supply downward onto the contained concentrate, thereby pressurizing the tank. Pressurized concentrate then is forced through an orifice back into the flowing water stream. This type of system is applicable for use with foam concentrates having a specific gravity substantially higher than water. It is not applicable for use with foam concentrates with a specific gravity at or near that of water.

3.3.28 Qualified. A competent and capable person or company that has met the requirements and training for a given field acceptable to the AHJ. [96, 2008]

3.3.29 Reduced-Pressure Principle Backflow Prevention Assembly (RPBA). Two independently acting check valves together with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and below the first check valve. These units are located between two tightly closed resilient-seated shutoff valves, as an assembly, and are equipped with properly located resilient-seated test cocks.

3.3.30 Sprinklers.

3.3.30.1 Corrosion-Resistant Sprinkler. A sprinkler fabricated with corrosion-resistant material, or with special coatings or platings, to be used in an atmosphere that would normally corrode sprinklers. [13, 2007]

3.3.30.2 Dry Sprinkler. A sprinkler secured in an extension nipple that has a seal at the inlet end to prevent water from entering the nipple until the sprinkler operates. [13, 2007]

3.3.30.3 Early Suppression Fast-Response (ESFR) Sprinkler. A type of fast-response sprinkler that meets the criteria of 3.6.1(a)(1) of NFPA 13, *Standard for the Installation of Sprinkler*

Systems, and is listed for its capability to provide fire suppression of specific high-challenge fire hazards. [13, 2007]

3.3.30.4 Extended Coverage Sprinkler. A type of spray sprinkler with maximum coverage areas as specified in Sections 8.8 and 8.9 of NFPA 13. [13, 2007]

3.3.30.5 Large Drop Sprinkler. A type of specific application control mode sprinkler that is capable of producing characteristic large water droplets and that is listed for its capability to provide fire control of specific high-challenge fire hazards. [13, 2007]

3.3.30.6 Nozzles. A device for use in applications requiring special water discharge patterns, directional spray, or other unusual discharge characteristics. [13, 2007]

3.3.30.7 Old-Style/Conventional Sprinkler. A sprinkler that directs from 40 percent to 60 percent of the total water initially in a downward direction and that is designed to be installed with the deflector either upright or pendent. [13, 2007]

3.3.30.8 Open Sprinkler. A sprinkler that does not have actuators or heat-responsive elements. [13, 2007]

3.3.30.9 Ornamental/Decorative Sprinkler. A sprinkler that has been painted or plated by the manufacturer. [13, 2007]

3.3.30.10 Pendent Sprinkler. A sprinkler designed to be installed in such a way that the water stream is directed downward against the deflector. [13, 2007]

3.3.30.11 Quick-Response Early Suppression (QRES) Sprinkler. A type of quick-response sprinkler that meets the criteria of 3.6.1(a)(1) of NFPA 13 and is listed for its capability to provide fire suppression of specific fire hazards. [13, 2007]

3.3.30.12 Quick-Response Extended Coverage Sprinkler. A type of quick-response sprinkler that meets the criteria of 3.6.1(a)(1) of NFPA 13 and complies with the extended protection areas defined in Chapter 8 of NFPA 13. [13, 2007]

3.3.30.13 Quick-Response (QR) Sprinkler. A type of spray sprinkler that meets the fast response criteria of 3.6.1(a)(1) of NFPA 13 and is listed as a quick-response sprinkler for its intended use. [13, 2007]

3.3.30.14 Recessed Sprinkler. A sprinkler in which all or part of the body, other than the shank thread, is mounted within a recessed housing. [13, 2007]

3.3.30.15 Residential Sprinkler. A type of fast-response sprinkler that meets the criteria of 3.6.1(a)(1) of NFPA 13 that has been specifically investigated for its ability to enhance survivability in the room of fire origin and is listed for use in the protection of dwelling units. [13, 2007]

3.3.30.16 Special Sprinkler. A sprinkler that has been tested and listed as prescribed in 8.4.8 of NFPA 13. [13, 2007]

3.3.30.17 Spray Sprinkler. A type of sprinkler listed for its capability to provide fire control for a wide range of fire hazards. [13, 2007]

3.3.30.18 Standard Spray Sprinkler. A spray sprinkler with maximum coverage areas as specified in Sections 8.6 and 8.7 of NFPA 13. [13, 2007]

3.3.30.19 Upright Sprinkler. A sprinkler designed to be installed in such a way that the water spray is directed upwards against the deflector. [13, 2007]



3.3.31* Standpipe System. An arrangement of piping, valves, hose connections, and allied equipment installed in a building or structure, with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire, thereby protecting a building or structure and its contents in addition to protecting the occupants. [14, 2007]

3.3.31.1 Dry Standpipe. A standpipe system designed to have piping contain water only when the system is being utilized.

3.3.31.1.1 Class I System. A system that provides 2½ in. (65 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams. [14, 2007]

3.3.31.1.2 Class II System. A system that provides 1½ in. (40 mm) hose stations to supply water for use primarily by trained personnel or by the fire department during initial response. [14, 2007]

3.3.31.1.3 Class III System. A system that provides 1½ in. (40 mm) hose stations to supply water for use by trained personnel and 2½ in. (65 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams. [14, 2007]

3.3.31.2 Manual Standpipe. Standpipe system that relies exclusively on the fire department connection to supply the system demand.

3.3.31.3 Wet Standpipe System. A standpipe system having piping containing water at all times. [14, 2007]

3.3.32* Strainer. A device capable of removing from the water all solids of sufficient size that are obstructing water spray nozzles.

3.3.33 Supervision. In water-based fire protection systems, a means of monitoring system status and indicating abnormal conditions.

3.3.34 Testing. A procedure used to determine the status of a system as intended by conducting periodic physical checks on waterbased fire protection systems such as waterflow tests, fire pump tests, alarm tests, and trip tests of dry pipe, deluge, or preaction valves. These tests follow up on the original acceptance test at intervals specified in the appropriate chapter of this standard.

3.3.35* Water Spray. Water in a form having a predetermined pattern, particle size, velocity, and density discharge from specially designed nozzles or devices. [15, 2007]

3.3.36 Water Supply. A source of water that provides the flows [gal/min (L/min)] and pressures [psi (bar)] required by the water-based fire protection system.

3.4 Deluge Foam-Water Sprinkler and Foam-Water Spray Systems Definitions.

3.4.1 Foam-Water Spray System. A special system that is pipe-connected to a source of foam concentrate and to a water supply. The system is equipped with foam-water spray nozzles for extinguishing agent discharge (foam followed by water or in reverse order) and for distribution over the area to be protected. System operation arrangements parallel those for foam-water sprinkler systems as described in the definition of Foam-Water Sprinkler System. [16, 2003]

3.4.2 Foam-Water Sprinkler System. A special system that is pipe-connected to a source of foam concentrate and to a water supply. The system is equipped with appropriate discharge de-

vices for extinguishing agent discharge and for distribution over the area to be protected. The piping system is connected to the water supply through a control valve that usually is actuated by operation of automatic detection equipment that is installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system, foam concentrate is injected into the water, and the resulting foam solution discharging through the discharge devices generates and distributes foam. Upon exhaustion of the foam concentrate supply, water discharge follows and continues until shut off manually. Systems can be used for discharge of water first, followed by discharge of foam for a specified period, and then followed by water until manually shut off. Existing deluge sprinkler systems that have been converted to the use of aqueous film-forming foam or film-forming fluoroprotein foam are classified as foam-water sprinkler systems. [16, 2003]

3.5 Valve Definitions.

3.5.1* Control Valve. A valve controlling flow to water-based fire protection systems. Control valves do not include hose valves, inspector's test valves, drain valves, trim valves for dry pipe, preaction and deluge valves, check valves, or relief valves.

3.5.2 Deluge Valve. A water supply control valve intended to be operated by actuation of an automatic detection system that is installed in the same area as the discharge devices. Each deluge valve is intended to be capable of automatic and manual operation.

3.5.3 Hose Valve. The valve to an individual hose connection. [14, 2007]

3.5.4 Pressure Control Valve. A pilot-operated pressure-reducing valve designed for the purpose of reducing the downstream water pressure to a specific value under both flowing (residual) and nonflowing (static) conditions. [14, 2007]

3.5.5 Pressure-Reducing Valve. A valve designed for the purpose of reducing the downstream water pressure under both flowing (residual) and nonflowing (static) conditions. [14, 2007]

3.5.5.1* Master Pressure Reducing Valve. A pressure reducing valve installed to regulate pressures in an entire fire protection system and/or standpipe system zone.

3.6 Water-Based Fire Protection System Definitions.

3.6.1 Combined Standpipe and Sprinkler System. A system where the water piping services both 2½ in. (65 mm) outlets for fire department use and outlets for automatic sprinklers.

