NFPA®

750

Standard on Water Mist Fire Protection Systems

2019

Full document details: NFPA 750 2019

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NFPA® 750

Standard on

Water Mist Fire Protection Systems

2019 Edition

This edition of NFPA 750, *Standard on Water Mist Fire Protection Systems*, was prepared by the Technical Committee on Water Mist Fire Suppression Systems. It was issued by the Standards Council on May 4, 2018, with an effective date of May 24, 2018, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 750 was approved as an American National Standard on May 24, 2018.

Origin and Development of NFPA 750

In 1993, representatives from the research and engineering communities, water mist system manufacturers, the insurance industry, enforcement authorities, and industrial users met and organized the NFPA Technical Committee on Water Mist Fire Suppression Systems. The committee started work on developing a new NFPA document that would begin to standardize water mist technology and provide for reliable design and installation of these systems.

Water mist systems were introduced in the 1940s and were used for specific applications such as on passenger ferries. The renewed interest in water mist systems is due partially to the phasing out of halon and their potential as a fire safety system for spaces where the amount of water that can be stored or that can be discharged is limited. In addition, their application and effectiveness for residential occupancies, flammable liquids storage facilities, and electrical equipment spaces continues to be investigated with encouraging results.

NFPA 750 contains elements that are similar to standards on other types of fire protection systems such as automatic sprinklers, fixed water spray, carbon dioxide, and halon. In many ways, water mist can be thought of as a hybrid of those systems. Overall, water mist systems use water as the extinguishing, suppression, or control medium but do so in a nontraditional manner. In developing this standard, the committee addressed system components and hardware, system types, installation requirements, design objectives, hazard classifications, calculations, water supplies, atomizing media, plans, documentation, acceptance criteria, and maintenance considerations.

The 2000 edition of NFPA 750 represented a significant advancement in water mist technology and the knowledge base associated with its application. That edition included a new definition of *water mist* and a complete rewrite and reorganization of what was Chapter 5, Design Objectives and Fire Test Protocols. Additionally, many new sections were added to address the design and safety considerations associated with positive displacement water mist pumps. New guidance was provided for the measurement of the water mist spray characteristics, including drop distribution. Finally, two new appendixes were added to address many of the current and proposed fire test protocols and the reliability of water mist systems.

The 2003 edition incorporated revisions that updated the standard to comply with the *Manual of Style for NFPA Technical Committee Documents*. Style changes included a restructuring of the document, reworded exceptions as requirements, and transition to a metric-as-primary document. The 2003 edition contained updated requirements for additives, proportioning methods, supervision, calculation methods, and inspection and testing of water mist systems. New requirements were added that addressed protection of machinery spaces on towing vessels.

The 2006 edition updated requirements for hangers, supports, reserve water supplies, pump capacities, and appropriate test connections.

The 2010 edition included new annex material providing guidance on obstruction to nozzle discharge and a number of editorial revisions.

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The 2015 edition of NFPA 750 provided significant development in the knowledge to design water mist systems for various defined occupancies. Two chapters were added to address the dynamics of occupancy classification in designing a water mist system: Chapter 5, Classification of Occupancies, and Chapter 10, Occupancy Protection Systems. In addition, the inspection, testing, and maintenance sections for water mist systems, other than those installed in one- and two-family dwellings, were removed and now reference NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

The 2019 edition of NFPA 750 contains updates that clarify the definitions of a gridded water mist system and twin-fluid system, which devices can be used as automatic means, which components can be used as provisions for cleaning, and the requirements for pressure-indicating devices used on a common manifold system. Further updates clarify that a listed system requires that any mixed components or systems have been tested together and expand requirements to include configurations allowed in current listed solutions. New sections have been added specifying design, testing, and installation of preaction water mist systems. Another section has been added to prevent debris and contaminants from entering a water mist system by requiring a strainer or filter after the fire department connection (FDC). It also clarifies the location of the FDC on a low-pressure water mist system. Throughout the standard, the terms *pressure container* and *pressurized container* have been replaced with the newly defined term *pressure vessel*, and the phrase *safety device to release excess pressure* has been replaced with *pressure relief device*. These changes were made to maintain consistency with industry practices and terminology. This edition also incorporates revisions that update referenced documents, extracts, and formatting to comply with the *Manual of Style for NFPA Technical Committee Documents*.

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Committee Scope: This Committee shall have primary responsibility for documents on the design and installation of systems which use a water mist for the control, suppression, or extinguishment of fire.

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Standard on

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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. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1* Scope. This standard contains the minimum requirements for the design, installation, maintenance, and testing of water mist fire protection systems. This standard does not provide definitive fire performance criteria, nor does it offer specific guidance on how to design a system to control, suppress, or extinguish a fire. Reliance is placed on the procurement and installation of listed water mist equipment or systems that have demonstrated performance in fire tests as part of a listing process.

1.2* Purpose.

1.2.1 The purpose of this standard is to provide protection for life and property from fire through the standardization of design, installation, maintenance, and testing requirements for water-based fire suppression systems that use a specific spray (mist) that absorbs heat, displaces oxygen, or blocks radiant heat to control, suppress, or extinguish fires as required by the application.

1.2.2 The user of this standard shall recognize the complexity of water mist fire suppression systems. Therefore, the designer shall be cautioned that the standard is not a design handbook. The standard shall not do away with the need for the engineer or for competent engineering judgment. It is the intent that a designer capable of applying more complete and rigorous analysis to special or unusual problems shall have latitude in the development of such designs. In such cases, the designer shall be responsible for demonstrating the validity of the design approach.

1.3 Application. This standard shall apply to water mist fire protection systems and shall establish minimum requirements for water mist technology on the basis of sound engineering principles, test data, and field experience.

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6* Units.

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

1.6.2 Two units (liter and bar) outside of but recognized by SI are commonly used in international fire protection.

1.6.3 These units are listed in Table 1.6.3 with conversion factors.

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

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Δ Table 1.6.3 Metric Conversion Factors

Name of Unit	Unit Abbreviation or Symbol	Conversion Factor
Millimeter	mm	1 in. = 25.4 mm
Square meter	m^2	1 ft^2 = 0.0929 m^2
Liter	L	1 gal = 3.785 L
Cubic decimeter	dm^3	1 gal = 3.785 dm^3
Cubic meter	m^3	1 ft^3 = 0.028317 m^3
Kilogram	kg	1 lb = 0.4536 kg
Kilograms per cubic meter	kg/m^3	1 lb/ft^3 = 16.0183 kg/m^3
Pascal	Pa	1 psi = 6895 Pa
Bar	bar	1 psi = 0.0689 bar; 1 bar = 10^5 Pa
Liter per minute per square meter	$L/min/m^2$	1 gpm = 40.746 $L/min/m^2$
Micron	μ	1 mm = 1000 μ

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 13, *Standard for the Installation of Sprinkler Systems,* 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2016 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2019 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2018 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2017 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code, 2019 edition.

NFPA 170, *Standard for Fire Safety and Emergency Symbols,* 2018 edition.

NFPA 220, *Standard on Types of Building Construction,* 2018 edition.

2.3 Other Publications.

Δ 2.3.1 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch),* 2013.

ANSI/ASME B16.18, *Cast Copper Alloy Solder Joint Pressure Fittings,* 2012.

ANSI/ASME B16.22, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings,* 2013.

ASME B31.1, *Power Piping Code,* 2016.

Boiler and Pressure Vessel Code, 2015.

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

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service,* 2015A.

ASTM A351/A351M, *Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex) for Pressure-Containing Parts,* 2016.

ASTM A403/A403M, *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings,* 2016.

ASTM A632, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service,* 2014.

ASTM A774/A774M, *Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures,* 2014.

ASTM A778/A778M, *Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products,* 2016.

ASTM A789/A789M, *Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service,* 2016A.

ASTM A815/A815M, *Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings,* 2014.

ASTM B32, *Standard Specification for Solder Metal,* 2014.

ASTM B42, *Standard Specification for Seamless Copper Pipe, Standard Sizes,* 2015.

ASTM B75/B75M, *Standard Specification for Seamless Copper Tube,* 2011.

ASTM B88, *Standard Specification for Seamless Copper Water Tube,* 2014.

ASTM B251, *Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube,* 2010.

ASTM B813, *Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper-Alloy Tube,* 2016.

2.3.3 AWS Publications. American Welding Society, 8669 N.W. 36 Street, #130, Miami, FL 33166-6672.

AWS A5.8M/A5.8, *Specification for Filler Metals for Brazing and Braze Welding,* 2011.

AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification,* 2014. (Supersedes AWS D10.9)

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Δ **2.3.4 IMO Publications.** International Maritime Organization, 4, Albert Embankment, London, SEI 7SR, United Kingdom.

IMO Assembly Resolution A.800(19), *Revised Guidelines for Approval of Sprinkler Systems Equivalent to That Referred to in SOLAS Regulation II-2/12, 1995; as amended by Resolution MSC.265(84) Amendments to the Revised Guidelines for Approval of Sprinkler Systems Equivalent to That Referred to in SOLAS Regulation II-2/12* (Resolution A.800(19)), 2008.

International Code for Fire Safety Systems, 2015.

MSC/Circ. 1165, *Revised Guidelines for the Approval of Equivalent Water-Based Fire-Extinguishing Systems for Machinery Spaces and Cargo Pump-Rooms*, 2005.

MSC.1/Circ. 1387, *Revised Guidelines for the Approval of Fixed Water-Based Local Application Fire-Fighting Systems for Use in Category A Machinery Spaces* (MSC/CIRC. 913), 2010.

SOLAS Regulation II-2/12.4.1, Consolidated Edition, 2014.

2.3.5 ISO Publications. International Organization for Standardization, ISO Central Secretariat BIBC II, 8, Chemin de Blandonnet, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphical symbols for conventional use and data-processing applications*, 2012.

ISO 1219-2, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 2: Circuit diagrams*, 2012.

Δ **2.3.6 ULC Publications.** Underwriters Laboratories of Canada, 7 Underwriters Road, Toronto, ON M1R 3A9, Canada.

CAN/ULC S524-14, *Standard for the Installation of Fire Alarm Systems*, 2014.

CAN/ULC S529-16, *Standard for Smoke Detectors for Fire Alarm Systems*, 2016.

2.3.7 U.S. Coast Guard Publications. 2703 Martin Luther King, Jr. Ave. SE, Stop 7509, Washington, DC 20593-7509.

NVIC 9-97 CH-1, *Guide to Structural Fire Protection*, 2010.

2.3.8 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 46, Code of Federal Regulations, Parts 56.50 and 56.75, "Shipping."

Title 49, Code of Federal Regulations, Parts 171–190.

