First Revision No. 30-NFPA 11-2022 [Global Input]

Include the word "series" in front of (304 or 316) when referring to stainless steel throughout the document.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jun 03 15:41:47 EDT 2022

Committee Statement

Committee Statement: The inclusion of the word “series” would include 304L and 316L for welding applications.
Response Message: FR-30-NFPA 11-2022

First Revision No. 46-NFPA 11-2022 [Global Input]

Move the notes sections of Tables 5.2.4.2.2, 5.2.5.2.2, 5.2.5.3.4, 5.2.6.2.8, 5.2.6.5.1, 5.3.5.3.1, and 5.3.5.3.6.1 to associated annex or body sections of the standard depending on their wording (Mandatory notes should be body sections, guidance notes should become annex material.)

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:45:51 EDT 2022

Committee Statement

Committee Statement: The notes sections of these respective tables either contain unenforceable language that should be in the Annex or mandatory language that belongs in the body of the standard based on the MOS.
Response Message: FR-46-NFPA 11-2022

First Revision No. 47-NFPA 11-2022 [Global Input]

Replace the words "combustible liquid" and "flammable liquid" throughout the standard with "ignitible liquid."

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Wed Jun 22 10:56:02 EDT 2022

Committee Statement

Committee Statement: NFPA 30 has changed the way flammable and combustible liquids are used throughout the standard, now calling them ignitible liquids. This is consistent with action taken on the definitions in Chapter 3.

Response Message: FR-47-NFPA 11-2022

<u>Public Input No. 39-NFPA 11-2022 [Global Input]</u>

First Revision No. 1-NFPA 11-2022 [Section No. 1.1.1]

1.1.1

This standard ~~covers the design, installation, operation, testing, and maintenance of low-, medium-, and high-expansion and compressed air foam systems for fire protection~~ <u>shall provide the minimum requirements for the design and installation of foam systems</u> .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Mon May 09 10:39:38 EDT 2022

Committee Statement

Committee Statement: Activities associated with inspection, testing, and maintenance are now located within NFPA 25.

Response Message: FR-1-NFPA 11-2022

<u>Public Input No. 27-NFPA 11-2022 [Section No. 1.1.1]</u>

First Revision No. 27-NFPA 11-2022 [Section No. 1.2.1]

1.2.1

~~This standard is intended for the use and guidance of those responsible for designing, installing, testing, inspecting, approving, listing, operating, or maintaining fixed, semifixed,~~ The purpose of this standard shall be to provide a reasonable degree of protection from fire through the standardization of design, installation, and testing requirements for fixed, semi fixed, or portable low-, medium-, and high-expansion and compressed air foam fire-extinguishing systems for interior or exterior hazards based on sound engineering principles, test date, and field experience .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jun 03 15:20:20 EDT 2022

Committee Statement

Committee Statement: Inspection, testing, and maintenance criteria for foam systems has been added to NFPA 25. The elimination of life and property was intended to allow the use of NFPA 11 for various applications. The descriptions of property and life safety are addressed in 1.2.3.

Response Message: FR-27-NFPA 11-2022

Public Input No. 28-NFPA 11-2022 [Section No. 1.2.1]

First Revision No. 28-NFPA 11-2022 [Section No. 1.6]

1.6 Units and Formulas.

Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). The liter unit, which is not part of but is recognized by SI, is commonly used in international fire protection. Conversion factors for this unit are found in Table 1.6.

Table 1.6 Conversion Factors

_	Name of Unit	Unit Symbol	Conversion Factor
Length	millimeter	mm	1 in. = 25.4 mm
	meter	m	1 ft = 0.3048 m
Area	square millimeters	mm^2	1 $in.^2$ = 645.2 mm^2
	square meter	m^2	1 ft^2 = 0.0929 m^2
Volume	milliliter	mL	1 fl oz = 29.57 mL
Fluid capacity	liter	l	1 fl oz = 0.02957 L
	liter	l	1 gal = 3.785 L
Flow	liter per minute	L/min	1 gpm = 3.7848 L/min
Pressure	bar	bar	1 psi = 0.0689 bar
Discharge Density	millimeter/minute	mm/min	1 gpm/ft^2 = 40.746 mm/min
	liter/minute/m^2	(L/min)/m^2	1 gpm/ft^2 = 40.746 (L/min)/m^2
Weight	kilogram	kg	1 lb = 0.4536 kg
Temperature	Fahrenheit	°F	°F = 9/5 x °C + 32
	Celsius	°C	°C = 5/9(°F - 32)
Velocity	meters per second	mps	1 fps = 0.3048 mps
Gauge (sheet steel)	millimeter	mm	10 gauge = 3.4 mm
			12 gauge = 2.8 mm
			14 gauge = 1.98 mm
			16 gauge = 1.57 mm
			22 gauge = 0.78 mm
			24 gauge = 0.63 mm

Note: For additional conversions and information, see IEEE/ASTM SI10.

Supplemental Information

File Name	Description	Approved
FR-28_1.6_Clean.docx	For staff use only	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jun 03 15:24:14 EDT 2022

Committee Statement

Committee Statement: 25.4 mm is a more accurate conversion for 1 inch.

Response Message: FR-28-NFPA 11-2022

Public Input No. 49-NFPA 11-2022 [Section No. 1.6]

First Revision No. 25-NFPA 11-2022 [Chapter 2]

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~~ 2022 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* ~~2019~~ 2023 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* ~~2017~~ 2022 edition.

~~NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems,* 2019 edition.~~

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* ~~2019~~ 2022 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* ~~2018~~ 2023 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* ~~2019~~ 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* ~~2020~~ 2023 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* ~~2021~~ 2024 edition.

NFPA 70®, *National Electrical Code®,* ~~2020~~ 2023 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®,* ~~2019~~ 2022 edition.

NFPA 220, *Standard on Types of Building Construction,* ~~2021~~ 2024 edition.

NFPA 409, *Standard on Aircraft Hangars,* ~~2021~~ 2022 edition.

NFPA 1150, *Standard on Foam Chemicals for Fires in Class A Fuels,* ~~2017~~ 2022 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus,* ~~2021~~ 2016 edition.

NFPA 1961, *Standard on Fire Hose,* 2020 edition.

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

2.3 Other Publications.

2.3.1 API Publications.

American Petroleum Institute, ~~1220 L Street, N.W., Washington, DC 20005-4070~~ 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001-5571 .

API STD 607, *Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats*, ~~7th edition,~~ 2016.