3.6.2 Fire Pump. A pump that is a provider of liquid flow and pressure dedicated to fire protection. [20, 2007]

3.6.3* Private Fire Service Main. Private fire service main, as used in this standard, is that pipe and its appurtenances on private property (1) between a source of water and the base of the system riser for water-based fire protection systems, (2) between a source of water and inlets to foam-making systems, (3) between a source of water and the base elbow of private hydrants or monitor nozzles, and (4) used as fire pump suction and discharge piping, (5) beginning at the inlet side of the check valve on a gravity or pressure tank. [24, 2007]

3.6.4* Sprinkler System. For fire protection purposes, an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The installation includes at least one automatic water supply which supplies one or more systems. The portion of the sprinkler system above ground is a network of specially sized or hydraulically

designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. Each system has a control valve located in the system riser or its supply piping. Each sprinkler system includes a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area. [13, 2007]

3.6.4.1 Antifreeze Sprinkler System. A wet pipe sprinkler system employing automatic sprinklers that are attached to a piping system that contains an antifreeze solution and that are connected to a water supply. The antifreeze solution is discharged, followed by water, immediately upon operation of sprinklers opened by heat from a fire. [13, 2007]

3.6.4.2 Deluge Sprinkler System. A sprinkler system employing open sprinklers that are attached to a piping system that is connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto. [13, 2007]

3.6.4.3 Dry Pipe Sprinkler System. A sprinkler system employing automatic sprinklers that are attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinklers. [13, 2007]

3.6.4.4 Preaction Sprinkler System. A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers. [13, 2007]

3.6.4.5* Wet Pipe Sprinkler System. A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire. [13, 2007]

3.6.5 Water Spray Fixed System. A special fixed pipe system connected to a reliable fire protection water supply and equipped with water spray nozzles for specific water discharge and distribution over the surface or area to be protected. The piping system is connected to the water supply through an automatically or manually actuated valve that initiates the flow of water. An automatic valve is actuated by operation of automatic detection equipment installed in the same areas as the water spray nozzles. (In special cases, the automatic detection system also is located in another area.)

3.6.6 Water Tank. A tank supplying water for water-based fire protection systems.

Chapter 4 General Requirements

4.1 Responsibility of the Property Owner or Occupant.

4.1.1* Responsibility for Inspection, Testing, and Maintenance. The responsibility for properly maintaining a water-based fire protection system shall be that of the owner of the property.

4.1.2* Accessibility. The property owner or occupant shall provide ready accessibility to components of water-based fire protection systems that require inspection, testing, or maintenance.

4.1.2.1 Inspection, testing, and maintenance shall be implemented in accordance with procedures meeting those established in this document and in accordance with the manufacturer's instructions.

4.1.2.2 These tasks shall be performed by personnel who have developed competence through training and experience.

4.1.2.3 Where the property owner is not the occupant, the property owner shall be permitted to pass on the authority for inspecting, testing, and maintaining the fire protection systems to the occupant, management firm, or managing individual through specific provisions in the lease, written use agreement, or management contract.

4.1.2.4 Where an occupant, management firm, or managing individual has received the authority for inspection, testing, and maintenance, the occupant, management firm, or managing individual shall comply with the requirements identified for the owner or occupant throughout this standard.

4.1.3 Notification of System Shutdown. The property owner or occupant shall notify the authority having jurisdiction, the fire department, if required, and the alarm-receiving facility before testing or shutting down a system or its supply.

4.1.3.1 The notification of system shutdown shall include the purpose for the shutdown, the system or component involved, and the estimated time of shutdown.

4.1.3.2 The authority having jurisdiction, the fire department, and the alarm-receiving facility shall be notified when the system, supply, or component is returned to service.

4.1.4* Corrections and Repairs. The property owner or occupant shall promptly correct or repair deficiencies, damaged parts, or impairments found while performing the inspection, test, and maintenance requirements of this standard.

4.1.4.1* Corrections and repairs shall be performed by qualified maintenance personnel or a qualified contractor.

4.1.5* Changes in Occupancy, Use, Process, or Materials. The property owner or occupant shall not make changes in the occupancy, the use or process, or the materials used or stored in the building without evaluation of the fire protection systems for their capability to protect the new occupancy, use, or materials.

4.1.5.1 The evaluation shall consider factors that include, but are not limited to, the following:

- (1) Occupancy changes such as converting office or production space into warehousing
- (2) Process or material changes such as metal stamping to molded plastics
- (3) Building revisions such as relocated walls, added mezzanines, and ceilings added below sprinklers
- (4) Removal of heating systems in spaces with piping subject to freezing

4.1.6 Addressing Changes in Hazard. Where changes in the occupancy, hazard, water supply, storage commodity, storage arrangement, building modification, or other condition that affects the installation criteria of the system are identified, the property owner or occupant shall promptly take steps, such as contacting a qualified contractor, consultant, or engineer, and



the authority having jurisdiction, to evaluate the adequacy of the installed system in order to protect the building or hazard in question.

4.1.6.1 Where the evaluation reveals a deficiency causing a threat to life or property, the property owner shall make appropriate corrections. All requirements of the authority having jurisdiction shall be followed.

4.1.7 Valve Location. The property owner shall ensure that responsible occupants are made aware of the location of the shut-off valves and the procedures for shutting down the system.

4.1.8 Information Sign. A permanently marked metal or rigid plastic information sign shall be placed at the system control riser supplying an antifreeze loop, dry system, preaction system, or auxiliary system control valve. Each sign shall be secured with a corrosion-resistant wire, chain, or other acceptable means and shall indicate the following information:

- (1) Location of the area served by the system
- (2) Location of auxiliary drains and low-point drains
- (3) The presence and location of antifreeze or other auxiliary systems

4.2 Impairments.

4.2.1 Where an impairment to a water-based fire protection system occurs, the procedures outlined in Chapter 15 of this standard shall be followed, including the attachment of a tag to the impaired system.

4.2.2 Where a water-based fire protection system is returned to service following an impairment, the system shall be verified to be working properly by means of an appropriate inspection or test.

4.3 Corrective Action. Manufacturers shall be permitted to make modifications to their own listed product in the field with listed devices that restore the original performance as intended by the listing, where acceptable to the authority having jurisdiction.

4.4 Records.

4.4.1* Records shall be made for all inspections, tests, and maintenance of the system and its components and shall be made available to the authority having jurisdiction upon request.

4.4.2 Records shall indicate the procedure performed (e.g., inspection, test, or maintenance), the organization that performed the work, the results, and the date.

4.4.3* Records shall be maintained by the property owner.

4.4.4 As-built system installation drawings, hydraulic calculations, original acceptance test records, and device manufacturer's data sheets shall be retained for the life of the system.

4.4.5 Subsequent records shall be retained for a period of 1 year after the next inspection, test, or maintenance of that type required by the standard.

4.5* Inspection. System components shall be inspected at intervals specified in the appropriate chapters.

4.6 Testing.

4.6.1* All components and systems shall be tested to verify that they function as intended.

4.6.1.1 The frequency of tests shall be in accordance with this standard.

4.6.1.1.1* As an alternative means of compliance, subject to the authority having jurisdiction, components and systems shall be permitted to be inspected, tested and maintained under a performance-based program.

4.6.2 Fire protection system components shall be restored to full operational condition following testing, including reinstallation of plugs and caps for auxiliary drains and test valves.

4.6.3 During testing and maintenance, water supplies, including fire pumps, shall remain in service unless under constant attendance by qualified personnel or impairment procedures in Chapter 15 are followed.

4.6.4* Test results shall be compared with those of the original acceptance test (if available) and with the most recent test results.

4.6.5* When a major component or subsystem is rebuilt or replaced, the subsystem shall be tested in accordance with the original acceptance test required for that subsystem.

4.7* Maintenance. Maintenance shall be performed to keep the system equipment operable or to make repairs.

4.8 Safety. Inspection, testing, and maintenance activities shall be conducted in a safe manner.

4.8.1 Confined Spaces. Legally required precautions shall be taken prior to entering confined spaces such as tanks, valve pits, or trenches.

4.8.2 Fall Protection. Legally required equipment shall be worn or used to prevent injury from falls to personnel.

4.8.3 Hazards. Precautions shall be taken to address any hazards, such as protection against drowning where working on the top of a filled embankment or a supported, rubberized fabric tank, or over open water or other liquids.

4.8.4* Hazardous Materials.

4.8.4.1 Legally required equipment shall be used where working in an environment with hazardous materials present.

4.8.4.2 The property owner shall advise anyone performing inspection, testing, and maintenance on any system under the scope of this document, with regard to hazardous materials stored on the premises.

4.9* Electrical Safety. Legally required precautions shall be taken when testing or maintaining electric controllers for motor-driven fire pumps.

