

NFPA® 15

Standard for Water Spray Fixed Systems for Fire Protection

2022 Edition



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

[This is a preview. Click here to purchase the full publication.](#)

Copyright © 2021 National Fire Protection Association®. All Rights Reserved.

NFPA® 15

Standard for

Water Spray Fixed Systems for Fire Protection

2022 Edition

This edition of NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, was prepared by the Technical Committee on Water Spray Fixed Systems. It was issued by the Standards Council on November 26, 2020, with an effective date of December 16, 2020, and supersedes all previous editions.

This edition of NFPA 15 was approved as an American National Standard on December 16, 2020.

Origin and Development of NFPA 15

Standard for Water Spray Fixed Systems for Fire Protection, formerly *Water Spray Nozzles and Extinguishing Systems*, first prepared by the Committee on Manufacturing Hazards, was tentatively adopted in 1939, with final adoption in 1940. Subsequently, the standard was placed under the jurisdiction of the Committee on Special Extinguishing Systems, and a new edition was adopted in 1947. In 1959, the committee organization was further changed to place primary responsibility in the hands of the Committee on Water Spray, under the general supervision of the General Committee on Special Extinguishing Methods. In 1966, the General Committee on Special Extinguishing Methods was discontinued, and the Committee on Water Spray was constituted as an independent committee. Revised editions were presented in 1969, 1973, 1977, 1979, and 1982.

The 1985 edition incorporated several technical changes concerning special piping provisions. The format of the document was also changed to more closely follow the *NFPA Manual of Style*.

Given the limited changes in water spray technology over the past few years, it was apparent that the 1985 edition could be reconfirmed with referenced publications being updated.

The 1996 edition represented a complete reorganization of the standard. Information was rearranged in a more functional and concise format to improve the usability of the document. Other major changes included a new chapter on high-speed systems and revised requirements for spray nozzles, piping protection, spacing of pilot sprinklers, discharge densities, and design calculations.

The 2001 edition represented a complete reorganization of the standard to conform to the requirements of the 2000 edition of the *NFPA Manual of Style for Technical Committee Documents*.

The 2007 edition incorporated welding requirements for pipe and fittings and also coordinated requirements for fire department connections with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

The 2012 edition provided updated rules for grooved couplings to comply with changes in the 2010 edition of NFPA 13. Other changes included an expanded section on designing for flammable vapor mitigation and the addition of contractor's material and test certificates.

The 2017 edition revised pipe support requirements and incorporated several new tables. In an effort to align this standard with NFPA 13 and NFPA 20, a 12-month limitation on water flow test information was added in addition to requirements for hydraulic design information signs and general information signs. The standard also added a requirement that a hazard analysis be performed on the physical and chemical properties of materials and that the layout, design, and installation be performed by qualified persons. New definitions for *hazard analysis* and *qualified* were also added.

The 2022 edition incorporates new requirements for system operational acceptance tests’ pressure reading procedures. Vapor cloud explosion is now required to be considered for vapor mitigation fire risk analysis. Other changes include an update of contractor's material and test certificates, clarification of remote location for hydraulic calculations, and allowance of multiple detector voting systems to reduce accidental activation.

Technical Committee on Water Spray Fixed Systems

Tracey D. Bellamy, *Chair*
Telgian Corporation, GA [SE]

Robert M. Gagnon, *Secretary*
Gagnon Engineering, MD [SE]

Luis F. Arango, Global Asset Protection Services, LLC, TX [I]

Roland A. Asp, National Fire Sprinkler Association, Inc., MD [IM]
Rep. National Fire Sprinkler Association

Kerry M. Bell, UL LLC, IL [RT]
Rep. UL LLC

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

Kevin F. Carrier, Miami-Dade Fire Rescue Department, FL [E]

Miheer Ghotikar, HD Fire Protect Pvt. Ltd., India [M]

Eric Grein, Westinghouse Electric Company, SC [U]

Russell J. Hardy, RSF Local 669, KS [L]
Rep. United Assn. of Journeymen and Apprentices of the
Plumbing and Pipe Fitting Industry

Scott D. Henderson, Allianz, MA [I]

Malik Shahid Hussain Awan, JGC Gulf International, Saudi Arabia
[SE]

James M. Maddry, James M. Maddry, P.E., GA [SE]

Randall A. McCune, Tri-State Fire Protection, Inc., IN [IM]

E. Parks Moore, S & S Sprinkler Company, LLC, AL [IM]
Rep. American Fire Sprinkler Association

David A. Moore, Jr., Glendale Fire Department, OH [E]