Δ **2.3.9 Other Publications.** BS EN-13480-3, *Metallic Industrial Piping Design and Calculation*, BSI British Standards, Reston, VA, 2017.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 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. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Acceptance Test Plan. A complete step-by-step description of the proposed acceptance test procedure that identifies all devices, controls, and functions to be tested and how the test will be conducted.

3.3.2* Additive. Any chemical or mixture of chemicals intentionally introduced into the system.

3.3.3* Additive Proportioning. Additive proportioning is the method (such as premix, metered, or balanced pressure) used for the introduction of an additive or additive mixture at the recommended percent ratio into the water system.

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3.3.4* Dv_f. A drop diameter such that the cumulative volume, from zero diameter to this respective diameter, is the fraction, *f*, of the corresponding sum of the total distribution.

3.3.5* Enclosure. A confined or partially confined volume.

3.3.6 Escutcheon. A protective or ornamental plate or flange.

3.3.7 Fire Control. Limiting the size of a fire by distribution of water so as to decrease the heat release rate and pre-wet adjacent combustibles, while controlling ceiling gas temperatures to avoid structural damage.

3.3.8 Fire Extinguishment. The complete suppression of a fire until there are no burning combustibles.

3.3.9 Fire Suppression. The sharp reduction of the rate of heat release of a fire and the prevention of regrowth.

N **3.3.10 Gridded Water Mist System.** A water mist system in which parallel cross mains are connected by multiple branch lines, causing an operating nozzle to receive water from both ends of its branch line while other branch lines help transfer water between cross mains.

3.3.11 High Pressure System. A water mist system where the distribution system piping is exposed to pressures of 34.5 bar (500 psi) or greater.

3.3.12 Intermediate Pressure System. A water mist system where the distribution system piping is exposed to pressures greater than 12.1 bar (175 psi) but less than 34.5 bar (500 psi).

3.3.13 Low Pressure System. A water mist system where the distribution piping is exposed to pressures of 12.1 bar (175 psi) or less.

3.3.14 Pressure.

3.3.14.1 ***Nozzle Operating Pressure.*** The pressure range at which nozzles are listed to control, suppress, or extinguish a fire.

3.3.14.2 ***Standby Pressure.*** The pressure that exists in the distribution system in the static state, prior to nozzle discharge.

3.3.14.3 ***System Design Pressure.*** The maximum pressure a system or component is rated to withstand.

3.3.14.4 ***Working Pressure.*** The maximum anticipated pressure applied to the system components exclusive of surge pressures.

3.3.15 Pressure Relief Device. A device designed for the purpose of preventing pressure levels in excess of the design pressure of the system, the system components, or both.

3.3.16 Pressure-Regulating Valve. A valve designed for the purpose of reducing, regulating, controlling, or restricting water pressure.

N **3.3.17 Pressure Vessel.** A container, process vessel, or other component designed in accordance with the ASME *Boiler and Pressure Vessel Code*, DOT, or other approved standards. [**1,** 2018]

3.3.18 Propellant. Compressed gas used as a prime mover to push water out of storage vessels, through pipe networks, or through distribution components.

3.3.19* Shall Be Considered. Requires an objective assessment, the results and basis of which are documented, to determine to what extent the specific factor, criterion, guideline, standard, and so forth, is incorporated into or satisfied by the design.

3.3.20 Single-Fluid System. A water mist system utilizing a single piping system to supply each nozzle.

3.3.21 Supervision. In water-based fire protection systems, a means of monitoring system status and indicating abnormal conditions. [**25,** 2017]

3.3.22 Twin-Fluid System. A water mist system in which water and an atomizing medium are supplied to the water mist nozzle utilizing a separate piping system for each medium or a single piping system for both.

3.3.23 Unloader Valve. A valve that is designed to relieve excess flow below pump capacity at set pump pressure. [**20**, 2019]

3.3.24* Water Mist. A water spray for which the $Dv_{0.99}$, for the flow-weighted cumulative volumetric distribution of water droplets is less than 1000 μm within the nozzle operating pressure range.

3.3.25 Water Mist Nozzle. A special purpose device, containing one or more orifices, designed to produce and deliver a water spray meeting either the definition of *water mist* or meeting the specific requirements of an approved water mist fire test protocol. *(See Annex C.)*

3.3.25.1 ***Automatic Water Mist Nozzles.*** Nozzles that operate independently of other nozzles by means of a detection/activation device built into the nozzle.

3.3.25.2* ***Multifunctional Water Mist Nozzles.*** Nozzles capable of operation using both automatic and nonautomatic means.

3.3.25.3 ***Nonautomatic Water Mist Nozzles (Open).*** Nozzles that operate as an entire system or grouping of nozzles, containing open orifices and activating the water flow to the nozzles by an independent detection system.

3.3.26 Water Mist System. A distribution system connected to a water supply or water and atomizing media supplies that is equipped with one or more nozzles capable of delivering water mist intended to control, suppress, or extinguish fires and that has been demonstrated to meet the performance requirements of its listing and this standard.

3.3.26.1 ***Deluge Water Mist System.*** A water mist system utilizing nonautomatic mist nozzles (open) attached to a piping network connected to the fluid supply(ies) directly or through a valve controlled by an independent detection system installed in the same area as the mist nozzles.

3.3.26.2 ***Dry Pipe Water Mist System.*** A water mist system using automatic nozzles attached to a piping system containing air, nitrogen, or inert gas under pressure, the release of which (as from an opening of an automatic nozzle) allows the water pressure to open a dry pipe valve. The water then flows into the piping system and out through any open nozzles.

3.3.26.3 ***Engineered Water Mist Systems.*** Those systems that need individual calculation and design to determine the flow rates, nozzle pressures, pipe size, area, or volume

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protected by each nozzle, discharge density of water mist, the number and types of nozzles, and the nozzle placement in a specific system.

3.3.26.4 ***Local-Application Water Mist System.*** A water mist system arranged to discharge directly on an object or hazard in an enclosed, unenclosed, or open outdoor condition.

3.3.26.5 ***Occupancy Protection Systems.*** A water mist system utilizing automatic water mist nozzles installed throughout a building or a portion of a building and intended to control, suppress, or extinguish a fire.

3.3.26.6 ***Preaction Water Mist System.*** A water mist system using automatic nozzles 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 mist nozzles. The actuation of the detection system opens a valve that allows water to flow into the piping system and discharges through all opened nozzles in the system.

3.3.26.7* ***Pre-Engineered Water Mist Systems.*** Those systems that have predetermined pipe and tube sizes, maximum and minimum pipe lengths, number of fittings and numbers and types of nozzles, nozzle pressures, atomizing media, and water storage quantities and that do not require additional hydraulic calculations.

3.3.26.8 ***Total Compartment Application Water Mist System.*** A deluge water mist system that provides complete protection of an enclosure or space by the simultaneous operation of all nozzles in the space by manual or automatic means.

3.3.26.9 ***Wet Pipe Water Mist System.*** A water mist system using automatic nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from nozzles operated by the heat from a fire.

3.3.26.10 ***Zoned Application Water Mist System.*** A total compartment application water mist system utilizing nonautomatic nozzles or intermixed nonautomatic and automatic nozzles in which the piping network is subdivided into predetermined zones controlled by individual control valves and which protects a predetermined portion of the compartment by the manual or automatic activation of a selected group of nozzles.

3.3.27 Water Mist, Atomizing Media. Compressed air or other gases that produce water mist by mechanical mixing with water.

Chapter 4 General

4.1* General.

4.1.1 Use and Limitations.

4.1.1.1 Water mist systems shall be permitted for use with a wide range of performance objectives, including the following:

(1) Fire extinguishment
(2) Fire suppression
(3) Fire control
(4) Temperature control
(5) Exposure protection

4.1.1.2* Water mist systems shall not be used for direct application to materials that react with water to produce violent reactions or significant amounts of hazardous products. Such materials include the following:

(1) Reactive metals, such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium
(2) Metal alkoxides, such as sodium methoxide
(3) Metal amides, such as sodium amide
(4) Carbides, such as calcium carbide
(5) Halides, such as benzoyl chloride and aluminum chloride
(6) Hydrides, such as lithium aluminum hydride
(7) Oxyhalides, such as phosphorus oxybromide
(8) Silanes, such as trichloromethylsilane
(9) Sulfides, such as phosphorus pentasulfide
(10) Cyanates, such as methylisocyanate

4.1.1.3 Water mist systems shall not be used for direct application to liquefied gases at cryogenic temperatures (such as liquefied natural gas), which boil violently when heated by water.

4.2* Safety.

4.2.1* Electrical Clearances.

Δ **4.2.1.1*** All system components shall be located to maintain minimum clearances from unenclosed and uninsulated energized electrical components in accordance with *NFPA 70*.

4.2.1.2 Where the design basic insulation level (BIL) is not known and where nominal voltage is used for the design criteria, the highest minimum clearance specified for this group shall be used.

4.2.1.3 The selected clearance to ground shall satisfy the greater of the switching surges or BIL duty, rather than being based on nominal voltage.

4.2.1.4 The clearance between uninsulated energized parts of the electrical system equipment and any portion of the water mist system shall not be less than the minimum clearance provided elsewhere for electrical system insulation on any individual component.

4.2.2 Environmental Factors. When selecting water mist to protect a hazard area, the effects of water runoff on the environment shall be considered.

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Chapter 5 Classification of Occupancies

5.1* Classification of Occupancies for Water Mist Systems. Occupancy classifications for this standard shall relate to water mist system design, installation, and water supply requirements only, as designated for the occupancies by their listing.

Δ **5.1.1* Light Hazard Occupancies.** Light hazard occupancies shall be defined as occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected.

Δ **5.1.2* Ordinary Hazard (Group 1) (OH1).** Ordinary hazard (Group 1) occupancies shall be defined as occupancies or portions of other occupancies where combustibility is low, the quantity of combustibles is moderate, stockpiles of contents do not exceed 2.4 m (8 ft), and fires with moderate rates of heat release are expected.

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Δ **5.1.3* Ordinary Hazard (Group 2) (OH2).** Ordinary hazard (Group 2) occupancies shall be defined as occupancies or portions of other occupancies where the quantity and combustibility of contents are moderate to high, stockpiles of contents with moderate rates of heat release do not exceed 3.66 m (12 ft), and stockpiles of contents with high rates of heat release do not exceed 2.4 m (8 ft).

• **5.2 Classification of Specific Applications for Water Mist Systems.**

5.2.1 Water mist systems for specific applications in this standard shall relate to water mist system design, installation, and water supply requirements as designated by their listing.