Chapter 5 Sprinkler Systems

5.1 General. This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of sprinkler systems. Table 5.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

5.1.1 Valves and Connections. Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

5.1.2 Impairments. The procedures outlined in Chapter 15 shall be followed where an impairment to protection occurs.

Table 5.1 Summary of Sprinkler System Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Gauges (dry, preaction, and deluge systems)	Weekly/monthly	5.2.4.2, 5.2.4.3
Control valves	Weekly/monthly	Table 13.1
Waterflow devices	Quarterly	5.2.6
Valve supervisory devices	Quarterly	5.2.6
Supervisory signal devices (except valve supervisory switches)	Quarterly	5.2.6
Gauges (wet pipe systems)	Monthly	5.2.4.1
Hydraulic nameplate	Quarterly	5.2.7
Buildings	Annually (prior to freezing weather)	5.2.5
Hanger/seismic bracing	Annually	5.2.3
Pipe and fittings	Annually	5.2.2
Sprinklers	Annually	5.2.1
Spare sprinklers	Annually	5.2.1.3
Fire department connections	Quarterly	Table 13.1
Valves (all types)		Table 13.1
Obstruction	5 years	14.2.2
Test		
Waterflow devices	Quarterly/semiannually	5.3.3
Valves supervisory devices	Semiannually	Table 13.1
Supervisory signal devices (except valve supervisory switches)	Semiannually	Table 13.1
Main drain	Annually	Table 13.1
Antifreeze solution	Annually	5.3.4
Gauges	5 years	5.3.2
Sprinklers — extra-high temperature	5 years	5.3.1.1.3
Sprinklers — fast-response	At 20 years and every 10 years thereafter	5.3.1.1.2
Sprinklers	At 50 years and every 10 years thereafter	5.3.1.1.1
Maintenance		
Valves (all types)	Annually or as needed	Table 13.1
Obstruction investigation	5 years or as needed	13.2.1, 13.2.2
Low-point drains (dry pipe system)	Annually prior to freezing and as needed	13.4.4.3.2
Investigation		
Obstruction	As needed	14.2.1

5.1.3 Notification to Supervisory Service. To avoid false alarms where a supervisory service is provided, the alarm receiving facility shall be notified by the property owner or designated representative as follows:

- (1) Before conducting any test or procedure that could result in the activation of an alarm
- (2) After such tests or procedures are concluded

5.1.4 Hose connections shall be inspected, tested, and maintained in accordance with Chapters 6 and 13.

5.2* Inspection.

5.2.1 Sprinklers.

5.2.1.1* Sprinklers shall be inspected from the floor level annually.

5.2.1.1.1* Sprinklers shall not show signs of leakage; shall be free of corrosion, foreign materials, paint, and physical damage; and shall be installed in the proper orientation (e.g., upright, pendent, or sidewall).

5.2.1.1.2 Any sprinkler shall be replaced that has signs of leakage; is painted, other than by the sprinkler manufacturer, corroded, damaged, or loaded; or in the improper orientation.

5.2.1.1.3 Glass bulb sprinklers shall be replaced if the bulbs have emptied.

5.2.1.1.4* Sprinklers installed in concealed spaces such as above suspended ceilings shall not require inspection.

5.2.1.1.5 Sprinklers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

5.2.1.1.6 Sprinklers that are subject to recall shall be replaced per the manufacturer's requirements.

5.2.1.2* The minimum clearance required by the installation standard shall be maintained below all sprinklers. Stock, furnishings, or equipment closer to the sprinkler than the clearance rules allow shall be corrected.

5.2.1.3 The supply of spare sprinklers shall be inspected annually for the following:

- (1) The proper number and type of sprinklers
- (2) A sprinkler wrench for each type of sprinkler

5.2.2* Pipe and Fittings. Sprinkler pipe and fittings shall be inspected annually from the floor level.

5.2.2.1 Pipe and fittings shall be in good condition and free of mechanical damage, leakage, and corrosion.

5.2.2.2 Sprinkler piping shall not be subjected to external loads by materials either resting on the pipe or hung from the pipe.

5.2.2.3* Pipe and fittings installed in concealed spaces such as above suspended ceilings shall not require inspection.

5.2.2.4 Pipe installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

5.2.3* Hangers and Seismic Braces. Sprinkler pipe hangers and seismic braces shall be inspected annually from the floor level.

5.2.3.1 Hangers and seismic braces shall not be damaged or loose.

5.2.3.2 Hangers and seismic braces that are damaged or loose shall be replaced or refastened.

5.2.3.3* Hangers and seismic braces installed in concealed spaces such as above suspended ceilings shall not require inspection.

5.2.3.4 Hangers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

5.2.4 Gauges.

5.2.4.1* Gauges on wet pipe sprinkler systems shall be inspected monthly to ensure that they are in good condition and that normal water supply pressure is being maintained.

5.2.4.2 Gauges on dry, preaction, and deluge systems shall be inspected weekly to ensure that normal air and water pressures are being maintained.

5.2.4.3 Where air pressure supervision is connected to a constantly attended location, gauges shall be inspected monthly.

5.2.4.4* For dry pipe or preaction systems protecting freezers, in accordance with Figure A.5.2.4.4 the air pressure gauge near the compressor shall be compared weekly to the pressure gauge above the dry pipe or preaction valve. When the gauge near the compressor is reading higher than the gauge near the dry pipe valve, the air line in service shall be taken out of service, and the alternate air line opened to equalize the pressure. The air line taken out of service shall be internally inspected, shall have all ice blockage removed, and shall be re-assembled for use as a future alternate air line.

5.2.5 Buildings. Annually, prior to the onset of freezing weather, buildings with wet pipe systems shall be inspected to verify that windows, skylights, doors, ventilators, other openings and closures, blind spaces, unused attics, stair towers, roof houses, and low spaces under buildings do not expose water-filled sprinkler piping to freezing and to verify that adequate heat [minimum 40°F (4.4°C)] is available.

5.2.6 Alarm Devices. Alarm devices shall be inspected quarterly to verify that they are free of physical damage.

5.2.7* Hydraulic Nameplate. The hydraulic nameplate for hydraulically designed systems shall be inspected quarterly to verify that it is attached securely to the sprinkler riser and is legible.

5.3 Testing.

5.3.1* Sprinklers.

5.3.1.1* Where required by this section, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing.

5.3.1.1.1 Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10-year intervals.

5.3.1.1.1.1 Sprinklers manufactured prior to 1920 shall be replaced.

5.3.1.1.1.2 Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be replaced, or representative samples shall be tested. They shall be re-tested at 10-year intervals.

5.3.1.1.1.3* Representative samples of solder-type sprinklers with a temperature classification of extra high 325°F (163°C) or greater that are exposed to semicontinuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.

5.3.1.1.1.4 Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing. Test procedures shall be repeated at 5-year intervals.

5.3.1.1.1.5* Dry sprinklers that have been in service for 10 years shall be replaced, or representative samples shall be tested. They shall be retested at 10-year intervals.

5.3.1.1.2* Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, sprinklers shall either be replaced or representative sprinkler samples shall be tested.

5.3.1.1.3 Where historical data indicate, longer intervals between testing shall be permitted.

5.3.1.2* A representative sample of sprinklers for testing per 5.3.1.1.1 shall consist of a minimum of not less than four sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater.

5.3.1.3 Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers within the area represented by that sample shall be replaced.

5.3.1.3.1 Manufacturers shall be permitted to make modifications to their own sprinklers in the field with listed devices that restore the original performance as intended by the listing, where acceptable to the authority having jurisdiction.

5.3.2* Gauges. Gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge. Gauges not accurate to within 3 percent of the full scale shall be recalibrated or replaced.

5.3.3 Alarm Devices.

5.3.3.1 Mechanical waterflow devices including, but not limited to, water motor gongs, shall be tested quarterly.

5.3.3.2* Vane-type and pressure switch-type waterflow devices shall be tested semiannually.

5.3.3.3 Testing the waterflow alarms on wet pipe systems shall be accomplished by opening the inspector's test connection.

5.3.3.3.1 Where freezing weather conditions or other circumstances prohibit use of the inspector's test connection, the bypass connection shall be permitted to be used.

5.3.3.4 Fire pumps shall not be turned off during testing unless all impairment procedures contained in Chapter 15 are followed.

5.3.3.5* Testing the waterflow alarm on dry pipe, preaction, or deluge systems shall be accomplished by using the bypass connection.

5.3.4* Antifreeze Systems. The freezing point of solutions in antifreeze shall be tested annually by measuring the specific gravity with a hydrometer or refractometer and adjusting the solutions if necessary.

5.3.4.1* Solutions shall be in accordance with Table 5.3.4.1(a) and Table 5.3.4.1(b).

5.3.4.2 The use of antifreeze solutions shall be in accordance with any state or local health regulations.

5.3.4.3 The antifreeze solution shall be tested at its most remote portion and where it interfaces with the wet-pipe system. When antifreeze systems have a capacity larger than 150 gal

(568 L), tests at one additional point for every 100 gal (379 L) shall be made. If the test results indicate an incorrect freeze point at any point in the system, the system shall be drained, the solution adjusted, and the systems refilled. For premixed solutions, the manufacturer's instructions shall be permitted to be used with regard to the number of test points and refill procedure.

5.4 Maintenance.

5.4.1 Sprinklers.

5.4.1.1* Replacement sprinklers shall have the proper characteristics for the application intended. These shall include the following:

- (1) Style
- (2) Orifice size and *K*-factor
- (3) Temperature rating
- (4) Coating, if any
- (5) Deflector type (e.g., upright, pendent, sidewall)
- (6) Design requirements

5.4.1.1.1* Spray sprinklers shall be permitted to replace old-style sprinklers.

5.4.1.1.2 Replacement sprinklers for piers and wharves shall comply with NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*.