API STD 650, *Welded Tanks for Oil Storage*, ~~12th edition, 2013, addendum 3, 2018~~ 2020 .

2.3.2 ASME Publications.

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

ASME *Boiler and Pressure Vessel Code*, ~~2019~~ 2021 .

ASME B1.20.1, *Standard for Pipe Threads, General Purpose (Inch)*, ~~2013~~ 2018 .

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250*, ~~2015~~ 2020 .

ASME B16.3, *Malleable Iron Threaded Fittings~~:~~ Classes 150~~,~~ and 300*, ~~2016~~ 2021 .

ASME B16.4, *Gray Iron Threaded Fittings Classes 125~~,~~ and 250*, ~~2016~~ 2021 .

ASME B16.5, *Pipe Flanges and Flanged Fittings~~:~~ NPS 1/2 Through NPS 24 Metric/Inch Standard*, ~~2017~~ 2020 .

ASME B16.9, *Factory-Made Wrought Buttwelding Fittings*, ~~2012~~ 2018 .

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*, 2016, Errata, 2017.

ASME B16.15, *Cast Copper Alloy Threaded Fittings Classes 125~~,~~* and 250, ~~2013~~ 2018 .

ASME B16.24, *Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500*, 2016.

ASME B16.25, *Buttwelding Ends*, 2017.

ASME B31.1, *Power Piping*, ~~2018~~ 2020 .

2.3.3 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~~ 2020 .

ASTM A135/A135M, *Standard Specification for Electric Resistance-Welded Steel Pipe*, ~~2009, reapproved 2014~~ 2021 .

ASTM A234/A234M, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High-Temperature Service*, ~~2018~~ 2019 .

ASTM A312/A312M, *Standard Specification for Seamless~~-~~ , Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, ~~2018~~ 2021 .

ASTM A795/A795M, *Standard Specification for Black and Hot-Dipped~~-,~~ Zinc-Coated~~-,~~ (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*, ~~2013~~ 2021 .

ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*, ~~2015~~ 2020 .

ASTM B315, *Standard Specification for Seamless Copper Alloy Pipe and Tube*, ~~2012~~ 2019 .

ASTM C582, *Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment*, 2009, reapproved 2016.

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, ~~2015a~~ 2020 .

ASTM D1331, *Standard Test Methods for Surface and Interfacial Tension of Solutions of Paints, Solvents, Solutions of Surface-Active Agents*, *and Related Materials*, ~~2014~~ 2020 .

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, ~~2019b~~ 2021 .

IEEE/ASTM SI10, *American National Standard for the Use of the International System of Units: The Modern Metric System*, 2016.

2.3.4 AWS Publications.

American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672.

AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*, ~~2014~~ 2021 .

2.3.5 IEEE Publications.

IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE 45, *Recommended Practice for Electric Installations on Shipboard*, 2002.

2.3.6 IMO Publications.

International Maritime Organization, 4 Albert Embankment, London, SE1 7SR, United Kingdom.

SOLAS Regulations II-2, *Safety of Life at Sea*, ~~SOLAS Regulations II-2/~~ 4.3 and 4.3.5.

2.3.7 ISO Publications.

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

ISO 7–1, *Pipe Threads Where Pressure-Tight Joints Are Made on the Threads — Part 1: Dimensions, Tolerances and Designation*, 1994, technical corrigendum 1, 2007.

2.3.8 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 162, *Foam Equipment and Liquid Concentrates*, ~~2018~~ 2022 .

2.3.9 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

~~NFPA 10, *Standard for Portable Fire Extinguishers,* 2018 edition.~~

NFPA 13, *Standard for the Installation of Sprinkler Systems,* ~~2019~~ 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* ~~2020~~ 2023 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* ~~2018~~ 2021 edition.

NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities,* ~~2016~~ 2020 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2022 edition.

Supplemental Information

File Name	Description	Approved
FR-25_Chp2_Clean.docx	For staff use only	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun May 22 18:30:09 EDT 2022

Committee Statement

Committee Statement: Updated references to conform to latest editions.
Response Message: FR-25-NFPA 11-2022

Public Input No. 17-NFPA 11-2021 [Section No. 2.3.8]

First Revision No. 33-NFPA 11-2022 [Section No. 3.3.1]

3.3.20 ~~Combustible~~ Ignitible Liquid.

Any liquid or liquid mixture that has a measurable closed-cup flash point. [**30,** 2021] . ~~at or above 100°F (38°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30. [**30,** 2018]~~

3.3.20.1* ~~Class II~~ Combustible Liquid.

~~A liquid that has a closed-cup flash point at or above 100°F (38°C) and below 140°F (60°C). [**30,** 2018]~~ An ignitible liquid that is classified as a Class II or Class III liquid . [**30,**~~2018~~ 2021]

A.3.3.20.1 Combustible Liquid.

~~A liquid that has a~~ NFPA 30 provides guidance on the criteria for ignitible liquids and describes Class II Liquids as liquids with closed-cup flash points at or above 100°F (~~38~~ 37.8 °C) ~~and~~ but below 140°F (60°C) and Class III liquids as liquids with closed-cup flash points at or above 140°F (60°C). The determination of the liquid class is typically based on the test procedures set forth in ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester* . Class III liquids can be further subclassified in accordance with the following:

(1) Class IIIA liquid: ~~Any~~ A liquid that has a ~~closed-cup~~ flash point at or above 140°F (60°C)~~,~~ but below 200°F (93°C).

(2) Class IIIB Liquid: ~~Any~~ A liquid that has a ~~closed-cup~~ flash point at or above 200°F (93°C).

~~**3.3.1.2** Class IIIA Liquid.~~

~~Any Liquid that has a closed-cup flash point at or above 140°F (60°C), but below 200°F (93°C). [**30,** 2018]~~

~~**3.3.1.3** Class IIIB Liquid.~~

~~Any liquid that has a closed-cup flash point at or above 200°F (93°C). [**30,** 2018]~~

3.3.20.2* Flammable Liquid.

An ignitible liquid that is classified as a Class I liquid. [**30,** 2021]

A.3.3.20.2 Flammable Liquid.

NFPA 30 provides guidance on the criteria for ignitible liquids and describes Class I liquids as liquids with closed-cup flash points below 100°F (37.8°C). The determination of the liquid class is typically based on test procedures set forth in ASTM D56. Class I liquids can be further subclassified in accordance with the following:

(1) Class IA Liquid: A liquid that has a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).