5.2.2* Specific applications include hazards and conditions similar to the following:

(1) Machinery spaces
(2) Combustion turbines
(3) Wet benches and other similar processing equipment
(4) Local application
(5) Industrial oil cookers
(6) Computer room raised floors
(7) Chemical fume hoods
(8) Continuous wood board presses

Chapter 6 System Components and Hardware

6.1 General. This chapter provides the requirements for water mist system components.

6.1.1 Component Listing.

6.1.1.1 Unless the requirements of 6.1.1.2 or 6.1.1.3 are met, all water mist system components shall be listed for their intended use.

6.1.1.2 The requirements of 6.1.1.1 shall not apply where approved components are specifically permitted to be substituted for listed components.

6.1.1.3 The requirements of 6.1.1.1 shall not apply to individual components where the components are part of a listed, pre-engineered system.

6.1.2 Design Pressure.

6.1.2.1 System components shall have a design pressure equal to or greater than the working pressure but not less than 12.1 bar (175 psi).

6.1.2.2 Where components are part of a listed, pre-engineered system with a self-contained water supply, the pressure rating shall be in accordance with the listing requirements.

6.1.3 Corrosion Resistance.

6.1.3.1 Corrosive Atmospheres. Where components are subjected to severe corrosive atmospheres, corrosion protection such as special corrosion-resistive materials or coating shall be required.

6.1.3.2* Water Additives. All components in the water mist systems and the additive injection system shall be of corrosion-resistant material.

6.2 Gas and Water Containers.

6.2.1 Capacity. Gas and water containers, where provided, shall be sized to supply quantities of gas and water as required by Chapter 12.

6.2.2 Design.

6.2.2.1* Installation. Gas and water containers shall be designed for installation according to the manufacturer's installation manual, including provision for attachment of seismic restraint where required.

6.2.2.2* Specifications. Gas and water containers subject to pressurization shall be made, tested, approved, equipped, and marked in accordance with the current specifications of the ASME *Boiler and Pressure Vessel Code*, Section VIII, or the requirements of the U.S. Department of Transportation, 49 CFR 171–190, 178.36–178.37, or other approved international standards.

6.2.2.3 Shipping Containers. Containers used as shipping containers shall be designed to meet the requirements of the U.S. Department of Transportation or of Transport Canada or of other approved international standards.

6.2.2.4 Design Pressure. The design pressure shall be based on the maximum pressure developed by the water mist system at 54°C (130°F) or a higher temperature as specified in the manufacturer's listing.

6.2.2.5 Excess Pressure. Each pressure vessel shall be provided with a pressure relief device.

6.2.2.6 Water Container Nameplate.

6.2.2.6.1 Unless the requirements of 6.2.2.6.2 are met, each water container shall have a permanent nameplate or other permanent marking specifying the liquid held in the container (including additives) and the nominal water volume and pressurization level (where applicable) of the container.

6.2.2.6.2 The requirements of 6.2.2.6.1 shall not apply where the information required by 6.2.2.8.1 is provided on a nameplate or placard permanently installed on the system at a location convenient for servicing or content measuring.

6.2.2.7 Sight Glasses. External sight glasses on water containers shall be protected against mechanical damage.

6.2.2.8 Gas Container Nameplate.

6.2.2.8.1 Unless the requirements of 6.2.2.8.2 are met, each gas container shall have a permanent nameplate or other permanent marking specifying the type of gas, weight of gas, weight of container, nominal gas volume, and pressurization level of the container.

6.2.2.8.2 The requirements of 6.2.2.8.1 shall not apply where the information required by 6.2.2.8.1 is provided on a nameplate or placard permanently installed on the system at a location convenient for servicing or content measuring.

6.2.2.9 Pressure Indicator. A reliable means shall be provided to indicate the pressure in refillable, pressurized gas containers.

6.2.3 Multiple Container Systems. All containers supplying the same manifold outlet shall be interchangeable and of the same size and charge.

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6.3 Piping and Tube.

6.3.1* General.

6.3.1.1 All wetted surfaces in piping, valves, and fittings, from the system strainer to the nozzle shall have corrosion resistance at least equivalent to that for piping as specified in Table 6.3.3.1.

6.3.1.2 Wherever the word *pipe* is used, it shall be understood also to mean *tube*.

6.3.2* Other Types of Pipe or Tube.

6.3.2.1 Other types of pipe or tube investigated for suitability in water mist system installations and listed for this service shall be permitted where installed in accordance with their listing limitations, including installation instructions.

6.3.2.2 Bending of the pipe shall be permitted as provided by the listing.

6.3.2.3 Pipe or tube shall not be listed for portions of an occupancy classification.

6.3.3 Low Pressure Systems.

6.3.3.1 Pipe or tube used in low pressure water mist systems shall meet or exceed one of the standards in Table 6.3.3.1 or shall be in accordance with 6.3.2.

6.3.3.2 The chemical properties, physical properties, and dimensions of the materials given in Table 6.3.3.1 shall conform at a minimum to the standards cited in the table.

6.3.3.3 Pipe and tube used in low pressure water mist systems shall be designed to withstand a working pressure of not less than 12.1 bar (175 psi).

6.3.3.4 Copper tube as specified in the standards referenced in Table 6.3.3.1 shall have a wall thickness of Type K, L, or M where used in water mist systems.

6.3.4 Intermediate and High Pressure Systems.

6.3.4.1 Pipe or tube shall be of noncombustible material having physical and chemical characteristics such that its deterioration under stress can be predicted with reliability.

6.3.4.2* The piping shall be in accordance with ASME B31.1, *Power Piping Code*, or BS EN-13480-3, *Metallic Industrial Piping Design and Calculation*.

6.3.4.3 Where the equations provided in ASME B31.1, *Power Piping Code*, or EN-13480-3, *Metallic Industrial Piping Code*, are used to calculate either the design pressure (P_w) for a specific pipe or tube or the minimum wall thickness (t_m) of the pipe or tube for a specific working pressure, a steel temperature of 54°C (130°F) or the expected ambient temperature to which the pipe or tube will be exposed, whichever is greater, shall be used.

6.3.4.4* Flexible piping, tubing, or hoses (including connections) shall be listed for their intended use.

6.3.5 Pipe or Tube Identification.

6.3.5.1 All pipe or tube, including specially listed pipe or tube, shall be marked continuously along its length by the manufacturer in such a way as to identify the type of pipe or tube.

6.3.5.2 Pipe or tube identification shall include the manufacturer's name, model designation, or schedule.

6.3.5.3 Pipe or tube marking shall not be painted, concealed, or removed prior to approval by the authority having jurisdiction.

Δ Table 6.3.3.1 Pipe or Tube Standards

Materials and Dimensions and Standard Titles	Standard No.
Copper Tube (Drawn, Seamless)	
Standard Specification for Solder Metal [95-5 (Tin-Antimony-Grade 95TA)]	ASTM B32
*Standard Specification for Seamless Copper Tube**	ASTM B75/B75M
*Standard Specification for Seamless Copper Water Tube**	ASTM B88
Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	ASTM B251
Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper-Alloy Tube	ASTM B813
Specification for Filler Metals for Brazing and Braze Welding (Classification BCuP-3 or BCuP-4)	AWS A5.8M/A5.8
Stainless Steel	
Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service	ASTM A269/A269M
Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service	ASTM A632
Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products	ASTM A778/A778M
Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service	ASTM A789/A789M

*Denotes pipe or tube suitable for bending *(see 6.3.6)* according to ASTM standards.

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6.3.6* Pipe or Tube Bending.

6.3.6.1 Bending of Type K and Type L copper tube or stainless steel tube or pipe shall be permitted, provided that all bending details are in accordance with the tubing manufacturer's recommendations, the strength requirements of ASME B31.1, *Power Piping Code*, or the following, whichever is greater:

(1) For Type K or Type L copper tubing and stainless steel pipe, the minimum bending radius is six pipe or tube diameters.
(2) For Type 304L or Type 316 stainless steel tube, the minimum bending radius is two diameters up to 38 mm (1½ in.) OD, and four diameters for 51 mm (2 in.) tubing.

6.3.6.2 Bending tools shall be used for all bending in accordance with the following:

(1) Power bending tools with the correct radius dies shall be required for pipe and tube larger than 20 mm (¾ in.).
(2) Hand or bench dies with the correct radius dies shall be permitted to be used to bend pipe or tubing 20 mm (¾ in.) and smaller.
(3) Flattened bends where the larger diameter is greater than 1.08 times the least diameter shall not be permitted.

6.4 Fittings.

6.4.1* General.

6.4.1.1 Fittings. All fittings used on piping described in 6.3.1 shall have a corrosion resistance at least equivalent to wrought copper fittings conforming to ANSI/ASME B16.22, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.*

6.4.1.2 Welding and brazing alloys shall have a melting point above 538°C (1000°F).

6.4.1.2.1* Conversion fittings from metric to fractional units shall be identified by color or tagging for quick notification in the field.

6.4.1.2.2 A minimum of one spare conversion fitting of each type shall be maintained on the premises so that any conversion fittings that have been damaged in any way can be promptly replaced.

6.4.1.2.3 Conversion fitting information shall be maintained on the drawings.

6.4.2 Low Pressure Systems.

6.4.2.1 Fittings used in water mist systems shall meet or exceed the standards in Table 6.4.2.1 or shall be in accordance with 6.4.2.2.

6.4.2.2* Other types of fittings investigated for suitability in water mist installations and listed for this service shall be permitted where installed in accordance with their listing limitations, including installation instructions.

6.4.2.3 Screwed unions shall not be used on pipe larger than 51 mm (2 in.).

6.4.2.4 Couplings and unions of other than the screwed type shall be listed for the intended use.

6.4.2.5 A one-piece reducing fitting shall be used wherever a change is made in the size of pipe.

6.4.2.6 Where standard fittings of the required size are not produced, hexagonal or face bushings shall be permitted in reducing the size of openings of fittings and shall meet the requirements of 6.4.2.5.

6.4.2.7 All threads used in joints and fittings shall conform to ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch).* Joint compound, tape, or thread lubricant shall be applied only to the male threads of the joint.

6.4.2.8 Soldering fluxes shall be in accordance with Table 6.3.3.1.

6.4.2.9 Brazing fluxes, if used, shall not be of a highly corrosive type.

6.4.2.10 Welding shall be performed in accordance with AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification,* Level AR-3.

6.4.3 Intermediate and High Pressure Systems.

6.4.3.1 Fittings shall have a minimum-rated system design working pressure equal to or greater than the maximum operating pressure of the water mist systems at 54°C (130°F).

6.4.3.2 For systems that use a pressure regulating device in the distribution piping, the fittings downstream of the device shall have a minimum rated system design working pressure equal to or greater than the maximum anticipated pressure in the downstream piping.