Table 5.3.4.1(a) Antifreeze Solutions To Be Used If Nonpotable Water Is Connected to Sprinklers

Material	Solution (by volume)	Specific Gravity at 60°F (15.6°C)	Freezing Point	
			°F	°C
Glycerine*				
Diethylene glycol	50% water	1.078	-13	-25.0
	45% water	1.081	-27	-32.8
	40% water	1.086	-42	-41.1
	Hydrometer scale 1.000 to 1.120 (subdivisions 0.002)			
Ethylene glycol	61% water	1.056	-10	-23.3
	56% water	1.063	-20	-28.9
	51% water	1.069	-30	-34.4
	47% water	1.073	-40	-40.0
	Hydrometer scale 1.000 to 1.120 (subdivisions 0.002)			
Propylene glycol*				
Calcium chloride 80% “flake”	lb CaCl ₂ /gal of water			
Fire protection grade**				
Add corrosion	2.83	1.183	0	-17.8
inhibitor of sodium	3.38	1.212	-10	-23.3
bichromate	3.89	1.237	-20	-28.9
¾ oz/gal water	4.37	1.258	-30	-34.4
	4.73	1.274	-40	-40.0
	4.93	1.283	-50	-45.6

*If used, see Table 5.3.4.1(b).

**Free from magnesium chloride and other impurities.



Table 5.3.4.1(b) Antifreeze Solutions To Be Used If Potable Water Is Connected to Sprinklers

Material	Solution (by volume)	Specific Gravity at 60°F (15.6°C)	Freezing Point	
			°F	°C
Glycerine C.P. or U.S.P. grade*	50% water	1.145	-20.9	-29.4
	40% water	1.171	-47.3	-44.1
	30% water	1.197	-22.2	-30.1
	Hydrometer scale 1.000 to 1.200			
Propylene glycol	70% water	1.027	+9	-12.8
	60% water	1.034	-6	-21.2
	50% water	1.041	-26	-32.2
	40% water	1.045	-60	-51.1
	Hydrometer scale 1.000 to 1.200 (subdivisions 0.0002)			

*C.P. = Chemically pure; U.S.P. = United States Pharmacopoeia 96.9%.

5.4.1.2 Only new, listed sprinklers shall be used to replace existing sprinklers.

5.4.1.3* Special and quick-response sprinklers as defined by NFPA 13, *Standard for the Installation of Sprinkler Systems*, shall be replaced with sprinklers of the same orifice, size, temperature range and thermal response characteristics, and *K*-factor.

5.4.1.4* A supply of spare sprinklers (never fewer than six) shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced.

5.4.1.4.1 The sprinklers shall correspond to the types and temperature ratings of the sprinklers in the property.

5.4.1.4.2 The sprinklers shall be kept in a cabinet located where the temperature in which they are subjected will at no time exceed 100°F (38°C).

5.4.1.4.2.1 Where dry sprinklers of different lengths are installed, spare dry sprinklers shall not be required, provided that a means of returning the system to service is furnished.

5.4.1.5 The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

- (1) For protected facilities having under 300 sprinklers — no fewer than 6 sprinklers
- (2) For protected facilities having 300 to 1000 sprinklers — no fewer than 12 sprinklers
- (3) For protected facilities having over 1000 sprinklers — no fewer than 24 sprinklers

5.4.1.6* A special sprinkler wrench shall be provided and kept in the cabinet to be used in the removal and installation of sprinklers. One sprinkler wrench shall be provided for each type of sprinkler installed.

5.4.1.7 Sprinklers protecting spray coating areas shall be protected against overspray residue.

5.4.1.7.1 Sprinklers subject to overspray accumulations shall be protected using plastic bags having a maximum thickness of 0.003 in. (0.076 mm) or shall be protected with small paper bags.

5.4.1.7.2 Coverings shall be replaced when deposits or residue accumulate.

5.4.1.8* Sprinklers shall not be altered in any respect or have any type of ornamentation, paint, or coatings applied after shipment from the place of manufacture.

5.4.1.9 Sprinklers and automatic spray nozzles used for protecting commercial-type cooking equipment and ventilating systems shall be replaced annually.

5.4.1.9.1 Where automatic bulb-type sprinklers or spray nozzles are used and annual examination shows no buildup of grease or other material on the sprinklers or spray nozzles, such sprinklers and spray nozzles shall not be required to be replaced.

5.4.2* Dry Pipe Systems. Dry pipe systems shall be kept dry at all times.

5.4.2.1 During nonfreezing weather, a dry pipe system shall be permitted to be left wet if the only other option is to remove the system from service while waiting for parts or during repair activities.

5.4.2.2 Air driers shall be maintained in accordance with the manufacturer's instructions.

5.4.2.3 Compressors used in conjunction with dry pipe sprinkler systems shall be maintained in accordance with the manufacturer's instructions.

5.4.3* Installation and Acceptance Testing. Where maintenance or repair requires the replacement of sprinkler system components affecting more than 20 sprinklers, those components shall be installed and tested in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

5.4.4* Marine Systems. Sprinkler systems that are normally maintained using fresh water as a source shall be drained and refilled, then drained and refilled again with fresh water following the introduction of raw water into the system.

5.5 Component Action Requirements.

5.5.1 Whenever a component in a sprinkler system is adjusted, repaired, reconditioned, or replaced, the actions required in Table 5.5.1 shall be performed.

5.5.1.1 Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

Table 5.5.1 Summary of Component Replacement Action Requirements

Component	Adjust	Repair/ Recondition	Replace	Required Action
Water Delivery Components				
Pipe and fittings affecting less than 20 sprinklers	X	X	X	Check for leaks at system working pressure
Pipe and fittings affecting more than 20 sprinklers	X	X	X	Hydrostatic test in conformance with NFPA 13, <i>Standard for the Installation of Sprinkler Systems</i>
Sprinklers, less than 20	X		X	Check for leaks at system working pressure
Sprinklers, more than 20	X		X	Hydrostatic test in conformance with NFPA 13
Fire department connections	X	X	X	See Chapter 13
Antifreeze solution	X		X	Check freezing point of solution Check for leaks at system working pressure
Valves				See Chapter 13
Fire pump				See Chapter 8
Alarm and Supervisory Components				
Vane-type waterflow	X	X	X	Operational test using inspector's test connection
Pressure switch-type waterflow	X	X	X	Operational test using inspector's test connection
Water motor gong	X	X	X	Operational test using inspector's test connection
High and low air pressure switch	X	X	X	Operational test of high and low settings
Valve supervisory device	X	X	X	Test for conformance with NFPA 13 and/or NFPA 72, <i>National Fire Alarm Code</i>
Detection system (for deluge or preaction system)	X	X	X	Operational test for conformance with NFPA 13 and/or NFPA 72
Status-Indicating Components				
Gauges			X	Verify at 0 bar (0 psi) and system working pressure
Testing and Maintenance Components				
Air compressor	X	X	X	Operational test for conformance with NFPA 13
Automatic air maintenance device	X	X	X	Operational test for conformance with NFPA 13
Main drain	X	X	X	Main drain test
Auxiliary drains	X	X	X	Check for leaks at system working pressure Main drain test
Inspector's test connection	X	X	X	Check for leaks at system working pressure Main drain test
Structural Components				
Hanger/seismic bracing	X	X	X	Check for conformance with NFPA 13
Pipe stands	X	X	X	Check for conformance with NFPA 13
Informational Components				
Identification Signs	X	X	X	Check for conformance with NFPA 13
Hydraulic Placards	X	X	X	Check for conformance with NFPA 13

5.5.1.2 A main drain test shall be required if the system control or other upstream valve was operated in accordance with 13.3.3.4.

5.5.1.3 These actions shall not require a design review, which is outside the scope of this standard.

Chapter 6 Standpipe and Hose Systems

6.1 General. This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of standpipe and hose systems. Table 6.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

6.1.1 Valves and Connections. Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

6.1.2 Impairments. Where the inspection, testing, and maintenance of standpipe and hose systems results or involves a system that is out of service, the procedures outlined in Chapter 15 shall be followed.

6.2 Inspection.

6.2.1 Components of standpipe and hose systems shall be visually inspected annually or as specified in Table 6.1.

6.2.2 Table 6.2.2 shall be used for the inspection, testing, and maintenance of all classes of standpipe and hose systems.

6.2.3 Checkpoints and corrective actions outlined in Table 6.2.2 shall be followed to determine that components are free of corrosion, foreign material, physical damage, tampering, or other conditions that adversely affect system operation.

6.3 Testing. Where water damage is a possibility, an air test shall be conducted on the system at 25 psi (1.7 bar) prior to introducing water to the system.

6.3.1 Flow Tests.

6.3.1.1* A flow test shall be conducted every 5 years at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify the water supply still provides the design pressure at the required flow.

6.3.1.2 Where a flow test of the hydraulically most remote outlet(s) is not practical, the authority having jurisdiction shall be consulted for the appropriate location for the test.

6.3.1.3 All systems shall be flow tested and pressure tested at the requirements for the design criteria in effect at the time of the installation.

6.3.1.3.1 The actual test method(s) and performance criteria shall be discussed in advance with the authority having jurisdiction.