John H. Pecot, Johnson Controls, TX [M]

Justin A. Perry, Dominion Energy, VA [U]
Rep. Edison Electric Institute

Richard Philbrick, Shell Oil Company, TX [U]
Rep. American Petroleum Institute

Matt Pognant, Liberty Mutual Property, GA [I]

Edward A. Ramirez, IHI E&C, TX [SE]

Joseph Radford Sellers, US Department of Energy, TN [U]

James R. Streit, Los Alamos National Laboratory, NM [U]

Jeffery W. Sutton, TUV SUD America Inc./Global Risk Consultants
Corporation, MN [SE]

Dennis W. Taylor, Dooley Tackaberry, Inc., TX [IM]

Christopher Wayne West, Eastman Chemical Company, TX [M]

Michael J. Wojcik, JENSEN HUGHES, AZ [SE]
Rep. JENSEN HUGHES

Jarrett Zuspan, State of Alaska Department of Public Safety, AK [E]

Alternates

Gregory A. Bartels, Sprinkler Fitters LU 669-JATC, MD [L]
(Alt. to Russell J. Hardy)

Ralph E. Bless, Jr., Telgian Corporation, GA [SE]
(Alt. to Tracey D. Bellamy)

Lawrence H. Cook, WorleyParsons, Inc., TX [SE]
(Voting Alt.)

James S. Crews, Allianz, GA [I]
(Alt. to Scott D. Henderson)

Bruce J. Curatola, Calpine Corporation, TX [U]
(Alt. to Justin A. Perry)

Jeffrey S. Grove, JENSEN HUGHES, NV [SE]
(Alt. to Michael J. Wojcik)

Jason Erik Hanson, Dooley Tackaberry Inc, TX [IM]
(Alt. to Dennis W. Taylor)

Jeff Hebenstreit, UL LLC, IL [RT]
(Alt. to Kerry M. Bell)

Baran Ozden, NFPA Staff Liaison

Michael W. Hembree, Liberty Mutual Insurance Company, IL [I]
(Alt. to Matt Pognant)

Edward F. Kadlec, C. L. Doucette, Inc., IL [IM]
(Alt. to Roland A. Asp)

Joseph A. Lynch, Swiss Re, GA [I]
(Alt. to Luis F. Arango)

Elmer Revilla, Chevron, TX [U]
(Alt. to Richard Philbrick)

Terry L. Victor, Johnson Controls, MD [M]
(Alt. to John H. Pecot)

John F. Viola, JFV Engineering, LLC, MA [IM]
(Alt. to E. Parks Moore)

Cary Webber, Reliable Automatic Sprinkler, SC [M]
(Alt. to Michael J. Bosma)

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the design, construction, installation, and test of fixed water spray systems for fire protection purposes.