(2) Class IB Liquid: A liquid that has a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C).

(3) (3) Class IC Liquid: A liquid that has a flash point at or above 73°F (22.8°C) but below 100°F (37.8°C).

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jun 03 16:11:27 EDT 2022

Committee Statement

Committee Statement: The revised language is consistent with the latest edition of NFPA 30. Annex text is added to further clarify the breakdown of Class **I**, **II**, and **III** liquids.

Response Message: FR-33-NFPA 11-2022

Public Input No. 31-NFPA 11-2022 [New Section after A.3.2.4]

Public Input No. 29-NFPA 11-2022 [New Section after 3.3.1]

Public Input No. 30-NFPA 11-2022 [Section No. 3.3.1]

First Revision No. 8-NFPA 11-2022 [Section No. 3.3.4]

3.3.3 Discharge Outlet.

3.3.3.1 Fixed Foam Discharge Outlet.

A device permanently attached to a tank, dike, or other containment structure~~,~~ designed to introduce foam.

3.3.3.2* Type I Discharge Outlet.

An approved discharge outlet that conducts and delivers foam ~~gently~~ onto the liquid surface ~~without~~ to lessen the submergence of the foam or agitation of the surface.

3.3.3.3 Type II Discharge Outlet.

An approved discharge ~~outlet that does not deliver foam gently onto the liquid surface but is designed to lessen submergence of the foam and agitation of the surface~~ device that forcefully applies foam with less submergence into the fuel than a Type III application and without losses from applying the foam from outside the tank .

3.3.3.4* Type III Discharge Outlet.

Portable monitors or nozzles that deliver foam forcefully onto the liquid surface with submergence of the foam ~~and agitation~~ into the fuel and considerable disturbance of the foam on the surface.

A.3.3.3.4 Type III Discharge Outlet.

This application type also involves foam losses outside the tank due to wind and other issues.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Mon May 09 23:50:57 EDT 2022

Committee Statement

Committee Statement: The existing Type I discharge outlet definition is obsolete. There is no current Type III discharge outlet definition. All discharge outlet definitions needed to be updated. All discharge outlet definitions will need to be reviewed for incorporation into the tables and charts of NFPA 11 for Second Draft.

Response Message: FR-8-NFPA 11-2022

Public Input No. 34-NFPA 11-2022 [Section No. 3.3.4.2]

Public Input No. 33-NFPA 11-2022 [Section No. 3.3.4.3]

Public Input No. 32-NFPA 11-2022 [New Section after 3.3.4.3]

First Revision No. 48-NFPA 11-2022 [Section No. 3.3.8.1]

3.3.7.1 Class A Fire.

A fire in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics. [~~**10,** 2018~~] [**2001,** 2022]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jul 15 16:23:28 EDT 2022

Committee Statement

Committee Statement: Revised to extract from NFPA 2001 instead of NFPA 10, as the text does not exist as a definition within NFPA 10 and does not comply with the extract policy.

Response Message: FR-48-NFPA 11-2022

First Revision No. 49-NFPA 11-2022 [Section No. 3.3.9]

3.3.8 Flammable (Class I) Liquid.

Any liquid that has a closed-cup flash point that is below 100°F (38°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30, and a Reid vapor pressure that does not exceed an absolute pressure of 40 psi (3 bar) at 100°F (38°C), as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method).* ~~[**30,** 2018]~~

3.3.8.1 Class IA Liquid.

Any liquid that has a closed-cup flash point below 73°F (23°C) and a boiling point below 100°F (38°C). ~~[**30,** 2018]~~

3.3.8.2 Class IB Liquid.

Any liquid that has a closed-cup flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C). ~~[**30,** 2018]~~

3.3.8.3 Class IC Liquid.

Any liquid that has a closed-cup flash point at or above 73°F (23°C) but below 100°F (38°C). ~~[**30,** 2018]~~

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jul 15 16:26:14 EDT 2022

Committee Statement

Committee Statement: These definitions do not exist in this form in the newest edition of NFPA 30. This information is important to NFPA 11, so the extract tag has been removed.

Response Message: FR-49-NFPA 11-2022

First Revision No. 9-NFPA 11-2022 [Section No. 3.3.17.2.1 [Excluding any Sub-Sections]]

A piping network ~~employing~~ that employs automatic or open sprinklers~~, nozzles, or other discharge devices, connected to a source of foam concentrate and to a water supply~~ to discharge a foam solution .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 00:01:48 EDT 2022

Committee Statement

Committee Statement: Foam-Water Sprinkler Systems should be differentiated from Foam-Water Spray Systems. Foam-Water Sprinkler Systems correlate to NFPA 13 while Foam-Water Spray Systems correlate to NFPA 15. This clarifies this differentiation.

Response Message: FR-9-NFPA 11-2022

Public Input No. 35-NFPA 11-2022 [Section No. 3.3.17.2.1 [Excluding any Sub-Sections]]

First Revision No. 10-NFPA 11-2022 [Section No. 3.3.17.2.1.1]

3.3.16.2.1.1* Foam-Water Deluge System.

A foam-water sprinkler system or foam-water spray system that employs ~~employing~~ open discharge devices~~, which~~ that are attached to a piping system ~~that is~~ connected to a water supply through a valve that is opened by the operation of a detection system~~, which is~~ installed in the same areas as the discharge devices.

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 00:04:06 EDT 2022

Committee Statement

Committee Statement: This revised definition clarifies that Foam-Water Deluge Systems may be either Foam-Water Sprinkler Systems or Foam-Water Spray Systems. The difference being the reference back to either NFPA 13 or NFPA 15.

Response Message: FR-10-NFPA 11-2022

Public Input No. 36-NFPA 11-2022 [Section No. 3.3.17.2.1.1]

First Revision No. 36-NFPA 11-2022 [Section No. 3.3.22]

3.3.22 Inspection, Testing, and Maintenance.

3.3.22.1 Inspection.

A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage. [**820,**~~2016~~ 2020]

3.3.22.2 Maintenance.

In water-based fire protection systems, work performed to keep equipment operable. [**25,**~~2020~~ 2023]

3.3.22.3 Test.

The operation of a device to verify that it is functioning correctly, or the measurement of a system characteristic to determine if it meets requirements. [**25,**~~2020~~ 2023]

3.3.22.4 Testing.

A procedure used to determine the operational status of a component or system by conducting periodic physical ~~checks, such as waterflow tests, fire pump tests, alarm tests, and trip tests of dry pipe, deluge, or preaction valves~~ tasks . [**25,**~~2020~~ 2023]

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Sun Jun 05 09:06:50 EDT 2022

Committee Statement

Committee Statement: Revised to align with updated edition years for NFPA 850 and NFPA 25. Revised the definition of "Testing" to align with changes made in NFPA 25.