Δ Table 6.4.2.1 Fitting Standards

Materials and Dimensions and Standard Titles	Standard No.
Copper	
Cast Copper Alloy Solder Joint Pressure Fittings	ANSI/ASME B16.18
Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	ANSI/ASME B16.22
Stainless Steel	
Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex) for Pressure-Containing Parts	ASTM A351/A351M
Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings	ASTM A403/A403M
Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures	ASTM A774/A774M
Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings	ASTM A815/A815M

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6.4.3.3 All threads used in joints and fittings shall conform to ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch).*

6.4.3.4 Joint compound, tape, or thread lubricant shall be applied only to the male threads of the joint.

6.4.3.5 Welding and brazing shall be performed in accordance with Section IX of the ASME *Boiler and Pressure Vessel Code.*

6.4.3.6 Where acceptable tubing is joined with compression-type fittings, the manufacturer's pressure temperature ratings for the fitting shall not be exceeded.

6.5 Hangers/Supports.

6.5.1 Supports. All references to hangers shall include supports.

Δ **6.5.2** Hangers used on low pressure water mist systems shall be permitted to be designed and installed in accordance with NFPA 13.

6.5.3 Listing. Unless the requirements of 6.5.4 are met, hangers shall be listed for use with the pipe or tube involved.

6.5.4 Special Designed Hangers.

6.5.4.1 The requirements of 6.5.3 shall not apply to hangers where the following conditions are met:

(1) Documentation shall be submitted to show that the hangers and hanging method are recognized as good industry practice for the piping system.
(2) Hangers shall be designed to support five times the weight of the pipe or tube when filled with gas or water, based on the system's use of the pipe or tube, plus 114 kg (250 lb) at each point of piping support.
(3) The points of support shall be able to support the water mist system.
(4) Hanger components shall be metal.
(5) Plastic inserts shall be permitted in tube clamps to avoid dissimilar metal reactions or dampen vibrations.

6.5.4.2 Detailed calculations shall be submitted, where required by the authority having jurisdiction, showing the stresses developed in both the hangers and the piping and the safety factors provided.

6.5.5 Bending. Threaded portions of hangers shall not be bent.

6.5.6 Listed Inserts. The use of listed inserts set in concrete to support hangers shall be permitted.

6.5.7 Powder-Driven Fasteners.

6.5.7.1 Unless the requirements of 6.5.7.2 are met, powder-driven fasteners shall not be used to attach hangers to the building structure where systems are required to be protected against earthquakes.

6.5.7.2 The requirements of 6.5.7.1 shall not apply to powder-driven fasteners that are specifically listed for service in seismic areas.

6.6 Nozzles.

6.6.1* Listing. Nozzles shall be listed either individually or as a part of a pre-engineered system, and the listing information shall include the following:

(1) Specific hazards and protection objectives
(2) Volumetric flow rate characteristics of water discharge for each nozzle
(3) Maximum height of protected space
(4)* Minimum distance between nozzle tip or diffuser, as applicable, and plane of protection
(5) Maximum spacing between nozzles
(6) Maximum coverage area per nozzle
(7) Minimum spacing between nozzles
(8) Maximum height between ceiling and nozzle diffuser or tip, as applicable
(9) Nozzle obstruction spacing criteria
(10) Maximum spacing of nozzles from walls
(11) Nozzle operating pressure range
(12) Allowable range of nozzle orientation angle from vertically down
(13) Classification of automatic nozzle thermal response characteristics as fast, special, or standard response
(14) Maximum compartment volume, if applicable
(15) Maximum time delay for water mist delivery to the most remote nozzle

6.6.2 New Nozzles. Only new nozzles shall be installed in water mist systems.

6.6.3 Marking. Nozzles shall be permanently marked to identify the manufacturer, type, and size of the orifice(s) or part number.

6.6.4 Corrosion Protection. Additional corrosion protection, such as special corrosion-resistant materials or coatings, shall be required in severely corrosive atmospheres.

6.6.5 Protective Coatings. Where protective coatings are used to meet the requirements of 6.1.3, the coatings shall be applied by the nozzle manufacturer, and the coated nozzle shall be listed.

6.6.6 Frangible Discs and Blowoff Caps.

6.6.6.1 Where clogging by external, foreign materials is possible, discharge nozzles shall be provided with frangible discs, blowoff caps, or other listed devices.

6.6.6.2 These devices shall provide an unobstructed opening upon system operation and shall be located so they cannot injure personnel.

6.6.7 Thermally Activated Nozzles.

6.6.7.1 The standard temperature ratings of individual, thermally activated nozzles shall be as shown in Table 6.6.7.1.

6.6.7.2 Individual, thermally activated nozzles shall be colored in accordance with the color code designated in Table 6.6.7.1.

6.6.7.3 The stock of spare, individual, thermally activated nozzles shall include all types and ratings installed and shall be as follows:

(1) For systems having fewer than 50 nozzles, not fewer than 3 nozzles
(2) For systems having 50 to 300 nozzles, not fewer than 6 nozzles
(3) For systems having 301 to 1000 nozzles, not fewer than 12 nozzles
(4) For systems having over 1000 nozzles, not fewer than 24 nozzles

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Table 6.6.7.1 Temperature Ratings, Classifications, and Color Coding of Individual, Thermally Activated Nozzles

Maximum Ambient Temperature		Nozzle Temperature Rating		Temperature Classification	Color Code	Glass Bulb Color
°C	°F	°C	°F			
38	100	57 to 77	135 to 170	Ordinary	Uncolored or black	Orange or red
66	150	79 to 107	175 to 225	Intermediate	White	Yellow or green
107	225	121 to 149	250 to 300	High	Blue	Blue
149	300	163 to 191	325 to 375	Extra high	Red	Purple
191	375	204 to 246	400 to 475	Very extra high	Green	Black
246	475	260 to 302	500 to 575	Ultra high	Orange	Black
329	625	343	650	Ultra high	Orange	Black

6.7 Valves.

6.7.1 Valve Listing.

6.7.1.1 Unless the requirements of 6.7.1.2 are met, all valves shall be listed for their intended use.

6.7.1.2 The requirements of 6.7.1.1 shall not apply to valves used only for drains or test connections, which shall be permitted to be approved.

6.7.2 Compatibility. All gaskets, O-rings, sealants, and other valve components shall be constructed of materials that are compatible with the gas or water and any additives contained in the water.

6.7.3 Identification of Valves.

6.7.3.1 All control, drain, and test connection valves shall be provided with permanently marked, weatherproof, metal or rigid plastic identification signs.

6.7.3.2 The sign shall be secured with corrosion-resistant wire, chain, or other approved means.

6.8 Strainers and Filters.

6.8.1 Listing. A system strainer shall be provided downstream of each water supply system, water supply tank, pump, pipe section, fitting, valve, or other piping component having a wetted surface that does not have corrosion resistance equivalent to the materials given in Table 6.3.3.1 or Table 6.4.2.1.

6.8.2* Flow, Pressure, and Duration Sizing. The strainer or filter shall be sized for continuous operation at the required minimum flow and pressure, as verified by hydraulic calculations, for the minimum water supply duration.

6.8.3 Corrosion Resistance. Each system strainer shall have corrosion resistance equivalent to the materials given in Table 6.4.2.1.

6.8.4 Listing. Pipeline strainers and filters shall be listed for use in water supply connections.

6.8.5 Provisions for Cleaning. Pipeline strainer and filter designs shall incorporate a flush-out connection or a cleanout port.

6.8.6 Sizing. Pipeline strainers and filters shall be sized in accordance with 12.5.1.4, 12.5.1.5, and 12.5.1.6.

6.8.7 Nozzle Strainers and Filters. Individual strainers or filters for water mist nozzles, where required by the manufacturer, shall be listed as a part of a nozzle.

6.8.8 Spare Strainers and Filters.

6.8.8.1 Spare pipeline and individual nozzle strainers and filters for water mist nozzles, if replaceable, shall be provided and shall include all types and sizes installed.

6.8.8.2 Spare strainers and filters shall be provided to service the nozzles, if replaceable, for the largest single hazard or group of hazards to be protected simultaneously.

6.9 Pump Systems.

6.9.1 Pumps.

Δ **6.9.1.1 Installation Standard.** Pumps for water mist systems shall be installed in accordance with NFPA 20.

6.9.1.2 Capacity. Pumps shall be designed with capacities in accordance with 12.5.2.

6.9.1.3 Overpressure.

6.9.1.3.1 Pumps capable of overpressurizing the system shall be provided with an approved means of pressure relief to prevent an excessive increase in pressure and temperature.

6.9.1.3.2 Overpressure shall not exceed the design pressure of the piping system.

6.9.1.4 Automatic Start. Pumps shall start automatically upon system actuation.

6.9.1.5* Gauges. Where pump vibrations impact gauge performance, gauges shall be isolated to prevent damage.

6.9.1.6 Pump Information Plate. Pump installations shall have a metal plate that contains the following information:

(1) Rated capacity and rated pressure of each pump
(2) Capacity of pump assembly with all pumps operating
(3) Capacity of individual unloader valve where there is one unloader valve per pump
(4) Capacity of manifold unloader valve where there is one unloader for the entire pump assembly
(5) Pressure setting for each individual unloader valve

6.9.1.7 Unloader Valves. Unloader valves shall be part of a listed pump assembly or be listed separately.

6.9.2 Power Supply.

Δ **6.9.2.1 Installation Standards.** The power supply for pump drivers shall be installed in accordance with NFPA 20, *NFPA 70*, and the manufacturer's listing.

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6.9.2.2 Independent Service Feed. Power supplies for water mist system pumps shall not be required to be fed by an independent service feed to the building.

6.9.2.3 Arrangement. Power supplies for pumps shall be arranged so that if the power supply within the protected facility itself must be disconnected during a fire, the power supply to the pump feeder circuit will not be interrupted.

6.9.3 Controllers.

Δ **6.9.3.1 Listing.** Controllers for pumps shall be listed fire pump controllers and be installed in accordance with NFPA 20.

6.9.3.2 Service-Disconnecting Means.

6.9.3.2.1 A service-disconnecting means in the feeder circuit to controllers shall be permitted where acceptable to the authority having jurisdiction, provided the disconnecting means is supervised in the proper position in accordance with 6.9.3.2.2.

6.9.3.2.2 Supervision for proper position shall be by one of the following methods:

(1) Central station, proprietary, or remote station signaling service
(2) Local electrical supervision through use of a signaling service that causes a supervisory signal at a constantly attended location
(3) Locking of the disconnecting means in the proper position, with monthly recorded inspections

6.10 Detection, Actuation, Alarm, and Control Systems.

6.10.1 General.

6.10.1.1 Installation, Testing, and Maintenance Standards. Detection, actuation, alarm, and control systems shall be installed, tested, and maintained in accordance with the following protective signaling systems standards as applicable:

(1) *NFPA 70, National Electrical Code*
(2) *NFPA 72, National Fire Alarm and Signaling Code*
(3) CAN/ULC S524-14, *Standard for the Installation of Fire Alarm Systems* (in Canada)
(4) CAN/ULC S529-16, *Standard for Smoke Detectors for Fire Alarm Systems* (in Canada)

6.10.1.2 Automatic Systems. Unless the requirements of 6.10.1.3 are met, where a detection system is used to actuate the water mist system and additive system where used, detection and actuation shall be automatic.