Contents

Chapter 1 Administration	15- 5	Chapter 7 Design Objectives	15- 20
1.1 Scope.	15- 5	7.1 System Design.	15- 20
1.2 Purpose.	15- 5	7.2 Extinguishment.	15- 20
1.3 Application.	15- 5	7.3 Control of Burning.	15- 21
1.4 Retroactivity.	15- 5	7.4 Exposure Protection.	15- 21
1.5 Equivalency.	15- 5	7.5 Flammable Vapor Mitigation.	15- 23
1.6 Units and Formulas.	15- 5	7.6 Combined Systems.	15- 23
		7.7 Automatic Detection Equipment.	15- 23
Chapter 2 Referenced Publications	15- 6	Chapter 8 Plans and Hydraulic Calculations	15- 24
2.1 General.	15- 6	8.1 General.	15- 24
2.2 NFPA Publications.	15- 6	8.2 Working Plans.	15- 24
2.3 Other Publications.	15- 6	8.3 Hydraulic Calculations.	15- 24
2.4 References for Extracts in Mandatory Sections. ...	15- 7	8.4 Water Supply Information.	15- 25
		8.5 Hydraulic Calculation Procedures.	15- 25
Chapter 3 Definitions	15- 7	Chapter 9 Water Supplies	15- 27
3.1 General.	15- 7	9.1 General.	15- 27
3.2 NFPA Official Definitions.	15- 7	9.2 Volume and Pressure.	15- 27
3.3 General Definitions.	15- 7	9.3 Acceptable Water Supply Systems.	15- 27
Chapter 4 General Requirements	15- 8	Chapter 10 System Acceptance	15- 27
4.1 Design Objectives.	15- 8	10.1 Certification.	15- 27
4.2 Special Considerations.	15- 8	10.2 Flushing of Supply Pipe.	15- 28
4.3 Qualifications.	15- 8	10.3 Hydrostatic Pressure Tests.	15- 28
4.4 Control of Runoff.	15- 8	10.4 Operating Tests.	15- 28
4.5 Flammable and Combustible Liquids.	15- 9	10.5 Hydraulic Design Information Sign.	15- 28
		10.6 General Information Sign.	15- 28
Chapter 5 System Components	15- 9	Chapter 11 System Inspection, Testing, and Maintenance	15- 35
5.1 General.	15- 9	11.1 General.	15- 35
5.2 Water Spray Nozzles.	15- 9	Chapter 12 Ultra-High-Speed Water Spray Systems	15- 35
5.3 Pipe and Tube.	15- 10	12.1 General.	15- 35
5.4 Fittings.	15- 11	12.2 Response Time.	15- 35
5.5 Joining of Pipe and Fittings.	15- 11	12.3 Design Considerations.	15- 35
5.6 Hangers.	15- 13	12.4 System Acceptance.	15- 37
5.7 Valves.	15- 13	12.5 Testing and Maintenance.	15- 37
5.8 Pressure Gauges.	15- 13	Annex A Explanatory Material	15- 37
5.9 Strainers.	15- 13	Annex B Hydraulic Calculations	15- 58
5.10 Fire Department Connections.	15- 14	Annex C Informational References	15- 73
5.11 Alarms.	15- 14	Index	15- 74
5.12 Detection Systems.	15- 14		
Chapter 6 Installation Requirements	15- 14		
6.1 Basic Requirements.	15- 14		
6.2 Water Spray Nozzles.	15- 14		
6.3 Piping Installation.	15- 15		
6.4 System Attachments.	15- 18		
6.5 Automatic Detection Equipment.	15- 18		

NFPA 15

Standard for

Water Spray Fixed Systems for Fire Protection

2022 Edition

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

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the “List of NFPA Codes & Standards” at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. 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 and extracted publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard provides the minimum requirements for the design, installation, and system acceptance testing of water spray fixed systems for fire protection service and the minimum requirements for the periodic testing and maintenance of ultra-high-speed water spray fixed systems.

1.1.2* Water spray fixed systems shall be specifically designed to provide for effective fire control, extinguishment, prevention, or exposure protection.

1.1.3* This standard shall not apply to water spray protection from portable nozzles, sprinkler systems, monitor nozzles, water mist suppression systems, explosion suppression, or other means of application covered by other standards of NFPA.

1.2 Purpose. The purpose of this standard shall be to provide the minimum requirements for water spray fixed systems based on sound engineering principles, test data, and field experience.

1.3 Application.

1.3.1 Water spray is applicable for protection of specific hazards and equipment and shall be permitted to be installed independently of, or supplementary to, other forms of fire protection systems or equipment.

1.3.2 Water spray protection is acceptable for the protection of hazards involving each of the following groups:

- (1) Gaseous and liquid flammable materials
- (2) Electrical hazards such as transformers, oil switches, motors, cable trays, and cable runs
- (3) Ordinary combustibles such as paper, wood, and textiles
- (4) Certain hazardous solids such as propellants and pyrotechnics
- (5) Vapor mitigation

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. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6 Units and Formulas.

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). Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection. These units are listed in Table 1.6.1, with conversion factors.

1.6.2 If a value for measurement as given in this standard is followed by an equivalent value in another unit, the first stated shall be regarded as the requirement. A given equivalent value might be approximate.

1.6.3 The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then to round the result to the appropriate number of significant digits.

Table 1.6.1 Unit Conversions

Name of Unit	Unit Symbol	Conversion Factor
Liter	L	1 gal = 3.785 L
Liter per minute per square meter	(L/min)/m ²	1 gpm/ft ² = 40.746 (L/min)/m ²
Cubic decimeter	dm ³	1 gal = 3.785 dm ³
Pascal	Pa	1 psi = 6894.757 Pa
Bar	bar	1 psi = 0.0689 bar
Bar	bar	1 bar = 10 ⁵ Pa

Note: For additional conversions and information see IEEE/ASTM SI-10, *American National Standard for Metric Practice*.

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 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 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

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

NFPA 1963, *Standard for Fire Hose Connections*, 2019 edition.

2.3 Other Publications.

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*, 2013.

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings*, 2015.