Response Message: FR-36-NFPA 11-2022

First Revision No. 4-NFPA 11-2022 [Section No. 4.2.2.2.3]

4.2.2.2.3*

Where the water supply is dependent on public water sources, attention shall be given to the ~~pollution~~ contamination hazard introduced by the use of foam concentrate.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Mon May 09 13:52:29 EDT 2022

Committee Statement

Committee Statement: With the introduction of SFFF and environmental concerns with PFAS foam. The issue is more with contaminating the water supply rather than pollution after it has been flowed.

Response Message: FR-4-NFPA 11-2022

Public Input No. 20-NFPA 11-2022 [Section No. 4.2.2.2.3]

First Revision No. 37-NFPA 11-2022 [Section No. 4.2.3.4]

4.2.3.4

Fire department connections shall be equipped with ~~listed~~ approved plugs or caps, properly secured and arranged for easy removal by fire departments. [**13:**16.12.3.2]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:08:51 EDT 2022

Committee Statement

Committee Statement: Revised to align the extracted text with changes made in the latest edition of NFPA 13.

Response Message: FR-37-NFPA 11-2022

First Revision No. 5-NFPA 11-2022 [New Section after 4.2.3.5]

4.2.3.6

Fire department connections shall be provided with a placard to identify the minimum pressure required to meet the hydraulic design requirements of the foam system.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Mon May 09 13:58:24 EDT 2022

Committee Statement

Committee Statement: It is important that the responding fire department know what is the minimum calculated foam flow rate required, so that the correct amount of foam or fire water is delivered.

Response Message: FR-5-NFPA 11-2022

Public Input No. 21-NFPA 11-2022 [New Section after 4.2.3.5]

First Revision No. 6-NFPA 11-2022 [Section No. 4.3.2.5.2.1]

4.3.2.5.2.1

There shall be a reserve supply of foam concentrate to meet the design requirements for the worst-case fire scenario ~~in order to~~ and put the system back into service after operation.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Mon May 09 14:03:30 EDT 2022

Committee Statement

Committee Statement: In many hydrocarbon processing or chemical facilities, there can be multiple fixed foam systems and even on fire trucks/foam trailers for the major tank fire incidences. This can be quite a large amount of foam reserve inventory. This statement makes it clear that the facility only need to maintain enough reserve foam for the worst case scenario and not for every fixed foam system on the facility.

Response Message: FR-6-NFPA 11-2022

Public Input No. 22-NFPA 11-2022 [Section No. 4.3.2.5.2.1]

First Revision No. 29-NFPA 11-2022 [Section No. 4.7.2.1]

Global FR-30

4.7.2.1*

Foam solution pipe shall be made of one of the following materials:

(1) Galvanized steel

(2) Stainless steel series (304 or 316)

(3) Copper nickel 90/10

(4) Internal/external corrosion-resistant pipe in accordance with the foam manufacturer's specification for compatibility and acceptable to the authority having jurisdiction

(5) Unprotected carbon steel pipe when filled with foam solution or water and the discharge devices are closed to the atmosphere

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jun 03 15:39:09 EDT 2022

Committee Statement

Committee Statement: Series 304 or 316 stainless steel are appropriate for foam solution piping.
Response Message: FR-29-NFPA 11-2022

First Revision No. 13-NFPA 11-2022 [Section No. 5.2.5.1.2.1]

5.2.5.1.2.1

~~Such outlets~~ Outlets shall be individually piped and separately valved for isolation outside the dike area in accordance with 10.5.1.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Tue May 10 10:44:49 EDT 2022

Committee Statement

Committee Statement: Unnecessary words deleted for clarity.
Response Message: FR-13-NFPA 11-2022

Public Input No. 37-NFPA 11-2022 [Section No. 5.2.5.1.2.1]

First Revision No. 14-NFPA 11-2022 [Section No. 5.3 [Excluding any Sub-Sections]]

Outdoor open-top floating roof tanks shall be as illustrated in Figure 5.3(a) through Figure 5.3(d).

Figure 5.3(a) ~~Pantograph-Type Seal~~ Primary Shoe Plate Seal on Open-Top Floating Roof Tank.

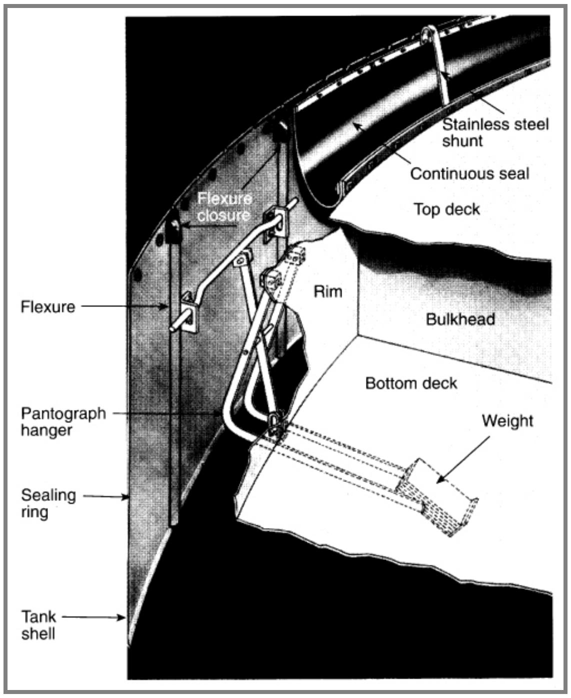


Figure 5.3(b) ~~Tube Seal~~ Primary Foam Seal with Weather Shield on Open-Top Floating Roof Tank.