6.10.1.3 Manual Systems. The requirements of 6.10.1.2 shall not apply to manual-only actuation systems where approved by the authority having jurisdiction.

6.10.2 Automatic Detection.

Δ **6.10.2.1* Listing.** Automatic detection shall be by listed equipment installed in accordance with *NFPA 72*.

6.10.2.2 Primary and Standby Power. Adequate and reliable primary and 24-hour minimum standby sources of energy shall be used to provide for operation of the detection, signaling, control, and actuation requirements of the systems.

6.10.2.3 Existing Detection Systems. If an existing detection system is used in a new water mist system, the detection system shall comply with the requirements of this standard.

6.10.3 Operating Devices.

6.10.3.1 Devices. Operating devices shall include water mist releasing devices or valves, discharge controls, and shutdown equipment necessary for successful performance of the system.

6.10.3.2 Operating Methods. Operation shall be by listed mechanical, electrical, or pneumatic equipment. An adequate and reliable source of energy shall be used.

6.10.3.3 Service Conditions. Devices shall be designed for the service they are to encounter and shall not be rendered inoperative or susceptible to accidental operation.

6.10.3.4 Temperature Limitations. Devices shall be designed to function from a minimum range of 4°C to 54°C (40°F to 130°F), or devices designed to function outside of this range shall be so indicated.

6.10.3.5 Emergency Release Device.

6.10.3.5.1 An emergency release device for the system shall be provided.

6.10.3.5.2 The emergency release device shall be activated by a single manual operation.

6.10.3.5.3 This operation shall be accomplished by a mechanical manual release or by an electrical manual release when the control equipment that monitors the battery voltage level of the standby battery supply indicates a low battery signal.

6.10.3.5.4 The release shall cause simultaneous operation of automatically operated valves that control agent release and distribution.

6.10.3.5.5 Unless the requirements of 6.10.3.5.6 are met, the battery shall be sized to accomplish all functions.

6.10.3.5.6 The requirements of 6.10.3.5 shall not apply to dry and wet pipe systems utilizing individual, thermally activated nozzles.

6.10.3.6 Manual Release Device.

6.10.3.6.1 The manual release device(s) shall be located so as to be accessible at all times.

6.10.3.6.2 The manual release device(s) shall be of distinct appearance and clearly recognizable for the purpose intended.

6.10.3.6.3 Operation of any manual release device shall cause the system to operate in accordance with the design or listing.

6.10.3.6.4 The manual release device(s) shall not require a force of more than 178 N (40 lbf) nor a movement of more than 356 mm (14 in.) to cause activation.

6.10.3.6.5 At least one manual release device for activation shall be located not more than 1.2 m (4 ft) above the floor.

6.10.3.6.6 All devices for shutting down supplementary equipment shall be integral parts of the system and shall function with the system in operation.

6.10.3.6.7 All manual devices shall be identified as to the hazard they protect.

6.10.3.6.8 The requirements of 6.10.3.6 shall not apply to dry and wet pipe systems utilizing individual thermally activated nozzles.

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6.10.3.7* Supplementary Equipment and Interfaces. All devices for shutting down supplementary equipment or interface with other systems, necessary for effective operation of the water mist system, such as fuel shutoff and ventilation shutoff, shall be considered integral parts of the system and shall function with the system operation unless specifically permitted by the listing.

6.10.4 Control Equipment.

Δ **6.10.4.1 Electrical Control Equipment.** Automatic control equipment shall be listed and installed in accordance with *NFPA 72*.

6.10.4.2 Listing. The control unit shall be listed for release device service.

6.10.4.3 Pneumatic Control Equipment.

6.10.4.3.1* Pneumatic control lines shall be protected against crimping and mechanical damage.

6.10.4.3.2 Unless the requirements of 6.10.4.3.3 or 6.10.4.3.4 are met, pneumatic control lines used to activate the system shall be supervised.

6.10.4.3.3 The requirements of 6.10.4.3.2 shall not apply to pneumatically operated control lines immediately adjacent to the pressurizing source.

6.10.4.3.4 The requirements of 6.10.4.3.2 shall not apply to pneumatic control lines from master to slave cylinders that are located in close proximity to one another.

6.10.4.3.5 The control equipment shall be specifically listed for the number and type of actuating devices utilized, and their compatibility shall have been listed.

6.11 Compatibility. All components of pneumatic, hydraulic, or electrical systems shall be compatible.

Chapter 7 System Requirements

7.1* General. Water mist systems shall be described by the following four parameters as appropriate:

(1) System application
(2) Nozzle type
(3) System operation method
(4) System media type

7.2 System Applications. System applications shall consist of one of the following four categories:

(1) Local-application systems
(2) Total compartment application systems
(3) Zoned application systems
(4) Occupancy protection systems

7.2.1 Local-Application Systems.

7.2.1.1 Local-application systems shall be designed and installed to provide complete distribution of mist on or around the hazard or object to be protected.

7.2.1.2 Local-application systems shall be designed to protect an object or a hazard in an enclosed, unenclosed, or open outdoor condition.

7.2.1.3 Local-application systems shall be actuated by either an automatic nozzle or by an integrated detection system with non-automatic water mist nozzles.

7.2.2 Total Compartment Application Systems.

7.2.2.1 Total compartment application systems shall be designed and installed to provide complete protection of an enclosure or space.

7.2.2.2* The complete protection of an enclosure or space shall be achieved by the simultaneous operation of all nozzles in the space by manual or automatic means.

7.2.3* Zoned Application Systems.

7.2.3.1 Zoned application systems shall be designed to protect a predetermined portion of the compartment by the activation of a selected group of nozzles.

7.2.3.2 Zoned application systems shall be designed and installed to provide complete mist distribution throughout a predetermined portion of an enclosure or space. This shall be achieved by simultaneous operation of a selected group of nozzles in a predetermined portion of the space by manual or automatic means or by an independent detection system.

7.2.4 Occupancy Protection Systems.

7.2.4.1 Occupancy protection systems shall be designed and installed to provide automatic fire protection throughout a building or occupancy.

Δ **7.2.4.2** Occupancy protection systems or devices shall be listed for the intended occupancy classification as described in Chapter 5 unless otherwise permitted in this standard.

7.2.4.3 Occupancy protection systems utilized as fire protection within buildings or occupancies shall be of the wet pipe, dry pipe, or pre-action type.

7.2.4.4 Occupancy protection systems shall be actuated by automatic water mist nozzles or by an integrated detection system.

7.3 Nozzle Types. Water mist nozzles shall be classified as one of the following three types:

(1) Automatic
(2) Nonautomatic
(3) Multifunctional

7.4 System Requirements.

7.4.1 Deluge Systems.

7.4.1.1 Deluge systems shall employ nonautomatic nozzles (open) attached to a piping network connected to the fluid supply(ies) through a valve controlled by an independent detection system installed in the same area as the mist nozzles.

7.4.1.2 When the valve(s) is activated, the fluid shall flow into the piping network and discharge from all nozzles attached thereto.

7.4.2 Wet Pipe Systems. Wet pipe systems shall employ automatic nozzles attached to a piping network pressurized with water up to the nozzles.

7.4.3 Preaction Systems.

7.4.3.1 Preaction systems shall employ automatic nozzles attached to a piping network containing a pressurized gas with

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a supplemental, independent detection system installed in the same area as the nozzles.

N **7.4.3.2** Preaction systems shall be one of the following types:

(1) A non-interlock system, which admits water to the water mist system on operation of the detection devices or automatic water mist nozzles
(2) A single interlock system, which admits water to the water mist system piping on actuation of detection devices
(3) A double interlock system, which admits water to the water mist system piping on operation of both detection devices and automatic nozzles

N **7.4.3.3** Preaction systems shall be designed and installed in accordance with the specifications developed for their listing in accordance with 9.4.5.

N **7.4.3.4** Preaction systems shall not use a gridded piping configuration.

N **7.4.3.5** The preaction system size shall be designed to deliver water mist to the most remote nozzle at no more than the maximum water mist delivery time from the listing for the application, starting at the normal air pressure on the system, with the detection system activated and the inspection test connection located for the most remote automatic nozzle fully opened simultaneously.

N **7.4.3.6** System operation tests shall be conducted to verify the actual water mist delivery time in accordance with 14.2.6.

N **7.4.3.7** The pressurized piping in all preaction systems shall be supervised to ensure system integrity.

7.4.3.8 Operation of the detection system shall actuate a listed tripping device that opens the valve, pressurizing the pipe network with water to the automatic nozzles.

N **7.4.3.8.1** The listed tripping device shall be provided with hydraulic, pneumatic, or mechanical manual means for operation that is independent of detection devices and of the automatic water mist nozzles.

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N **7.4.3.9** The automatic detection for the preaction system shall be provided in accordance with 6.10.2.

7.4.4 Dry Pipe Systems.

7.4.4.1 Dry pipe systems shall employ automatic nozzles attached to a piping network containing a pressurized gas.

7.4.4.2 The loss of pressure in the piping network shall activate a control valve, which causes water to flow into the piping network and out through the activated nozzles.

7.4.4.3 The pressurized piping in all dry pipe systems shall be supervised to ensure system integrity.

7.5* Media System Types. Water mist systems shall be classified by two media system types:

(1) Single fluid
(2) Twin fluid composed of water and atomizing media

7.6 Additive Systems. The additive manufacturer or system provider shall be consulted and performance specifications shall be provided to ensure proper operation and reliability. Where additives are used to enhance fire performance, system proportioning accuracy shall comply with the appropriate standards.

Chapter 8 Installation Requirements

8.1 General. This chapter provides requirements for the installation of water mist system components.

8.1.1* Listing. Listed materials and devices shall be installed in accordance with their listing.

8.1.2 Design and Installation Manual. Materials and devices shall be installed in accordance with the manufacturer's system design and installation manual.

8.1.3 Corrosive Environments. Systems installed in corrosive environments shall comply with 6.1.3.

8.1.4 Mechanical and Chemical Damage. System components shall be located, installed, or suitably protected so they are not subject to mechanical, chemical, or other damage that could render them inoperative.

8.1.5 Installation and Testing Procedures. Manufacturers shall provide installation and testing procedures to ensure that the system is installed and will operate as intended.