Table 6.1 Summary of Standpipe and Hose Systems Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Control valves	Weekly/monthly	Table 13.1
Pressure regulating devices	Quarterly	Table 13.1
Piping	Annually	6.2.1
Hose connections	Annually	Table 13.1
Cabinet	Annually	NFPA 1962, <i>Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose</i>
Hose	Annually	NFPA 1962
Hose storage device	Annually	NFPA 1962
Hose nozzle	Annually and after each use	NFPA 1962
Test		
Waterflow devices	Quarterly/semiannually	Table 13.1
Valve supervisory devices	Semiannually	Table 13.1
Supervisory signal devices (except valve supervisory switches)	Semiannually	Table 13.1
Hose storage device	Annually	NFPA 1962
Hose	5 years/3 years	NFPA 1962
Pressure control valve	5 years	Table 13.1
Pressure reducing valve	5 years	Table 13.1
Hydrostatic test	5 years	6.3.2
Flow test	5 years	6.3.1
Main drain test	Annually	Table 13.1
Maintenance		
Hose connections	Annually	Table 6.2.2
Valves (all types)	Annually/as needed	Table 13.1

Table 6.2.2 Standpipe and Hose Systems

Component/Checkpoint	Corrective Action
Hose Connections Cap missing Fire hose connection damaged Valve handles missing Cap gaskets missing or deteriorated Valve leaking Visible obstructions Restricting device missing Manual, semiautomatic, or dry standpipe — valve does not operate smoothly	Replace Repair Replace Replace Close or repair Remove Replace Lubricate or repair
Piping Damaged piping Control valves damaged Missing or damaged pipe support device Damaged supervisory devices	Repair Repair or replace Repair or replace Repair or replace
Hose Inspect Mildew, cuts, abrasions, and deterioration evident Coupling damaged Gaskets missing or deteriorated Incompatible threads on coupling Hose not connected to hose rack nipple or valve Hose test outdated	Remove and inspect the hose, including gaskets, and rerack or rereel at intervals in accordance with NFPA 1962, <i>Standard for the Care, Use, and Service Testing of Fire Hose Including Couplings and Nozzles</i> Replace with listed lined, jacketed hose Replace or repair Replace Replace or provide thread adapter Connect Retest or replace in accordance with NFPA 1962
Hose Nozzle Hose nozzle missing Gasket missing or deteriorated Obstructions Nozzle does not operate smoothly	Replace with listed nozzle Replace Remove Repair or replace
Hose Storage Device Difficult to operate Damaged Obstruction Hose improperly racked or rolled Nozzle clip in place and nozzle correctly contained? If enclosed in cabinet, will hose rack swing out at least 90 degrees?	Repair or replace Repair or replace Remove Remove Replace if necessary Repair or remove any obstructions
Cabinet Check overall condition for corroded or damaged parts Difficult to open Cabinet door will not open fully Door glazing cracked or broken If cabinet is break-glass type, is lock functioning properly? Glass break device missing or not attached Not properly identified as containing fire equipment Visible obstructions All valves, hose, nozzles, fire extinguisher, etc., easily accessible	Repair or replace parts; replace entire cabinet if necessary Repair Repair or move obstructions Replace Repair or replace Replace or attach Provide identification Remove Remove any material not related

6.3.1.4 Standpipes, sprinkler connections to standpipes, or hose stations equipped with pressure reducing valves or pressure regulating valves shall have these valves inspected, tested, and maintained in accordance with the requirements of Chapter 13.

6.3.1.5 A main drain test shall be performed on all standpipe systems with automatic water supplies in accordance with the requirements of Chapter 13.

6.3.1.5.1 The test shall be performed at the low point drain for each standpipe or the main drain test connection where the supply main enters the building (when provided).

6.3.1.5.2 Pressure gauges shall be provided for the test and shall be maintained in accordance with 5.3.2.

6.3.2 Hydrostatic Tests.

6.3.2.1 Hydrostatic tests of not less than 200 psi (13.8 bar) pressure for 2 hours, or at 50 psi (3.4 bar) in excess of the maximum pressure, where maximum pressure is in excess of 150 psi (10.3 bar), shall be conducted every 5 years on manual standpipe systems and automatic-dry standpipe systems, including piping in the fire department connection.

6.3.2.2* Hydrostatic tests shall be conducted in accordance with 6.3.2.1 on any system that has been modified or repaired.

6.3.2.2.1 Manual wet standpipes that are part of a combined sprinkler/standpipe system shall not be required to be tested in accordance with 6.3.2.1.

6.3.2.3 The hydrostatic test pressure shall be measured at the low elevation point of the individual system or zone being tested. The inside standpipe piping shall show no leakage.

6.3.3 Alarm Devices. Where provided, waterflow alarm and supervisory devices shall be tested in accordance with 13.2.6 and 13.3.3.5.

6.3.3.1 Where freezing conditions necessitate a delay in testing, tests shall be performed as soon as weather allows.

6.4 Maintenance. Maintenance and repairs shall be in accordance with 6.2.3 and Table 6.2.2.

6.4.1 Equipment that does not pass the inspection or testing requirements shall be repaired and tested again or replaced.

6.5 Component Action Requirements.

6.5.1 Whenever a component in a standpipe and hose system is adjusted, repaired, reconditioned or replaced, the action required in Table 6.5.1, Summary of Component Replacement Action Requirements, shall be performed.

Table 6.5.1 Summary of Component Replacement Action Requirements

Component	Adjust	Repair	Replace	Required Action
Water Delivery Components				
Control valves	X	X	X	See Chapter 13
Hose valve pressure regulating devices	X	X	X	See Chapter 13
System pressure regulating devices	X	X	X	See Chapter 13
Piping	X	X	X	Hydrostatic test in conformance with NFPA 14, <i>Standard for the Installation of Standpipe and Hose Systems</i>
Fire hose			X	
Hose valve	X	X	X	See Chapter 13
Fire department connections	X	X	X	See Chapter 13
Backflow prevention device	X	X	X	See Chapter 13
Valves				See Chapter 13
Fire pump				See Chapter 8
Alarm and Supervisory Components				
Vane-type waterflow	X	X		Operational test using inspector's test connection
Vane-type waterflow			X	Operational test using inspector's test connection
Pressure switch-type waterflow	X	X	X	Operational test using inspector's test connection
Water motor gong	X	X	X	Operational test using inspector's test connection
Valve supervisory device	X	X	X	Operational test for receipt of alarms and verification of conformance with NFPA 14 and/or NFPA 72, <i>National Fire Alarm Code</i>
Status-Indicating Components				
Gauges			X	Verify at 0 psi and system working pressure
System Housing and Protection Components				
Cabinet	X	X	X	Verify compliance with NFPA 14
Hose storage rack	X	X	X	Verify compliance with NFPA 14
Testing and Maintenance Components				
Drain riser	X	X	X	Check for leaks while flowing from connection above the repair
Auxiliary drains	X	X	X	Check for leaks at system working pressure
Main drain	X	X	X	Check for leaks and residual pressure during main drain test
Structural Components				
Hanger/seismic bracing	X	X	X	Verify conformance with NFPA 14
Pipe stands	X	X	X	Verify conformance with NFPA 14
Informational Components				
Identification signs	X	X	X	Verify conformance with NFPA 14
Hydraulic placards	X	X	X	Verify conformance with NFPA 14

6.5.1.1 Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

6.5.1.2 A main drain test shall be required if the control valve or other upstream valve was operated in accordance with 13.3.3.4.

6.5.1.3 These actions shall not require a design review, which is outside the scope of this standard.

Chapter 7 Private Fire Service Mains

7.1 General. This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of private fire service mains and their appurtenances. Table 7.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

7.1.1 Valves and Connections. Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

7.1.2 Fire Hose. Fire hose shall be maintained in accordance with NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose*.

7.1.3 Impairments. The procedures outlined in Chapter 15 shall be followed wherever such an impairment to protection occurs.

7.1.4 Notification to Supervisory Service. To avoid false alarms where a supervisory service is provided, the alarm receiving facilities always shall be notified by the property owner or designated representative as follows:

- (1) Before conducting any test or procedure that could result in the activation of an alarm
- (2) After such tests or procedures are concluded

7.2 Inspection.

7.2.1 General. Private fire service mains and their appurtenances shall be inspected at the intervals specified in Table 7.1.

7.2.2* Procedures. All procedures shall be carried out in accordance with the manufacturer's instructions, where applicable.

7.2.2.1 Exposed Piping.

7.2.2.1.1 Exposed piping shall be inspected annually.

7.2.2.1.2 Piping shall be inspected, and the necessary corrective action shall be taken as shown in Table 7.2.2.1.2.

Table 7.2.2.1.2 Exposed Piping

Condition	Corrective Action
Leaks	Repair
Physical damage	Repair or replace
Corrosion	Clean or replace and coat with corrosion protection
Restraint methods	Repair or replace

7.2.2.1.3 Piping installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

7.2.2.2 Underground Piping. Generally, underground piping cannot be inspected on a routine basis. However, flow testing can reveal the condition of underground piping and shall be conducted in accordance with Section 7.3.