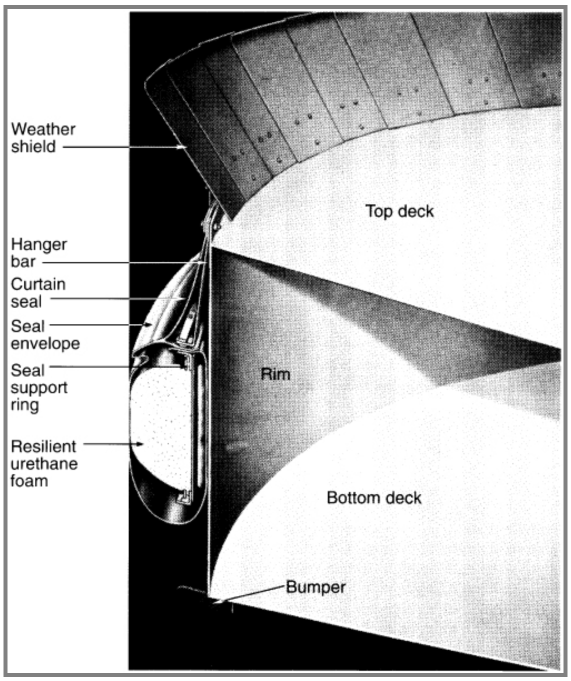


Figure 5.3(c) Double Seal System for Floating Roofs.

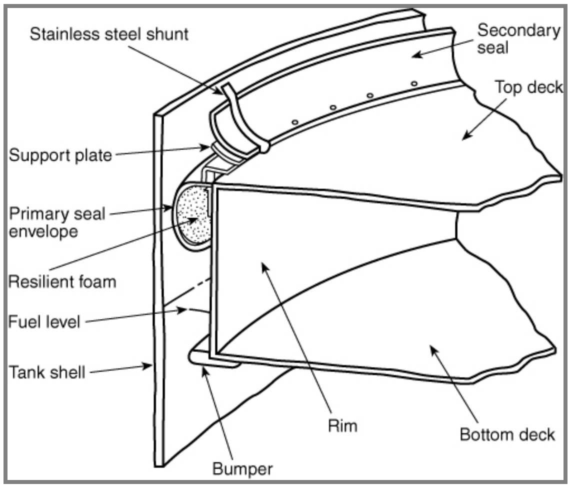
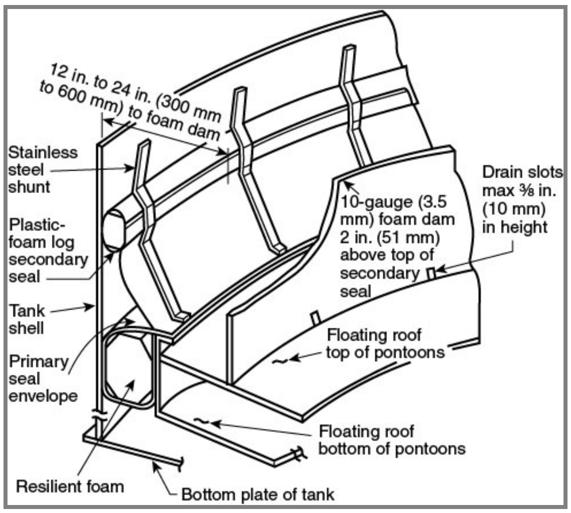


Figure 5.3(d) Double Seal System for Floating Roofs Using Plastic-Foam Log (Secondary Seal).



Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Tue May 10 10:58:33 EDT 2022

Committee Statement

Committee Statement: The technical committee agrees that the terminology in the figures and titles should be updated to more current language.
Response Message: FR-14-NFPA 11-2022

Public Input No. 41-NFPA 11-2022 [Section No. 5.3 [Excluding any Sub-Sections]]

First Revision No. 15-NFPA 11-2022 [Section No. 5.3.5.2.1]

5.3.5.2.1

Fixed foam discharge outlets located above a ~~mechanical shoe~~ single primary seal, ~~above~~ a ~~tube~~ primary seal combined with weather shields , or ~~above~~ a secondary seal shall be used in conjunction with a foam dam.

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 10:59:14 EDT 2022

Committee Statement

Committee Statement: The technical committee agrees that the terminology should be updated to more current language.

Response Message: FR-15-NFPA 11-2022

Public Input No. 42-NFPA 11-2022 [Section No. 5.3.5.2.1]

First Revision No. 31-NFPA 11-2022 [Section No. 5.3.5.3.1]

Global FR-46

5.3.5.3.1*

The design parameters for the application of fixed foam discharge outlets on top of the seal to protect open-top floating roof tanks shall be in accordance with Table 5.3.5.3.1 and Figure 5.3.5.3.1.

Table 5.3.5.3.1 Top-of-Seal Fixed Foam Discharge Protection for Open-Top and Internal Floating Roof Tanks

	Applicable Illustration Detail	Minimum Application Rate		Minimum Discharge Time (minutes)	Maximum Spacing Between Discharge Outlets with			
					12 in. (305 mm) Foam Dam		24 in. (600 mm) Foam Dam	
		gpm/ft²	mm/min*		ft	m	ft	m
Mechanical shoe seal	A	0.3	12.2	20	40	12.2	80	24.4
Tube seal with metal weather shield	B	0.3	12.2	20	40	12.2	80	24.4
Fully or partly combustible secondary seal	C	0.3	12.2	20	40	12.2	80	24.4
All metal secondary seal	D	0.3	12.2	20	40	12.2	80	24.4