8.1.6 Occupancy Protection Systems.

8.1.6.1 Spacing and Location of Automatic Water Mist Nozzles. The requirements for spacing, location, and position of water mist nozzles shall be based on the following:

(1) Water mist nozzles shall be installed throughout the building or occupancy being protected, except where permitted to be omitted from areas as referenced in this standard or by the listing.
(2) Water mist nozzles shall be positioned and located so as to provide satisfactory performance with respect to activation time and distribution pattern.
(3) When nozzles are specifically tested and the test results demonstrate that deviations from clearance requirements to obstructions do not impair the ability of the system to control or suppress a fire, positioning and locating the nozzles in accordance with the test results shall be permitted.
(4) Nozzles shall be located so as not to exceed the spacing criteria specified by the manufacturer in the system design, installation, and operations manual.

8.1.6.1.1 Clearance between nozzles and ceilings exceeding the maximums specified in the standard or in the manufacturer's design, installation, and operations manual shall be permitted, provided that tests or calculations demonstrate performance of the automatic water mist nozzles comparable to those installed in conformance with this standard.

8.1.6.1.2 Furniture, portable wardrobe units, cabinets, trophy cases, and similar objects or features not intended for occupancy, whether freestanding or attached to the finished structure, do not require nozzles to be installed in them.

8.1.6.2 System Protection Area Limitations. The maximum area on any one floor to be protected by water mist supplied by any one water mist system riser or combined system riser shall be as follows:

(1) Light hazard: 4831 m^2 (52,000 ft^2)
(2) Ordinary hazard: 4831 m^2 (52,000 ft^2)

8.1.6.3 Mezzanines. Mezzanine floor areas shall not be included in the area limits of 8.1.6.2.

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8.1.6.4 Multiple Buildings. Multiple buildings attached by canopies, covered breezeways, common roofs, or a common wall(s) shall be permitted to be supplied by a single system riser provided that the maximum system size complies with 8.1.6.2.

8.2 Nozzles.

8.2.1 General. Nozzles shall be installed in accordance with the manufacturer's listing.

8.2.2 Nozzle Height Limitations. The minimum and maximum heights shall be in accordance with the manufacturer's listing.

8.2.3 Nozzle Spacing Limitations. The minimum and maximum distances between nozzles shall be in accordance with the manufacturer's listing.

8.2.4 Distance from Walls. The minimum and maximum distance from nozzles to walls or partitions shall be in accordance with the manufacturer's listing.

8.2.5* Obstructions to Nozzle Discharge. The location of nozzles with respect to continuous or discontinuous obstructions shall be in accordance with the manufacturer's listing.

8.2.6 Distance Below Ceilings. The distance between the nozzle and the ceiling shall be in accordance with the range (minimum and maximum) identified in the manufacturer's listing.

8.2.7 Spacing Under Pitched or Curved Surfaces. The distance between nozzles in or under a pitched or curved surface shall be in accordance with the manufacturer's listing.

8.2.8 Nozzle Protection.

8.2.8.1 Nozzles subject to mechanical damage shall be protected with listed guards.

8.2.8.2 Guards shall not significantly reduce the effectiveness of the nozzle.

8.2.9 Escutcheons and Cover Plates.

8.2.9.1 Escutcheons used in a recessed or flush-type nozzle installation shall be a part of a listed nozzle assembly.

8.2.9.2 Nonmetallic escutcheons shall be listed.

8.2.9.3 Cover plates used with concealed nozzles shall be part of the listed assembly.

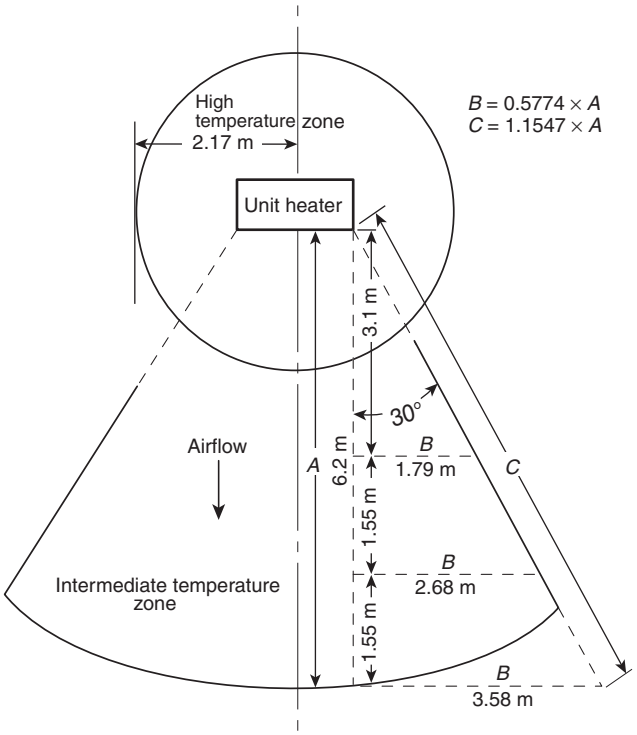
8.2.10 Thermally Activated Nozzle Temperature Ratings.

8.2.10.1 Temperature ratings shall be selected as follows:

(1) Where the maximum ceiling temperature does not exceed 38°C (100°F), ordinary temperature nozzles shall be permitted to be used throughout.
(2) Where maximum ceiling temperatures exceed 38°C (100°F), nozzles with temperature ratings in accordance with the maximum ambient temperatures of Table 6.6.7.1 shall be used.
(3) High temperature nozzles shall be permitted to be used throughout.
(4) Where high temperature nozzles are not utilized throughout, nozzles of intermediate and high temperature classifications shall be installed in specific locations as required by 8.2.10.2.

8.2.10.2 The following practices shall be observed to provide nozzles of other than ordinary temperature classification unless other temperatures are determined or unless high temperature nozzles are used throughout. *[See Figure 8.2.10.2, Table 8.2.10.2(a), and Table 8.2.10.2(b).]*

(1) Nozzles in the high temperature zone shall be of the high temperature classification, and nozzles in the intermediate temperature zone of the intermediate temperature classification.
(2) Nozzles located within 305 mm (12 in.) to one side or 762 mm (30 in.) above an uncovered steam main, heating coil, or radiator shall be of the intermediate temperature classification.
(3) Nozzles within 2.1 m (7 ft) of a low pressure blowoff valve that discharges free in a large room shall be of the high temperature classification.
(4) Nozzles under glass or plastic skylights exposed to the direct rays of the sun shall be of the intermediate temperature classification.
(5) Nozzles in an unventilated, concealed space, under an uninsulated roof, or in an unventilated attic shall be of the intermediate temperature classification.
(6) Nozzles in unventilated show windows having high-powered electric lights near the ceiling shall be of the intermediate temperature classification.
(7) Nozzles protecting commercial-type cooking equipment and ventilation systems shall be of the high or extra high temperature classification as determined by use of a temperature measuring device.



For U.S. units: 1 m = 3.23 ft

FIGURE 8.2.10.2 High Temperature and Intermediate Temperature Zones at Unit Heaters.

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Δ Table 8.2.10.2(a) Temperature Ratings of Nozzles Based on Distance from Heat Sources

	Type of Heat Condition	Ordinary Degree Rating	Intermediate Degree Rating	High Degree Rating
1.	Heating ducts			
	(a) Above	More than 775 mm (2 ft 6 in.)	775 mm (2 ft 6 in.) or less	
	(b) Side and below	More than 310 mm (1 ft 0 in.)	310 mm (1 ft 0 in.) or less	
	(c) Diffuser	Any distance except as shown in Intermediate Degree Rating column	*Downward discharge:* Cylinder with 310 mm (1 ft 0 in.) radius from edge, extending 310 mm (1 ft 0 in.) below and 775 mm (2 ft 6 in.) above *Horizontal discharge:* Semi-cylinder with 775 mm (2 ft 6 in.) radius in direction of flow, extending 310 mm (1 ft 0 in.) below and 775 mm (2 ft 6 in.) above	
2.	Unit heater			
	(a) Horizontal discharge		*Discharge side:* 2.2 m to 6.2 m (7 ft 0 in. to 20 ft 0 in.) radius pie-shaped cylinder *(see Figure 8.2.10.2)* extending 2.2 m (7 ft 0 in.) above and 620 mm (2 ft 0 in.) below heater; also 2.2 m (7 ft 0 in.) radius cylinder more than 2.2 m (7 ft 0 in.) above unit heater	2.2 m (7 ft 0 in.) radius cylinder extending 2.2 m (7 ft 0 in.) above and 620 mm (2 ft 0 in.) below unit heater
	(b) Vertical downward discharge		2.2 m (7 ft 0 in.) radius cylinder extending upward from an elevation 2.2 m (7 ft 0 in.) above unit heater	2.2 m (7 ft 0 in.) radius cylinder extending from the top of the unit heater to an elevation 2.2 m (7 ft 0 in.) above unit heater
3.	Steam mains (uncovered)			
	(a) Above	More than 775 mm (2 ft 6 in.)	775 mm (2 ft 6 in.) or less	
	(b) Side and below	More than 310 mm (1 ft 0 in.)	310 mm (1 ft 0 in.) or less	
	(c) Blowoff valve	More than 2.2 m (7 ft 0 in.)		2.2 m (7 ft 0 in.) or less

8.2.10.3 In case of occupancy change involving temperature change, the nozzles shall be changed accordingly.

8.3 Pipe and Tubing.

8.3.1 Installation Manual. Piping and tubing for water mist systems shall be installed in accordance with the manufacturer's installation manual.

8.3.2 Installation Standards. All water and atomizing media piping and tubing for water mist systems shall be installed in accordance with one of the following:

(1) ASME B31.1, *Power Piping Code*
(2) BS EN-13480-3, *Metallic Industrial Piping Design and Calculation*
(3) NFPA 13, *Standard for the Installation of Sprinkler Systems*, only for water piping, in low-pressure systems
(4) Piping installed in accordance with its listing where the listing criteria are different from ASME B31.1, *Power Piping Code*, or BS EN-13480-3, *Metallic Industrial Piping Design and Calculation*

8.3.3 Listing. Any flexible piping, tubing, hose, or combination thereof shall be constructed and installed in accordance with the manufacturer's listing.