Table 7.1 Summary of Private Fire Service Main Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Hose houses	Quarterly	7.2.2.7
Hydrants (dry barrel and wall)	Annually and after each operation	7.2.2.4
Monitor nozzles	Semiannually	7.2.2.6
Hydrants (wet barrel)	Annually and after each operation	7.2.2.5
Mainline strainers	Annually and after each significant flow	7.2.2.3
Piping (exposed)	Annually	7.2.2.1
Piping (underground)	See 7.2.2.2	7.2.2.2
Test		
Monitor nozzles	Flow, annually (range and operation)	7.3.3
Hydrants	Flow, annually	7.3.2
Piping (exposed and underground) (flow test)	5 years	7.3.1
Maintenance		
Mainline strainers	Annually and after each operation	7.2.2.3
Hose houses	Annually	7.2.2.7
Hydrants	Annually	7.4.2
Monitor nozzles	Annually	7.4.3



7.2.2.3* Mainline Strainers. Mainline strainers shall be inspected and cleaned after each system flow exceeding that of a nominal 2 in. (50 mm) orifice and shall be removed and inspected annually for failing, damaged, and corroded parts with the necessary corrective action taken as shown in Table 7.2.2.3.

7.2.2.4 Dry Barrel and Wall Hydrants. Dry barrel and wall hydrants shall be inspected annually and after each operation with the necessary corrective action taken as shown in Table 7.2.2.4.

7.2.2.5 Wet Barrel Hydrants. Wet barrel hydrants shall be inspected annually and after each operation with the necessary corrective action taken as shown in Table 7.2.2.5.

Table 7.2.2.3 Mainline Strainers

Condition	Corrective Action
Plugging or fouling	Clean
Corrosion	Replace or repair

Table 7.2.2.4 Dry Barrel and Wall Hydrants

Condition	Corrective Action
Inaccessible	Make accessible
Barrel contains water or ice (presence of water or ice could indicate a faulty drain, a leaky hydrant valve, or high groundwater table)	Repair and drain; for high groundwater it could be necessary to plug the drain and pump out the barrel after each use
Improper drainage from barrel	Repair drain
Leaks in outlets or at top of hydrant	Repair or replace gaskets, packing, or parts as necessary
Cracks in hydrant barrel	Repair or replace
Tightness of outlet caps	Lubricate if necessary; tighten if necessary
Worn outlet threads	Repair or replace
Worn hydrant operating nut	Repair or replace
Availability of operating wrench	Make sure wrench is available

Table 7.2.2.5 Wet Barrel Hydrants

Condition	Corrective Action
Inaccessible	Make accessible
Leaks in outlets or at top of hydrant	Repair or replace gaskets, packing, or parts as necessary
Cracks in hydrant barrel	Repair or replace
Tightness of outlet caps	Lubricate if necessary; tighten if necessary
Worn outlet threads	Repair or replace
Worn hydrant operating nut	Repair or replace
Availability of operating wrench	Make sure wrench is available

7.2.2.6 Monitor Nozzles. Monitor nozzles shall be inspected semiannually with the necessary corrective action taken as shown in Table 7.2.2.6.

7.2.2.7 Hose Houses. Hose houses shall be inspected quarterly with the necessary corrective action taken as shown in Table 7.2.2.7.

Table 7.2.2.6 Monitor Nozzles

Condition	Corrective Action
Leakage	Repair
Physical damage	Repair or replace
Corrosion	Clean or replace, and lubricate or protect as necessary

Table 7.2.2.7 Hose Houses

Condition	Corrective Action
Inaccessible	Make accessible
Physical damage	Repair or replace
Missing equipment	Replace equipment

7.3 Testing.

7.3.1* Underground and Exposed Piping Flow Tests. Underground and exposed piping shall be flow tested to determine the internal condition of the piping at minimum 5-year intervals.

7.3.1.1 Flow tests shall be made at flows representative of those expected during a fire, for the purpose of comparing the friction loss characteristics of the pipe with those expected for the particular type of pipe involved, with due consideration given to the age of the pipe and to the results of previous flow tests.

7.3.1.2 Any flow test results that indicate deterioration of available waterflow and pressure shall be investigated to the complete satisfaction of the authority having jurisdiction to ensure that the required flow and pressure are available for fire protection.

7.3.1.3 Where underground piping supplies individual fire sprinkler, standpipe, water spray, or foam-water sprinkler systems and there are no means to conduct full flow tests, tests generating the maximum available flows shall be permitted.

7.3.2 Hydrants. Hydrants shall be tested annually to ensure proper functioning.

7.3.2.1 Each hydrant shall be opened fully and water flowed until all foreign material has cleared.

7.3.2.2 Flow shall be maintained for not less than 1 minute.

7.3.2.3 After operation, dry barrel and wall hydrants shall be observed for proper drainage from the barrel.

7.3.2.4 Full drainage shall take no longer than 60 minutes.

7.3.2.5 Where soil conditions or other factors are such that the hydrant barrel does not drain within 60 minutes, or where the groundwater level is above that of the hydrant drain, the hydrant drain shall be plugged and the water in the barrel shall be pumped out.

7.3.2.6 Dry barrel hydrants that are located in areas subject to freezing weather and that have plugged drains shall be identified clearly as needing pumping after operation.

7.3.3 Monitor Nozzles.

7.3.3.1 Monitor nozzles that are mounted on hydrants shall be tested as specified in 7.3.2.

7.3.3.2 All monitor nozzles shall be oscillated and moved throughout their full range annually to ensure proper operability.

7.4 Maintenance.

7.4.1 General. All equipment shall be maintained in proper working condition, consistent with the manufacturer's recommendations.

7.4.2 Hydrants.

7.4.2.1 Hydrants shall be lubricated annually to ensure that all stems, caps, plugs, and threads are in proper operating condition.

7.4.2.2* Hydrants shall be kept free of snow, ice, or other materials and protected against mechanical damage so that free access is ensured.

7.4.3 Monitor Nozzles. Monitor nozzles shall be lubricated annually to ensure proper operating condition.

7.5 Component Action Requirements.

7.5.1 Whenever a component in a private fire service system is adjusted, repaired, reconditioned, or replaced, the action required in Table 7.5.1 shall be performed.

7.5.1.1 Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

7.5.1.2 A main drain test shall be required if the system control or other upstream valve was operated in accordance with 13.3.3.4.

7.5.1.3 These actions shall not require a design review, which is outside the scope of this standard.

Table 7.5.1 Summary of Component Replacement Action Requirements

Component	Adjust	Repair/ Recondition	Replace	Test Criteria
Water Delivery Components				
Pipe and fittings (exposed and underground)	X	X	X	Hydrostatic test in conformance with NFPA 24, <i>Standard for the Installation of Private Fire Service Mains and Their Appurtenances</i>
Hydrants	X	X	X	Hydrostatic test in conformance with NFPA 24 Water flow in conformance with NFPA 24 Check for proper drainage
Monitor nozzles	X	X	X	Hydrostatic test in conformance with NFPA 24 Flush in conformance with NFPA 24
Mainline strainers	X	X	X	Flow test downstream of strainer
Fire department connection	X	X	X	See Chapter 13
Valves				See Chapter 13
Fire pump				See Chapter 8
Alarm and Supervisory Components				
Valve supervisory device	X	X	X	Operational test for conformance with NFPA 24 and/or NFPA 72, <i>National Fire Alarm Code</i>
System-Indicating Components				
Gauges			X	Verify at 0 psi and system working pressure
System Housing and Protection Components				
Hose houses	X	X	X	Verify integrity of hose and hose house components
Structural Components				
Thrust blocks	X	X	X	Test at system working pressure
Tie rods	X	X	X	Test at system working pressure
Retainer glands	X	X	X	Test at system working pressure
Informational Components				
Identification signs	X	X	X	Verify conformance with NFPA 24



Chapter 8 Fire Pumps

8.1* General. This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of fire pump assemblies. Table 8.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

8.1.1 Valves and Connections. Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

8.1.2* Auxiliary Equipment. The pump assembly auxiliary equipment shall include the following:

- (1) Pump accessories as follows:
 - (a) Pump shaft coupling
 - (b) Automatic air release valve
 - (c) Pressure gauges
 - (d) Circulation relief valve (not used in conjunction with diesel engine drive with heat exchanger)
- (2) Pump test device(s)
- (3) Pump relief valve and piping (where maximum pump discharge pressure exceeds the rating of the system components or the driver is of variable speed)
- (4) Alarm sensors and indicators
- (5) Right-angle gear sets (for engine-driven vertical shaft turbine pumps)
- (6) Pressure maintenance (jockey) pump and accessories

8.1.3 Water Supply to Pump Suction. The suction supply for the fire pump shall provide the required flow at a gauge pressure of zero (0) psi [zero (0) bar] or higher at the pump suction flange to meet the system demand.

8.1.3.1 Those installations for which NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, permitted negative suction gauge pressures at the time of pump installation, where the system demand still can be met by the pump and water supply, shall be considered to be in compliance with 8.1.3.

8.1.4 Energy Source. The energy sources for the pump driver shall supply the necessary brake horsepower of the driver so that the pump meets system demand.

8.1.5 Driver. The pump driver shall not overload beyond its rating (including any service factor allowance) when delivering the necessary brake horsepower.

8.1.6* Controller. Automatic and manual controllers for applying the energy source to the driver shall be capable of providing this operation for the type of pump used.