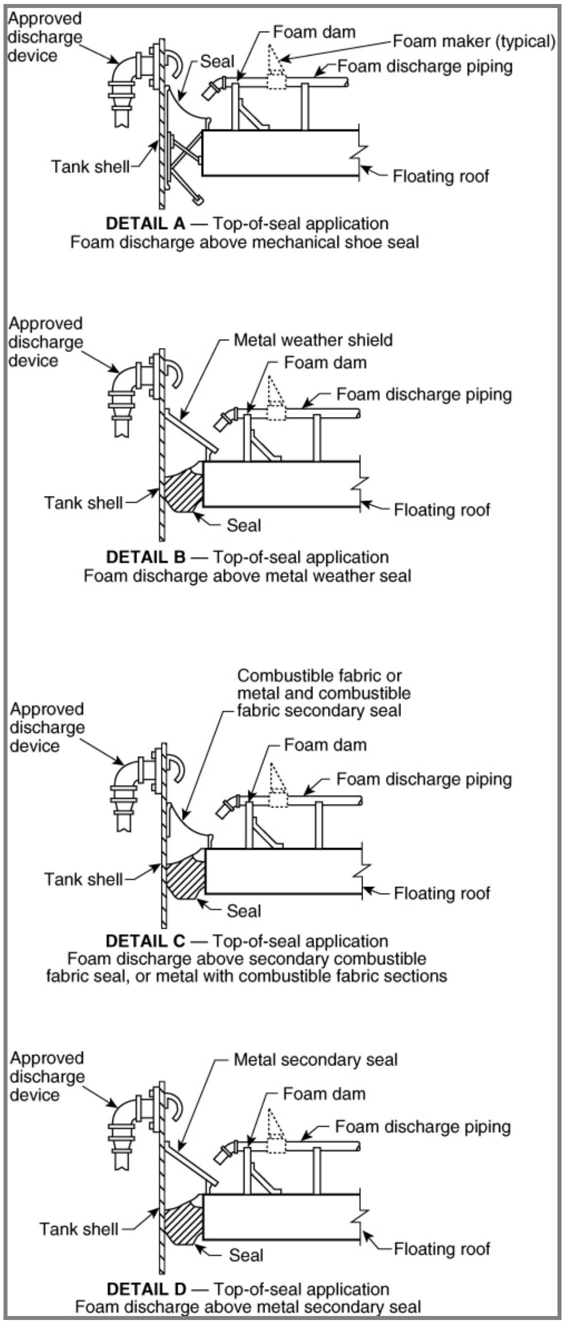
~~Notes:~~

~~(1) Where the fixed foam discharge outlets are mounted above the top of the tank shell, a foam splashboard is necessary due to the effect of winds.~~

~~(2) When using SFFF, the user should refer to Annex H and the manufacturer's recommendations to determine application rates.~~

*L/min·m^2 is equivalent to mm/min.

Figure 5.3.5.3.1 Typical Foam System Illustrations for Top-of-Seal Fire Protection. Both fixed foam (wall-mounted) and roof-mounted discharge outlets are shown for illustrative purposes. Although both methods are shown, only one is needed.



Supplemental Information

File Name	Description	Approved
FR-31_5.3.5.3.1_Clean.docx	For staff use only	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jun 03 15:49:44 EDT 2022

Committee Statement

Committee Statement: The revision to the metric conversions is a level of detail consistent with Table 1.6 of NFPA 11.

Response Message: FR-31-NFPA 11-2022

Public Input No. 50-NFPA 11-2022 [Section No. 5.3.5.3.1]

First Revision No. 17-NFPA 11-2022 [Section No. 5.3.5.3.5.2]

5.3.5.3.5.2

A foam dam shall be installed if a ~~tube~~ primary seal is used, foam release is above the primary seal or vapor barrier of the primary seal (or under the secondary seal or weather shield), and the top of the ~~tube~~ primary seal is less than 6 in. (152 mm) below the top of the pontoon.

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 11:07:19 EDT 2022

Committee Statement

Committee Statement: The technical committee agrees that the terminology should be updated to more current language.

Response Message: FR-17-NFPA 11-2022

Public Input No. 44-NFPA 11-2022 [Section No. 5.3.5.3.5.2]

First Revision No. 32-NFPA 11-2022 [Section No. 5.3.5.4.4]

5.3.5.4.4

The foam dam shall be at least 12 in. (300 mm)~~,~~ but not more than 24 in. (600 mm)~~,~~ from the tank shell at the highest point of the foam dam .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jun 03 15:59:53 EDT 2022

Committee Statement

Committee Statement: This adds clarification to the requirement that the measurement should be taken from the wall to the dam.

Response Message: FR-32-NFPA 11-2022

First Revision No. 18-NFPA 11-2022 [Section No. 5.6.4]

5.6.4 Design Criteria for Foam-Water Sprinkler Systems.

The design criteria for sprinkler systems shall be in accordance with ~~NFPA 16~~ Chapter 6 .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 12:08:16 EDT 2022

Committee Statement

Committee Statement: NFPA 16 has been withdrawn and these requirements are now located in Chapter 6.

Response Message: FR-18-NFPA 11-2022

Public Input No. 7-NFPA 11-2021 [Section No. 5.6.4]

First Revision No. 50-NFPA 11-2022 [Section No. 5.7.3.4.1]

5.7.3.4.1

Where fixed foam-water sprinklers or nozzles are used, the system design shall be in accordance with ~~NFPA 16~~ Chapter 6 .

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jul 15 16:27:55 EDT 2022

Committee Statement

Committee Statement: NFPA 16 has been withdrawn and the information is now located in Chapter 6 of NFPA 11.

Response Message: FR-50-NFPA 11-2022

First Revision No. 51-NFPA 11-2022 [Section No. 6.1.2]

6.1.2* Purpose.

The purpose of these requirements ~~is~~ shall be to provide a reasonable degree of protection for life and property from fire through installation requirements for foam-water sprinkler and spray systems based on sound engineering principles, test data, and field experience.

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jul 15 16:29:17 EDT 2022

Committee Statement

Committee Statement: Replaced "is" with "shall be" to align with the MOS. Mandatory language needs to include a shall statement.

Response Message: FR-51-NFPA 11-2022

First Revision No. 39-NFPA 11-2022 [Section No. 6.4.11.3]

6.4.11.3

The sprinklers shall be kept in a cabinet located where the temperature to which they are subjected will at no time exceed the maximum ceiling temperatures specified in Table 6.4.11.3(a)and Table 6.4.11.3(b) for each of the sprinklers within the cabinet. [**13:**16.2.7.3]

Table 6.4.11.3(a) Temperature Ratings, Classifications, and Color Codings for Glass Bulbs

Maximum Ceiling Temperature °F	Maximum Ceiling Temperature °C	Temperature Rating °F	Temperature Rating °C	Temperature Classification	~~Color Code~~	Glass Bulb Colors
100	38	135~~–170~~	57~~–77~~	Ordinary	~~Uncolored or black~~	Orange~~ or red~~
120	49	155	68	Ordinary		Red
150	66	175~~–225~~	79~~–107~~	Intermediate	~~White~~	Yellow~~ or green~~
150	66	200	93	Intermediate		Green
225	107	250–300	121–149	High	~~Blue~~	Blue
300	149	325–375	163–191	Extra high	~~Red~~	Purple
375	191	400–475	204–246	Very extra high	~~Green~~	Black
475	246	500–575	260–302	Ultra high	~~Orange~~	Black
625	329	650	343	Ultra high	~~Orange~~	Black

[**13:**Table 7.2.4.1(a)]

Table 6.4.11.3(b) Temperature Ratings, Classifications, and Color Codings for Fusible Links

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

[**13:** Table 7.2.4.1(b)]

Supplemental Information

File Name	Description	Approved
FR-39_6.4.11.3_Clean.docx	For staff use only.	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:16:07 EDT 2022

Committee Statement

Committee Statement: Revised to align extracted material with changes made to the latest edition of NFPA 13.
Response Message: FR-39-NFPA 11-2022

First Revision No. 40-NFPA 11-2022 [Section No. 6.4.11.5]

6.4.11.5

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

(1) For protected facilities having under 300 sprinklers — no fewer than six sprinklers

(2) For protected facilities having 300 to 1000 sprinklers — no fewer than 12 sprinklers

(3) For protected facilities having over 1000 sprinklers — no fewer than 24 sprinklers

[**13:**~~16.2.7.4~~ 16.2.7.5]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:22:19 EDT 2022

Committee Statement

Committee Statement: Revised to align the extract to the correct section as revised in the latest edition of NFPA 13.
Response Message: FR-40-NFPA 11-2022

First Revision No. 45-NFPA 11-2022 [Section No. 6.5.10.1.5]

6.5.10.1.5

For the purposes of computing friction loss in piping, the *C* values shall be used for the Hazen–Williams formula in accordance with Table 6.5.10.1.5.