8.3.4 Piping Support.

8.3.4.1 The system piping shall be supported by structural elements that are independent of the ceiling sheathing to

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Δ Table 8.2.10.2(b) Ratings of Nozzles in Specified Locations

Location	Ordinary Degree Rating	Intermediate Degree Rating	High Degree Rating
Skylights		Glass or plastic	
Attics	Ventilated	Unventilated	
Peaked roof: Metal or thin boards, concealed or not concealed, insulated or uninsulated	Ventilated	Unventilated	
Flat roof: Metal, concealed, insulated or uninsulated	Ventilated or unventilated	Note: For uninsulated roof, climate and occupancy could necessitate intermediate nozzles. Check on job.	
Flat roof: Metal, concealed, insulated or uninsulated	Ventilated	Unventilated	
Show windows	Ventilated	Unventilated	

Table 8.3.4.2 Tube Hanger Maximum Spacing

Tube O.D.		Maximum Distance Between Hangers	
mm	in.	m	ft
6–14	¼, ⅜, ½	1.21	4.0
15–22	¾–⅞	1.52	5.0
23–28	1	1.82	6.0
30–38	1¼–1½	2.12	7.0
40–49		2.42	8.0
50–59		3.00	10.0
60–70		3.33	11.0
71–89		3.64	12.0
90–108		3.94	13.0

prevent lateral and horizontal movement upon system actuation.

8.3.4.2 Tube hangers shall be spaced in accordance with Table 8.3.4.2.

8.3.5 System Drainage. All system piping and fittings shall be installed so that the entire system can be drained.

8.3.6 Location of Hangers and Supports.

8.3.6.1 Hangers and supports shall be located in accordance with the requirements contained within the system's design manual.

Δ 8.3.6.2 For low pressure and intermediate systems, steel pipe and copper tubing shall be supported in accordance with NFPA 13.

8.3.6.3 The length of an unsupported arm over to a nozzle shall not exceed 0.6 m (2 ft) for steel pipe or 0.3 m (1 ft) for steel tubing.

Δ 8.3.7* Protection of System Components Against Damage Where Subject to Earthquakes. Where subject to earthquakes, water mist systems shall be protected to prevent pipe breakage in accordance with the seismic requirements of NFPA 13.

8.4 Fittings.

8.4.1 Listing. All system fittings shall be installed in accordance with the manufacturer's listing.

Δ 8.4.2 Low Pressure Systems. In addition to the requirements of 8.4.1, all fittings installed in low pressure water mist systems shall conform to NFPA 13.

8.5 Gas and Water Storage Containers.

8.5.1 Listing. Storage containers shall be installed, mounted, and braced in accordance with the manufacturer's listing.

8.5.2 Accessibility. Storage containers and accessories shall be installed so that inspection, testing, recharging, and other maintenance are facilitated and interruption to protection is held to a minimum.

8.5.3* Location. Storage containers shall be located as close as possible to the hazard or within the hazards they protect and shall not be exposed to fire or mechanical damage in a manner that affects performance.

8.5.4 Damage. Storage containers shall be protected from severe weather conditions and from mechanical, chemical, or other damage.

8.5.5 High Pressure Storage Containers.

8.5.5.1 Standards. High pressure vessels or cylinders shall be constructed, tested, and marked in accordance with recognized international standards, such as the U.S. Department of Transportation, 49 CFR, 171-190, 178.36-178.37, specifications (in effect upon date of manufacture and test) for DOT-3A, 3AA-1800, or higher seamless steel cylinders.

8.5.5.2 Preshipping Testing. Charged cylinders shall be tested for tightness before shipment in accordance with an approved procedure.

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8.5.5.3 Manifolded Cylinders.

8.5.5.3.1 Where manifolded, cylinders shall be mounted and supported in a rack provided for this purpose, including facilities for convenient, individual servicing or weighing of contents.

8.5.5.3.2* When any cylinder is removed for maintenance, automatic means shall be provided to prevent leakage from the manifold if the system is operated.

8.5.5.4 Storage Temperatures.

8.5.5.4.1 Storage temperatures shall be maintained within the range specified in the manufacturer's listing.

8.5.5.4.2 External heating or cooling shall be an approved method to keep the temperature of the storage container within desired ranges.

8.5.5.5 Container Securement. Containers shall be secured with manufacturer-listed supports to prevent container movement and possible physical damage.

8.5.6 Intermediate and Low Pressure Storage Cylinders.

8.5.6.1 Unless the requirements of 8.5.6.3 are met, the pressure vessel shall be made, tested, approved, equipped, and marked in accordance with the current specifications of the ASME *Boiler and Pressure Vessel Code*, Section VIII, or the requirements of U.S. Department of Transportation, 49 CFR, 171-190, 178.36-178.37, or other approved international standards.

8.5.6.2 The system design pressure shall be in accordance with the manufacturer's listing.

8.5.6.3 The requirements of 8.5.6.1 shall not apply to pressure vessels for heated water mist systems, which shall be in accordance with the manufacturer's listing.

8.5.6.4 Each pressure vessel shall be equipped with a liquid level gauge, a pressure gauge, and a high/low pressure supervisory alarm set at the values identified in the manufacturer's listing.

8.5.6.5 Media storage containers that become pressurized only during system activation shall not require high/low pressure supervisory alarms.

8.5.6.6 Storage Temperature.

8.5.6.6.1 Storage temperatures shall be maintained within the range specified in the manufacturer's listing.

8.5.6.6.2 External heating or cooling shall be an approved method to keep the temperature of the storage container within desired ranges.

8.5.6.7 Securement. Containers shall be secured with manufacturer-listed supports to prevent container movement and possible physical damage.

8.6 Pumps and Pump Controllers.

8.6.1* Sizing. Pumps shall be sized to meet the required system water flow rate, at the minimum system pressure, as determined by hydraulic calculations.

8.6.2 Automatic Start. Pumps shall start automatically and shall supply water to the water mist system until manually shut off or automatically shut off in accordance with the manufacturer's listing.

8.6.3 Supervisory Service. Unless the requirements of 8.6.4 are met, pumps shall be provided with supervisory service from a listed central station, proprietary, or remote station system or equivalent.

8.6.4 Single Family Dwellings. The requirements of 8.6.3 shall not apply to pumps for single-family dwellings.

Δ **8.6.5 Test Fittings or Hose Outlets.** Pumps shall be equipped with a test fitting or hose outlet on the discharge side of the pump to facilitate the annual full-flow pump test required per NFPA 25.

8.7 Strainers and Filters.

8.7.1 Location. Strainers and filters shall be provided at all water supply connections in accordance with Chapter 12.

8.7.2 Installation. Filters and strainers shall be installed to minimize potential head loss due to accumulation of particulates.

8.8 Valves and Pressure Gauges.

8.8.1 General.

8.8.1.1 All valves shall be installed in accordance with the manufacturer's listing.

8.8.1.2 Valves having components that extend beyond the valve body shall be installed in a manner that does not interfere with the operation of any system components.

8.8.1.3 All valves shall be listed for their particular application and installation.

8.8.1.4 Valves forming part of a listed system shall not be required to be individually listed.

8.8.1.5 Valve Identification.

8.8.1.5.1 All control, drain, and test connection valves shall be provided with permanently marked, weatherproof, metal or rigid plastic identification signs.

8.8.1.5.2 The sign shall be secured by corrosion-resistant wire or chain or by other approved means.

8.8.1.6 Valve Accessibility. System valves and gauges shall be installed such that they are accessible for operation, inspection, and maintenance.

8.8.1.7 Indicating Valves.

8.8.1.7.1 Unless the requirements of 8.8.1.7.2 are met, at least one listed indicating valve shall be installed in each source of water supply.

8.8.1.7.2 The requirements of 8.8.1.7 shall not apply to systems with a single water supply source comprised of a self-contained system (cylinders, containers).

8.8.1.8 Valve Supervision.

8.8.1.8.1 Valves on connections to water supplies, sectional control and isolation valves, and other valves in supply pipes to nozzles and other fixed water-based fire suppression systems shall be supervised by one of the following methods:

(1) Central station, proprietary, or remote station signaling service
(2) Local signaling service that will cause the sounding of an audible signal at a constantly attended point

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(3) Valves locked in the correct position
(4) Valves located within fenced enclosures under the control of the owner, sealed in the open position, and inspected weekly as part of an approved procedure

Δ **8.8.1.8.2** Valves controlling manual system activation shall not be locked and shall be supervised in accordance with 8.8.1.8.1(1), 8.8.1.8.1(2), or 8.8.1.8.1(3).

8.8.2 Control and Activation Valves.

8.8.2.1 Control and activation valves shall include any device or valve that automatically opens to supply water to the nozzles after the detection of a fire.

8.8.2.2 Control and activation valves shall operate by an approved mechanical, electrical, or pneumatic means.

8.8.2.3 Control and activation valves shall be installed such that they are not subject to mechanical, chemical, or other damage that would render them inoperative.

8.8.3 Pressure Regulating Valves, Pressure Relief Valves, and Unloader Valves.

8.8.3.1 Valves for Use with Water.

8.8.3.1.1 Pressure regulating valves shall be installed in any portion of the system where the potential exists for the working pressure to exceed the system design pressure of the system, the system components, or both.

8.8.3.1.2 These valves shall open at a pressure greater than the working pressure and less than the system design pressure.

8.8.3.1.3 A relief valve of not less than 13 mm (½ in.) shall be provided on the discharge side of the pressure regulating valve that is set to operate at a pressure not exceeding the system design pressure.

8.8.3.1.4 Unless the requirements of 8.8.3.1.5 are met, a listed indicating valve shall be provided on the inlet side of each pressure reducing valve.

8.8.3.1.5 The requirements of 8.8.3.1.4 shall not apply where the pressure regulating valve meets the listing requirements for use as an indicating valve.

8.8.3.1.6 A waterflow test valve that is sized to produce the designed flow of the pressure reducing valve shall be installed on the downstream side of the pressure reducing valve.

8.8.3.1.7 A sign indicating the correct discharge pressure for static and residual pressures shall be attached to the pressure reducing valve.

8.8.3.1.8 Unloader valves shall not be required to meet the requirements of 8.8.3.1.1 through 8.8.3.1.7.

8.8.3.1.9 Unloader valves shall meet the requirements of NFPA 20, Chapter 8.

8.8.3.2 Compressed Gas Pressure Regulating Valves (PRVs).

8.8.3.2.1 PRVs shall be installed in accordance with the manufacturer's listing.

8.8.3.2.2 PRVs shall be installed where the supply pressure is higher than the system design pressure of the water mist system.

8.8.3.2.3 PRVs shall be capable of providing a stable regulating output at the rated flow capacity and design set point over the full range of input pressures that will be experienced over the course of the discharge period.

8.8.3.2.4 Downstream pressure drift under no-flow conditions shall not exceed the lesser of the downstream components' pressure rating or the pressure relief valve set point, if provided.

8.8.3.2.5 Pressure set, point-adjusting mechanisms on the PRVs shall be tamper resistant, and the adjustment shall be indicated by a permanent marking.