8.1.7 Impairments. The procedures outlined in Chapter 15 shall be followed where an impairment to protection occurs.

8.1.8 Notification to Supervisory Service. To avoid false alarms where a supervisory service is provided, the alarm receiving facility always shall be notified by the property owner or designated representative as follows:

- (1) Before conducting any test or procedure that could result in the activation of an alarm
- (2) After such tests or procedures are concluded

8.2 Inspection.

8.2.1 The purpose of inspection shall be to verify that the pump assembly appears to be in operating condition and is free from physical damage.

8.2.2* The pertinent visual observations specified in the following checklists shall be performed weekly:

- (1) Pump house conditions:
 - (a) Heat is adequate, not less than 40°F (4.4°C) [70°F (21°C)] for pump room with diesel pumps without engine heaters.
 - (b) Ventilating louvers are free to operate.
- (2) Pump system conditions:
 - (a) Pump suction and discharge and bypass valves are fully open.
 - (b) Piping is free of leaks.
 - (c) Suction line pressure gauge reading is within acceptable range.
 - (d) System line pressure gauge reading is within acceptable range.

Table 8.1 Summary of Fire Pump Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Pump house, heating ventilating louvers	Weekly	8.2.2(1)
Fire pump system	Weekly	8.2.2(2)
Test		
Pump operation		
No-flow condition	Weekly	8.3.1
Flow condition	Annually	8.3.3.1
Maintenance		
Hydraulic	Annually	8.5
Mechanical transmission	Annually	8.5
Electrical system	Varies	8.5
Controller, various components	Varies	8.5
Motor	Annually	8.5
Diesel engine system, various components	Varies	8.5

- (e) Suction reservoir is full.
- (f) Wet pit suction screens are unobstructed and in place.
- (3) Electrical system conditions:
 - (a) Controller pilot light (power on) is illuminated.
 - (b) Transfer switch normal pilot light is illuminated.
 - (c) Isolating switch is closed — standby (emergency) source.
 - (d) Reverse phase alarm pilot light is off, or normal phase rotation pilot light is on.
 - (e) Oil level in vertical motor sight glass is within acceptable range.
- (4) Diesel engine system conditions:
 - (a) Fuel tank is two-thirds full.
 - (b) Controller selector switch is in auto position.
 - (c) Batteries' (2) voltage readings are within acceptable range.
 - (d) Batteries' (2) charging current readings are within acceptable range.
 - (e) Batteries' (2) pilot lights are on or battery failure (2) pilot lights are off.
 - (f) All alarm pilot lights are off.
 - (g) Engine running time meter is reading.
 - (h) Oil level in right angle gear drive is within acceptable range.
 - (i) Crankcase oil level is within acceptable range.
 - (j) Cooling water level is within acceptable range.
 - (k) Electrolyte level in batteries is within acceptable range.
 - (l) Battery terminals are free from corrosion.
 - (m) Water-jacket heater is operating.
- (5)*Steam system conditions: Steam pressure gauge reading is within acceptable range.

8.3* Testing.

8.3.1 A weekly test of fire pump assemblies shall be conducted without flowing water.

8.3.1.1 The weekly test shall be conducted by starting the pump automatically.

8.3.1.2 The electric pump shall run a minimum of 10 minutes.

8.3.1.3 The diesel pump shall run a minimum of 30 minutes.

8.3.1.4 A valve installed to open as a safety feature shall be permitted to discharge water.

8.3.1.5 The automatic weekly test timer shall be permitted to be substituted for the starting procedure.

8.3.2 Weekly Tests.

8.3.2.1 Qualified operating personnel shall be in attendance during the weekly pump operation.

8.3.2.2* The pertinent visual observations or adjustments specified in the following checklists shall be conducted while the pump is running:

- (1) Pump system procedure:
 - (a) Record the system suction and discharge pressure gauge readings.
 - (b) Check the pump packing glands for slight discharge.
 - (c) Adjust gland nuts if necessary.
 - (d) Check for unusual noise or vibration.
 - (e) Check packing boxes, bearings, or pump casing for overheating.
 - (f) Record the pump starting pressure.

- (2) Electrical system procedure:
 - (a) Observe the time for motor to accelerate to full speed.
 - (b) Record the time controller is on first step (for reduced voltage or reduced current starting).
 - (c) Record the time pump runs after starting (for automatic stop controllers).
- (3) Diesel engine system procedure:
 - (a) Observe the time for engine to crank.
 - (b) Observe the time for engine to reach running speed.
 - (c) Observe the engine oil pressure gauge, speed indicator, water, and oil temperature indicators periodically while engine is running.
 - (d) Record any abnormalities.
 - (e) Check the heat exchanger for cooling waterflow.
- (4) Steam system procedure:
 - (a) Record the steam pressure gauge reading.
 - (b) Observe the time for turbine to reach running speed.

8.3.3 Annual Tests.

8.3.3.1* An annual test of each pump assembly shall be conducted under minimum, rated, and peak flows of the fire pump by controlling the quantity of water discharged through approved test devices.

8.3.3.1.1 If available suction supplies do not allow flowing of 150 percent of the rated pump capacity, the fire pump shall be permitted to operate at maximum allowable discharge.

8.3.3.1.2* The annual test shall be conducted as described in 8.3.3.1.2.1, 8.3.3.1.2.2, or 8.3.3.1.2.3.

8.3.3.1.2.1 Use of the Pump Discharge via the Hose Streams. Pump suction and discharge pressures and the flow measurements of each hose stream shall determine the total pump output. Care shall be taken to prevent water damage by verifying there is adequate drainage for the high-pressure water discharge from hoses.

8.3.3.1.2.2 Use of the Pump Discharge via the Bypass Flowmeter to Drain or Suction Reservoir. Pump suction and discharge pressures and the flowmeter measurements shall determine the total pump output.

8.3.3.1.2.3 Use of the Pump Discharge via the Bypass Flowmeter to Pump Suction (Closed-Loop Metering). Pump suction and discharge pressures and the flowmeter measurements shall determine the total pump output.

8.3.3.1.3 Where the annual test is conducted periodically in accordance with 8.3.3.1.2.3, a test shall be conducted every 3 years in accordance with 8.3.3.1.2.1 or 8.3.3.1.2.2 in lieu of the method described in 8.3.3.1.2.3.

8.3.3.1.4 Where 8.3.3.1.2.2 or 8.3.3.1.2.3 is used, the flow meter shall be adjusted immediately prior to conducting the test in accordance with the manufacturer's instructions. If the test results are not consistent with the previous annual test, 8.3.3.1.2.1 shall be used. If testing in accordance with 8.3.3.1.2.1 is not possible, a flowmeter calibration shall be performed and the test shall be repeated.

8.3.3.2 The pertinent visual observations, measurements, and adjustments specified in the following checklists shall be conducted annually while the pump is running and flowing water under the specified output condition:



- (1) At no-flow condition (churn):
 - (a) Check the circulation relief valve for operation to discharge water.
 - (b) Check the pressure relief valve (if installed) for proper operation.
 - (c) Continue the test for ½ hour.
- (2) At each flow condition:
 - (a) Record the electric motor voltage and current (all lines).
 - (b) Record the pump speed in rpm.
 - (c) Record the simultaneous (approximately) readings of pump suction and discharge pressures and pump discharge flow.

8.3.3.3* For installations having a pressure relief valve, the operation of the relief valve shall be closely observed during each flow condition to determine whether the pump discharge pressure exceeds the normal operating pressure of the system components.

8.3.3.3.1* The pressure relief valve shall also be observed during each flow condition to determine whether the pressure relief valve closes at the proper pressure.

8.3.3.3.2 The pressure relief valve shall be closed during flow conditions if necessary to achieve minimum rated characteristics for the pump, and reset to normal position at the conclusion of the pump test.

8.3.3.4 For installations having an automatic transfer switch, the following test shall be performed to ensure that the over-current protective devices (i.e., fuses or circuit breakers) do not open:

- (1) Simulate a power failure condition while the pump is operating at peak load.
- (2) Verify that the transfer switch transfers power to the alternate power source.
- (3) Verify that the pump continues to perform at peak load.
- (4) Remove the power failure condition, and verify that, after a time delay, the pump is reconnected to the normal power source.

8.3.3.5 Alarm conditions shall be simulated by activating alarm circuits at alarm sensor locations, and all such local or remote alarm indicating devices (visual and audible) shall be observed for operation.

8.3.3.6 Safety. Section 4.8 shall be followed for safety requirements while working near electric motor-driven fire pumps.

8.3.3.7* Suction Screens. After the waterflow portions of the annual test or fire protection system activations, the suction screens shall be inspected and cleared of any debris or obstructions.

8.3.3.8* Where engines utilize electronic fuel management control systems, the backup electronic control module (ECM), and the primary and redundant sensors for the ECM, shall be tested annually.

8.3.4 Other Tests.

8.3.4.1 Engine generator sets supplying emergency or standby power to fire pump assemblies shall be tested routinely in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

8.3.4.2 Automatic transfer switches shall be tested routinely and exercised in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

8.3.4.3 Tests of appropriate environmental pump room space conditions (e.g., heating, ventilation, illumination) shall be made to ensure proper manual or automatic operation of the associated equipment.

8.3.4.4* Parallel and angular alignment of the pump and driver shall be checked during the annual test. Any misalignment shall be corrected.

8.3.5 Test Results and Evaluation.

8.3.5.1* Interpretation.