Table 6.5.10.1.5 Hazen–Williams *C* Values

Pipe or Tube	*C* Value*
Unlined cast or ductile iron	100
Black steel (dry systems including preaction)	100
Black steel (wet systems including deluge)	120
Black steel (dry systems including preaction) using nitrogen ‡	120
Galvanized steel (dry systems including preaction)	100
Galvanized steel (wet systems including deluge)	120
Galvanized steel (dry systems including preaction) using nitrogen ‡	120
Plastic (listed) all	150
Cement-lined cast or ductile iron	140
Copper tube, brass or stainless steel	150
Asbestos cement	140
Concrete	140

*The authority having jurisdiction is permitted to allow other *C* values.

‡ Nitrogen supply shall be installed in accordance with 8.2.6.9 of NFPA 13.

[**13:**Table ~~27.2.4.8.1~~ 28.2.4.8.1]

Supplemental Information

File Name	Description	Approved
FR-45_6.5.10.1.5_Clean.docx	For staff use only	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:32:44 EDT 2022

Committee Statement

Committee Statement: Revised table to align with revisions made to the latest edition of NFPA 13.
Response Message: FR-45-NFPA 11-2022

First Revision No. 55-NFPA 11-2022 [Section No. 7.6]

7.6* Occupant Safety ~~and Rescue Operations~~ .

A.7.6

~~The discharge of large amounts of medium- or high-expansion foam can inundate personnel, while blocking vision, making hearing difficult, creating some discomfort in breathing, and causing spatial disorientation. This breathing discomfort will increase with a reduction in expansion ratio of the foam while the foam is under the effect of sprinkler discharge.~~ Additional exits and other measures might be necessary to ensure safe evacuation of personnel.

7.6.1 ~~Occupant Evacuation.~~

Facility occupants shall be briefed on system operation (activation and emergency shutdown) and evacuation procedures.

~~**A.7.6.1**~~

~~Additional exits and other measures might be necessary to ensure safe evacuation of personnel.~~

7.6.1.1

Upon system activation, occupants shall evacuate the facility and assemble in a predetermined location to conduct a count of personnel.

~~**7.6.2**~~

~~Foam discharge points relative to building exits shall not inhibit evacuation where possible.~~

<u>7.6.2</u>

<u>Where possible, the location of the foam discharge points relative to the building exits shall be arranged to facilitate the evacuation of personnel.</u>

7.6.3* Rescue Operations.

7.6.3.1

Upon notification of entrapped occupant(s), only trained rescue personnel wearing full personal protective equipment with self-contained breathing apparatus shall enter the foam-filled facility.

7.6.3.2*

To facilitate rescue operations, facility doors shall be fully opened and a blended attack of coarse water and industrial silicone-based de-foaming agent shall be utilized.

7.6.3.2.1

Facility foam generators shall remain operational (water only) to aid in foam dispersion.

7.6.3.3*

Rescue personnel shall use a straight-line search pattern and search wands to effectively cover large floor spaces.

7.6.3.3.1*

To ensure effective communications, rescue personnel shall remain within line-of-sight of each other.

7.6.4* Electrical Clearances.

7.6.4.1

All system components shall be located to maintain minimum clearances from live parts as shown in Table 7.6.4.1.

Table 7.6.4.1 Clearance from Medium- and High-Expansion Foam Equipment to Live Uninsulated Electrical Components

Nominal Line Voltage (kV)	Nominal Voltage to Ground (kV)	Design BIL* (kV)	Minimum Clearance	
			in.	mm
To 15	To 9	110	7	178
23	13	150	10	254
34.5	20	200	13	330
46	27	250	17	432
69	40	350	25	635
115	66	550	37	940
138	80	650	44	1118
161	93	750	52	1321
196–230	114–132	900	63	1600
		1050	76	1930
		1175	87	2210
		1300	98	2489
287–380	166–220	1425	109	2769
		1550	120	3048
500	290	1675	131	3327
		1800	142	3607
		1925	153	3886
500–700	290–400	2100	168	4267
		2300	184	4674

*Basic insulation level (BIL) values are expressed as kilovolts (kV), the number being the crest value of the full wave impulse test that the electrical equipment is designed to withstand.

7.6.4.2

The clearances given are for altitudes of 3281 ft (1000 m) or less.

7.6.4.2.1*

At altitudes in excess of 3281 ft (1000 m), the clearance shall be increased at the rate of 1 percent for each 328 ft (100 m) increase in altitude above 3281 ft (1000 m).

7.6.4.2.2

To coordinate the required clearance with the electrical design, the design BIL of the equipment being protected shall be used as a basis, although this is not material at nominal line voltages of 161 kV or less.

7.6.4.2.3

At voltages higher than 161 kV, uniformity in the relationship between design BIL kV and the various electrical system voltages has not been established in practice and is dependent on several variables; thus, the required clearances to ground shall be based on the design BIL used rather than on the nominal line or ground voltage.

7.6.4.2.4

The clearance between uninsulated energized parts of the electrical system equipment and any portion of the medium- or high-expansion foam system shall not be less than the minimum clearance provided elsewhere for electrical system insulations on any individual component.

Supplemental Information

File Name	Description	Approved
FR-new_7.6.1_Clean_FR55_TH.docx	For staff use only	
11_FR-55_7.6.docx	Final for production	

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Mon Jul 25 12:31:12 EDT 2022

Committee Statement

Committee Statement: Occupant safety requirements were strengthened because of the risk of being trapped by medium- and high-expansion foam.