8.8.3.2.6 A means to indicate evidence of tampering shall be provided.

8.8.3.2.7 The PRVs' set point shall be set by the manufacturer.

8.8.3.2.8 Permanent markings shall indicate the inlet and outlet connections of the PRVs.

8.8.4 Check Valves and Backflow Preventers.

8.8.4.1 Check valves shall be installed in accordance with the manufacturer's listing.

8.8.4.2 A check valve shall be installed between the system and the point of permanent connection to a potable water supply.

8.8.4.3 Where additives are used in the water mist system, either by injection into flowing lines or by premixing into stored water sources, a backflow preventer shall be installed between the system control valve or stored water supply and a permanent connection to a potable water supply.

8.8.4.4 Check valves shall be installed in the main feed lines, near the control valves of both the water and pneumatic system piping of a twin-fluid system, to prevent the backflow of water or atomizing fluid into the companion piping.

8.8.4.4.1 Where the water and atomizing fluid are separated by an air gap, check valves shall be permitted to be omitted.

8.8.5 Pressure Gauges.

8.8.5.1 Pressure gauges shall be installed in the following locations:

(1) On both sides of a pressure regulating valve
(2) On the pressurized side of all supply connections
(3) On the pressurized side of all system control valves
(4) On all pressurized storage containers
(5) On all air supplies for dry pipe and preaction systems
(6) When multiple gas cylinders are employed with their individual cylinder valves sealed or supervised in the open position and connected to a pressurized manifold, a single pressure gauge on the pressurized section of the manifold shall be permitted for indicating the pressure in all the gas cylinders.

8.8.5.2 The required pressure gauges shall be compatible with their intended use and shall have an operating range not less than twice the working pressure of the system.

8.9 Electrical Systems.

8.9.1 Electrical Equipment.

Δ **8.9.1.1** Electrical equipment associated with water mist systems shall be installed in accordance with the requirements of *NFPA 70*.

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Δ **8.9.1.2*** All signaling system circuits and wiring shall be installed in accordance with *NFPA 72*.

Δ **8.9.1.3*** All signaling line circuits and wiring shall be installed in accordance with *NFPA 72*, Style 6.

8.9.2 Control Equipment.

8.9.2.1 Installation Standards. Electrical fire detection and control equipment used to activate water mist systems shall be installed in accordance with the following:

(1) *NFPA 70, National Electrical Code*
(2) *NFPA 72, National Fire Alarm and Signaling Code*
(3) Other approved, recognized standards and the manufacturer's recommendations

Δ **8.9.2.2 Supervision.** All circuitry that is monitoring or controlling the water mist system shall be electrically supervised in accordance with *NFPA 72*.

8.9.2.3 Primary and Standby Power. Approved primary and 24-hour minimum standby sources of energy shall be used to provide for the operation of the detection, signaling, control, and actuation requirements of the system.

8.9.2.4 Alarms.

8.9.2.4.1 Alarms shall be provided to indicate system waterflow and system trouble.

8.9.2.4.2 Trouble and supervisory signals shall include power failure, operation (closing) of monitored valving, and electrical faults in the detection/activation of pump power control systems.

8.9.2.4.3 These alarms shall be both visible and audible inside the protected space, at the location of the primary system components (e.g., pumps, storage tanks), and in a continuously attended location.

8.9.2.4.4 The system activation alarm shall be distinctly different from the system trouble signal to prevent confusion.

8.9.3 Fire Detection.

Δ **8.9.3.1*** Where electrically operated automatic fire detection systems are used, the installation shall be in accordance with *NFPA 72*.

8.9.3.2 Approved primary and 24-hour minimum standby sources of energy shall be used to provide for operation of the detection, signaling, control, and actuation requirements of the system.

8.9.3.3 Where a new water mist system is installed in a space that has an existing detection system, an analysis shall be made of the detection devices to ensure that the detection system meets the requirements of the water mist system listing and that the detection system is in operating condition.

8.9.4 Automatic and Manual Activation.

8.9.4.1 Unless the requirements of 8.9.4.2 are met, a means of automatic operation of the water mist system shall be provided.

8.9.4.1.1 Automatic operation shall be accomplished by means of automatic nozzles (independently thermally activated), automatic group control valves, or an independent automatic fire detection system, coupled with a listed system activation panel.

8.9.4.2 The requirements of 8.9.4.1 shall not apply to manual-only actuation systems where approved by the authority having jurisdiction.

8.9.4.3 A means of manual release of the system shall be installed and arranged in accordance with 6.10.3.

8.10 Test Connections.

8.10.1* A test connection shall be provided at the most hydraulically remote point on the water mist system.

8.10.2 The inside diameter shall not be less than the largest orifice diameter used in the water mist system.

8.10.3 Discharge from the test connection shall be piped to a safe discharge location.

8.10.4 Where occupancy conditions prohibit water from being discharged from the most hydraulically remote point, a test connection shall be provided immediately upstream of each hazard area protected.

Chapter 9 Design Objectives and Fire Test Protocols

9.1* General.

9.1.1 Listing. Water mist protection systems shall be designed and installed for the specific hazards and protection objectives specified in the listing.

9.1.2 Application Characteristics. The characteristics of the specific application (compartment variables and hazard classification) shall be consistent with the listing of the system.

9.1.3 Application Evaluations. An evaluation of the compartment geometry, fire hazard, and system variables described in this chapter shall be performed to ensure that the system design and installation are consistent with the system listing.

9.1.4 Pre-Engineered Systems. Pre-engineered water mist systems for compartment enclosures shall not be extrapolated beyond the volume, ceiling height, ventilation rate, and number of nozzles tested, unless dimensions of the enclosure are such that additional nozzles are required to maintain nozzle spacing.

9.2* Listing Evaluations.

9.2.1* Scope. Listing of water mist fire protection systems or devices shall be based on a comprehensive evaluation designed to include fire test protocols, system components, and the contents of the manufacturer's design and installation manual.

9.2.2* Fire Test Protocols. Fire test protocols shall be designed to address performance objectives of the application specified in the listing and the application parameters described in Section 9.4.

9.2.3 Application Parameters.

9.2.3.1 Application parameters shall be the features that define an application.

9.2.3.2 Application parameters shall include compartment variables (such as height, volume, obstructions, and ventilation), fire hazard (fuel type and configuration), and occupancy, with consideration of performance objectives specific to the application.

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9.2.4 Applicability.

9.2.4.1 Fire test protocols shall be designed to replicate the range of the application parameters associated with a particular hazard or occupancy.

Δ **9.2.4.2** Water mist systems designed to provide fire protection within a building or occupancy shall be listed for the appropriate occupancy classifications as described in Chapter 5.

9.2.5 Testing. Test protocols shall be conducted to verify the working limits and installation parameters of the system and its components, as described in the manufacturer's design and installation manual.

9.2.6 Design and Installation Manual.

9.2.6.1 The system design and installation manual evaluated by the listing tests shall identify the working limits and parameters of the system, the fire hazards, and the range of compartment variables for which the listing is applicable.

Δ **9.2.6.2** It shall also include recommended installation, testing, inspection, and maintenance procedures and, by reference, the requirements of NFPA 750.

9.3 Performance Objectives.

9.3.1* Fire Performance Objectives. The fire-fighting performance objectives of a water mist system shall be described using at least one of the following three terms:

(1) Control
(2) Suppression
(3) Extinguishment

9.3.1.1 Fire Control. Fire control shall be measured using three basic approaches:

(1) A reduction in the thermal exposure to the structure, where the primary objective is to maintain the structural integrity of the building (e.g., prevent flashover)
(2) A reduction in the threat to occupants, where the primary objective is to minimize the loss of life
(3) A reduction in a fire-related characteristic, such as heat release rate, fire growth rate, or spread to adjacent objects

9.3.1.2 Fire Suppression. Fire suppression is the sharp reduction in the heat release rate of a fire and the prevention of its regrowth by a sufficient application of water mist.

9.3.1.3 Fire Extinguishment. Fire extinguishment is the complete suppression of a fire until there are no burning combustibles.

9.4 Application Parameters.

9.4.1* Compartment Variables. Compartment variables shall include both the geometry of the compartment and the ventilation conditions in the compartment.

9.4.1.1 Compartment Geometry. The compartment geometry (floor area, compartment volume, ceiling height, and aspect ratio) shall be considered when designing such parameters as nozzle locations, system flow rate, and total water use needs of the system.

9.4.1.2 Ventilation. Ventilation considerations shall include both natural and forced ventilation parameters.

9.4.1.2.1* Natural Ventilation.

9.4.1.2.1.1 The number, size, and location of the openings in the space (e.g., door, windows) shall be addressed in the design and installation of the system.

9.4.1.2.1.2 In some cases, special precautions shall be given to minimize the effects of these openings, including, but not limited to, automatic door closures and water mist curtains.

9.4.1.2.2 Forced Ventilation.

9.4.1.2.2.1 The magnitude of the forced ventilation in the compartment shall be addressed in the design and installation of the water mist system.

9.4.1.2.2.2 In some cases, consideration shall be given to shutting down the forced ventilation prior to mist system activation.

9.4.2 Fire Hazard Classification. Fire hazards shall be classified as follows:

(1) Specific application systems in accordance with Chapter 5 and this section
(2) Occupancy protection systems' classifications in accordance with Chapter 5

9.4.2.1 Combustible Loading.

9.4.2.1.1 A fire hazard analysis shall be conducted to determine both the design parameters of the water mist system and the type of detection and activation scheme employed by the system.

9.4.2.1.2 The system shall be based on the fuel type, combustible loading, and anticipated fire growth rate as well as the desired fire-fighting performance objectives.

9.4.2.2 Fuel Type.

9.4.2.2.1 Overall fire hazard shall be directly related to the type and quantity of the fuel present in a space.

9.4.2.2.2 The ease of ignition and reignition of the fuel, the fire growth rate, and the difficulty of achieving control, suppression, extinguishment, or any combination thereof, shall be considered when selecting or designing a water mist system.

9.4.2.2.3 Class A Fires.

9.4.2.2.3.1 Fuel loading and configuration shall be considered when selecting and designing a system to protect a space or area containing Class A materials.

9.4.2.2.3.2 If fire extinguishment is desired, consideration shall be given to the potential for deep-seated fires as well as to the potential for smoldering fires.

9.4.2.2.4 Class B Fires.

9.4.2.2.4.1 The hazard associated with Class B fires shall be related primarily to the fuel loading, fuel configuration, flashpoint, and burning rate of the fuel.

9.4.2.2.4.2 Preburn time shall be evaluated as it affects the overall characteristics of the fire.

9.4.2.2.4.3 Class B fires shall be grouped into two categories: two-dimensional pool fires and three-dimensional spray and running fuel fires. The parameters associated with each category shall be as follows:

(1) Class B two-dimensional fires

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