8.3.5.1.1 The interpretation of the test results shall be the basis for determining performance of the pump assembly.

8.3.5.1.2 Qualified individuals shall interpret the test results.

8.3.5.2 Engine Speed.

8.3.5.2.1 Theoretical factors for correction to the rated speed shall be applied where determining the compliance of the pump per the test.

8.3.5.2.2 Increasing the engine speed beyond the rated speed of the pump at rated condition is not an acceptable method for meeting the rated pump performance.

8.3.5.3 The fire pump assembly shall be considered acceptable if either of the following conditions is shown during the test:

- (1)*The test is no less than 95 percent of the pressure at rated flow and rated speed of the initial unadjusted field acceptance test curve, provided that the original acceptance test curve matches the original certified pump curve by using theoretical factors.
- (2) The fire pump is no less than 95 percent of the performance characteristics as indicated on the pump nameplate.

8.3.5.4* Degradation in excess of 5 percent of the pressure of the initial unadjusted acceptance test curve or nameplate shall require an investigation to reveal the cause of degraded performance.

8.3.5.5 Current and voltage readings whose product does not exceed the product of the rated voltage and rated full-load current multiplied by the permitted motor service factor shall be considered acceptable.

8.3.5.6 Voltage readings at the motor within 5 percent below or 10 percent above the rated (i.e., nameplate) voltage shall be considered acceptable.

8.4 Reports.

8.4.1 Any abnormality observed during inspection or testing shall be reported promptly to the person responsible for correcting the abnormality.

8.4.2* Test results shall be recorded and retained for comparison purposes in accordance with Section 4.4.

8.4.2.1 All time delay intervals associated with the pump's starting, stopping, and energy source transfer shall be recorded.

8.5 Maintenance.

8.5.1* A preventive maintenance program shall be established on all components of the pump assembly in accordance with the manufacturer's recommendations.

8.5.2 Records shall be maintained on all work performed on the pump, driver, controller, and auxiliary equipment.

8.5.3 In the absence of manufacturer's recommendations for preventive maintenance, Table 8.5.3 shall be used for alternative requirements.

8.5.4 The preventive maintenance program shall be initiated immediately after the pump assembly has passed acceptance tests.

8.6 Component Replacement Testing Requirements.

8.6.1 Whenever a component in a fire pump is adjusted, repaired, rebuilt, or replaced, the tests required to restore the system to service shall be performed in accordance with Table 8.6.1.

8.6.2 NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, shall be consulted for the minimum requirements for design and installation, including acceptance testing.

Table 8.5.3 Summary of Fire Pump Inspection, Testing, and Maintenance

Complete as Applicable	Visual Inspection	Check	Change	Clean	Test	Frequency
Pump System						
Lubricate pump bearings			X			Annually
Check pump shaft end play		X				Annually
Check accuracy of pressure gauges and sensors		X	X			Annually (change or recalibrate when 5% out of calibration)
Check pump coupling alignment		X				Annually
Wet pit suction screens		X		X		After each pump operation
Mechanical Transmission						
Lubricate coupling			X			Annually
Lubricate right-angle gear drive			X			Annually
Electrical System						
Exercise isolating switch and circuit breaker					X	Monthly
Trip circuit breaker (if mechanism provided)					X	Annually
Operate manual starting means (electrical)					X	Semiannually
Inspect and operate emergency manual starting means (without power)	X				X	Annually
Tighten electrical connections as necessary		X				Annually
Lubricate mechanical moving parts (excluding starters and relays)		X				Annually
Calibrate pressure switch settings		X				Annually
Grease motor bearings			X			Annually
Diesel Engine System						
<i>Fuel</i>						
Tank level	X	X				Weekly
Tank float switch	X				X	Weekly
Solenoid valve operation	X				X	Weekly
Strainer, filter, or dirt leg, or combination thereof				X		Quarterly
Water and foreign material in tank				X		Annually
Water in system		X		X		Weekly
Flexible hoses and connectors	X					Weekly
Tank vents and overflow piping unobstructed		X			X	Annually
Piping	X					Annually

Table 8.5.3 Continued

Complete as Applicable	Visual Inspection	Check	Change	Clean	Test	Frequency
<i>Lubrication system</i>						
Oil level	X	X				Weekly
Oil change			X			50 hours or annually
Oil filter(s)			X			50 hours or annually
Lube oil heater		X				Weekly
Crankcase breather	X		X	X		Quarterly
<i>Cooling system</i>						
Level	X	X				Weekly
Antifreeze protection level					X	Semiannually
Antifreeze		X				Annually
Adequate cooling water to heat exchanger		X				Weekly
Rod out heat exchanger				X		Annually
Water pump(s)	X					Weekly
Condition of flexible hoses and connections	X	X				Weekly
Jacket water heater		X				Weekly
Inspect duct work, clean louvers (combustion air)	X	X	X			Annually
Water strainer				X		Quarterly
<i>Exhaust system</i>						
Leakage	X	X				Weekly
Drain condensate trap		X				Weekly
Insulation and fire hazards	X					Quarterly
Excessive back pressure					X	Annually
Exhaust system hangers and supports	X					Annually
Flexible exhaust section	X					Semiannually
<i>Battery system</i>						
Electrolyte level		X				Weekly
Terminals clean and tight	X	X				Quarterly
Case exterior clean and dry	X	X				Monthly
Specific gravity or state of charge					X	Monthly
Charger and charge rate	X					Monthly
Equalize charge		X				Monthly
Clean terminals				X		Annually
<i>Electrical system</i>						
General inspection	X					Weekly
Tighten control and power wiring connections		X				Annually
Wire chafing where subject to movement	X	X				Quarterly
Operation of safeties and alarms		X			X	Semiannually
Boxes, panels, and cabinets				X		Semiannually
Circuit breakers or fuses	X	X				Monthly
Circuit breakers or fuses			X			Biennially

Table 8.6.1 Summary of Component Replacement Testing Requirements

Component	Adjust	Repair	Rebuild	Replace	Test Criteria
Fire Pump System					
Entire pump assembly				X	Perform acceptance test in accordance with NFPA 20, <i>Standard for the Installation of Stationary Pumps for Fire Protection</i>
Impeller/rotating assembly		X		X	Perform acceptance test in accordance with NFPA 20
Casing		X		X	Perform acceptance test in accordance with NFPA 20
Bearings				X	Perform annual test in accordance with NFPA 25
Sleeves				X	Perform annual test in accordance with NFPA 25
Wear rings				X	Perform annual test in accordance with NFPA 25
Main shaft		X		X	Perform annual test in accordance with NFPA 25
Packing	X			X	Perform weekly test in accordance with NFPA 25
Mechanical Transmission					
Gear right angle drives		X	X	X	Perform acceptance test in accordance with NFPA 20
Drive coupling	X	X	X	X	Perform weekly test in accordance with NFPA 25
Electrical System/Controller					
Entire controller		X	X	X	Perform acceptance test in accordance with NFPA 20
Isolating switch				X	Perform weekly test in accordance with NFPA 25 and exercise 6 times
Circuit breaker	X				Perform six momentary starts in accordance with NFPA 20
Circuit breaker				X	Perform a one-hour full-load current test
Electrical connections	X				Perform weekly test in accordance with NFPA 25
Main contactor			X		Perform weekly test in accordance with NFPA 25
Main contactor				X	Perform acceptance test in accordance with NFPA 20
Power monitor				X	Perform weekly test in accordance with NFPA 25
Start relay				X	Perform weekly test in accordance with NFPA 25
Pressure switch	X			X	Perform acceptance test in accordance with NFPA 20
Pressure transducer	X			X	Perform acceptance test in accordance with NFPA 20
Manual start or stop switch				X	Perform six operations under load
Transfer switch — load carrying parts		X	X	X	Perform a one-hour full-load current test, and transfer from normal power to emergency power and back one time
Transfer switch — non-load parts		X	X	X	Perform six no-load operations of transfer of power
Electric Motor Driver					
Electric motor		X	X	X	Perform acceptance test in accordance with NFPA 20
Motor bearings				X	Perform annual test in accordance with NFPA 25
Incoming power conductors				X	Perform a one-hour full-load current test
Diesel Engine Driver					
Entire engine			X	X	Perform annual test in accordance with NFPA 25
Fuel transfer pump	X		X	X	Perform weekly test in accordance with NFPA 25
Fuel injector pump	X			X	Perform weekly test in accordance with NFPA 25
Fuel system filter		X		X	Perform weekly test in accordance with NFPA 25
Combustion air intake system		X		X	Perform weekly test in accordance with NFPA 25
Fuel tank		X		X	Perform weekly test in accordance with NFPA 25
Cooling system		X	X	X	Perform weekly test in accordance with NFPA 25
Batteries		X		X	Perform a start/stop sequence in accordance with NFPA 25
Battery charger		X		X	Perform weekly test in accordance with NFPA 25
Electric system		X		X	Perform weekly test in accordance with NFPA 25
Lubrication filter/oil service		X		X	Perform weekly test in accordance with NFPA 25
Steam Turbines					
Steam turbine		X		X	Perform annual test in accordance with NFPA 20
Steam regulator or source upgrade		X		X	Perform annual test in accordance with NFPA 20