ASME B16.3, *Malleable Iron Threaded Fittings Classes 150 and 300*, 2016.

ASME B16.4, *Gray Iron Threaded Fittings Classes 125 and 250*, 2016.

ASME B16.5, *Pipe Flanges and Flanged Fittings*, 2017.

ASME B16.9, *Factory-Made Wrought Steel Butt Welding Fittings*, 2018.

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*, 2016.

ASME B16.18, *Cast Copper Alloy Solder Joint Pressure Fittings*, 2018.

ASME B16.22, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*, 2018.

ASME B16.25, *Butt Welding Ends*, 2017.

ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*, 2018.

ASME B36.19M, *Stainless Steel Pipe*, 2018.

Boiler and Pressure Vessel Code (BPVC), Section IX, *Welding, Brazing, and Fusing Qualifications*, 2019.

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

ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, 2018.

ASTM A135/A135M, *Standard Specification for Electric-Resistance-Welded Steel Pipe*, 2019.

ASTM A182/A182M, *Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*, 2019.

ASTM A234/A234M, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service*, 2019.

ASTM A312/A312M, *Standard Specification for Seamless Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2019.

ASTM A536, *Standard Specification for Ductile Iron Castings*, 2019.

ASTM A795/A795M, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*, 2013.

ASTM B75/B75M, *Standard Specification for Seamless Copper Tube*, 2019.

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2016.

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

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, 2015.

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

AWS A5.8/A5.8M, *Specification for Filler Metals for Brazing and Braze Welding*, 2019.

AWS B2.1/B2.1M, *Specification for Welding Procedures and Performance Qualification*, 2014.

AWS B2.2/B2.2M, *Standard for Brazing Procedure and Performance Qualification*, 2016.

2.3.4 IEEE Publications. IEEE, 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE/ASTM SI-10, *American National Standard for Metric Practice*, 2016.

IEEE C2, *National Electrical Safety Code*, 2017.

2.3.5 Other Publications.

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

Δ 2.4 References for Extracts in Mandatory Sections.

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

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 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 Combined System. A system of piping that connects both sprinklers and water spray nozzles in a common fire area, and is supplied by a single riser and system actuation valve.

3.3.2* Combustible Liquid. Any liquid that has a closed-cup flash point at or above 100°F (37.8°C), as determined by the appropriate test procedures and apparatus.

3.3.3 Control of Burning. Application of water spray to equipment or areas where a fire can occur to control the rate of burning and thereby limit the heat release from a fire until the fuel can be eliminated or extinguishment effected.

3.3.4 Deflagration. Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium.

3.3.5 Density. The unit rate of water application to an area or surface expressed in gpm/ft² [(L/min)/m²].

3.3.6 Detection Equipment.

3.3.6.1 Automatic Detection Equipment. Equipment that automatically detects heat, flame, products of combustion, flammable gases, or other conditions likely to produce fire or explosion and cause other automatic actuation of alarm and protection equipment. [25, 2020]

3.3.6.2 Flammable Gas Detection Equipment. Equipment that will automatically detect a percent volume concentration of a flammable gas or vapor relative to a predetermined level.

3.3.7 Detonation. Propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium.

3.3.8 Electrical Clearance. The air distance between the water spray equipment, including piping and nozzles, and unenclosed or uninsulated live electrical components at other than ground potential.

3.3.9 Exposure Protection. Absorption of heat through application of water spray to structures or equipment exposed to a fire, to limit surface temperature to a level that will minimize damage and prevent failure.

3.3.10* Fire Area. For the purpose of this standard, an area that is physically separated from other areas by space, barriers, walls, or other means.

3.3.11* Flammable Liquid. Any liquid that has a closed-cup flash point below 100°F (37.8°C), as determined by the appropriate test procedures and apparatus.

3.3.12 Hazard Analysis. An approved assessment performed by personnel knowledgeable of a particular process and the specific hazards of the material.

3.3.13 Impingement. The striking of a protected surface by water droplets issuing directly from a water spray nozzle.

Δ 3.3.14 Insulation.

3.3.14.1* Insulated. Refers to equipment, structures, or vessels provided with an encapsulating material that, for the expected duration of fire exposure, will limit steel temperatures to a maximum of 850°F (454°C) for structural members or 650°F (343°C) for vessels. The insulation system shall be: (1) noncombustible and fire retardant; (2) mildew and weather resistant; (3) resistant to the force of hose streams; and (4) secured by fire and corrosion-resistant fastenings.