Response Message: FR-55-NFPA 11-2022

Public Input No. 3-NFPA 11-2021 [Section No. 7.6.1]

First Revision No. 52-NFPA 11-2022 [Section No. 7.12.8.2.3.2]

7.12.8.2.3.2*

The factor (R_S) for compensation for breakdown by sprinkler discharge shall be determined either by test or, in the absence of specific test data, by the following formula:

$$R_S = S \times Q \quad [7.12.8.2.3.2]$$

where:

S = foam breakdown in ft^3/min · gpm (m^3/min · L/min) of sprinkler discharge. ~~S shall be 10 ft^3 /min · gpm (0.0748 m^3 /min· L/min).~~

Q = estimated total discharge from maximum number of sprinklers expected to operate in gpm (L/min).

Supplemental Information

File Name	Description	Approved
FR-52_7.12.8.2.3.2_FINAL.docx	Final for production	

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jul 15 16:36:54 EDT 2022

Committee Statement

Committee Statement: Breaking out mandatory language from formula 7.12.8.2.3.2 for clarity and to be consistent with the other mandatory factors from formula 7.12.8.2.3.1.

Response Message: FR-52-NFPA 11-2022

First Revision No. 41-NFPA 11-2022 [Section No. 12.9.6.1]

12.9.6.1

The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion-resistant wire, chain, or other approved means. [**13:**~~28.5.1~~ 29.4.1]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:25:39 EDT 2022

Committee Statement

Committee Statement: Revised to align the section number with change to where it is located in the latest edition of NFPA 13.
Response Message: FR-41-NFPA 11-2022

First Revision No. 42-NFPA 11-2022 [Section No. 12.9.6.2]

12.9.6.2

Such signs shall be placed at ~~the~~ every system riser, floor control assembly, alarm valve, dry pipe valve, preaction valve, or deluge valve supplying the corresponding hydraulically designed area unless the AHJ approves an alternate location . [**13:**~~28.5.2~~ 29.4.2]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:26:50 EDT 2022

Committee Statement

Committee Statement: Revised to align extract text and section number with the latest edition of NFPA 13.
Response Message: FR-42-NFPA 11-2022

First Revision No. 43-NFPA 11-2022 [Section No. 12.9.7.1]

12.9.7.1

The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25. [**13:**~~28.6.1~~ 29.6.1]

12.9.7.1.1

Such general information shall be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. [**13:**~~28.6.1.1~~ 29.6.1.1]

12.9.7.1.2

Such signs shall be placed at each system control riser and auxiliary system control valve.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:29:00 EDT 2022

Committee Statement

Committee Statement: Revised to align extract sections with the latest edition of NFPA 13.
Response Message: FR-43-NFPA 11-2022

First Revision No. 20-NFPA 11-2022 [Sections 13.1, 13.2, 13.3]

13.1 General.

A foam system shall be inspected, tested, and maintained by the property owner or their authorized representative in accordance with NFPA 25 to ensure the system continues to provide a reasonable degree of protection for life and property from fire.

~~**13.1.1** Minimum Requirements.~~

~~**13.1.1.1***~~

~~This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of low-, medium-, and high-expansion foam, as well as foam-water sprinkler systems.~~

~~**A.13.1.1.1**~~

~~An inspection contract for the equipment service tests and operation at regular intervals is recommended.~~

~~13.1.1.2~~

~~Table 13.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance. [**25:** 11.1.1.2]~~

~~Table 13.1.1.2 Summary of Foam-Water Sprinkler System Inspection, Testing, and Maintenance~~

~~System/Component~~	~~Frequency~~	~~Reference [NFPA 25]~~
~~**Inspection**~~	-	-
~~Control valve(s)~~	-	~~Chapter 13~~
~~Deluge/preaction valve(s)~~	-	~~Chapter 13~~
~~Discharge device location (spray nozzle)~~	~~Monthly~~	~~11.2.4~~
~~Discharge device location (sprinkler)~~	~~Annually~~	~~11.2.4~~
~~Discharge device position (spray nozzle)~~	~~Monthly~~	~~11.2.4~~
~~Discharge device position (sprinkler)~~	~~Annually~~	~~11.2.4~~
~~Drainage in system area~~	~~Quarterly~~	~~11.2.7~~
~~Fire pump system~~	-	~~Chapter 8~~
~~Fittings corrosion~~	~~Annually~~	~~11.2.2~~
~~Fittings damage~~	~~Annually~~	~~11.2.2~~
~~Foam concentrate strainer(s)~~	~~Quarterly~~	~~11.2.6.4~~
~~Gauges~~	-	~~Chapter 13~~
~~Hangers/braces/supports~~	~~Annually~~	~~11.2.3~~
~~Pipe corrosion~~	~~Annually~~	~~11.2.2~~
~~Pipe damage~~	~~Annually~~	~~11.2.2~~
~~Proportioning system(s) — all~~	~~Monthly~~	~~11.2.8~~
~~Strainer(s) — Mainline~~	~~5 years~~	~~11.2.6.1~~
~~Water supply piping~~	-	~~11.2.5.1~~
~~Water supply tank(s)~~	-	~~Chapter 9~~
~~Waterflow alarm devices~~	-	~~Chapter 13~~
~~**Test**~~	-	-
~~Backflow preventer(s)~~	-	~~Chapter 13~~
~~Complete foam-water sprinkler system(s) (operational test)~~	~~Annually~~	~~11.3.2, 11.3.3~~
~~Control valve(s)~~	-	~~Chapter 13~~
~~Deluge/preaction valve(s)~~	-	~~Chapter 13~~
~~Discharge device location~~	~~Annually~~	~~11.3.2.6~~
~~Discharge device obstruction~~	~~Annually~~	~~11.3.2.6~~
~~Discharge device position~~	~~Annually~~	~~11.3.2.6~~
~~Fire pump system~~	-	~~Chapter 8~~
~~Foam-water solution~~	~~Annually~~	~~11.3.5~~
~~Manual actuation device(s)~~	~~Annually~~	~~11.3.4~~
~~Valve status test~~	-	~~Chapter 13~~
~~Water supply flow test~~	-	~~Chapter 7~~
~~Water supply tank(s)~~	-	~~Chapter 9~~
~~Waterflow alarm devices~~	-	~~Chapter 13~~
~~**Maintenance**~~	-	-
~~Backflow preventer(s)~~	-	~~Chapter 13~~
~~Bladder tank type~~	-	-
~~— Foam concentrate tank — hydrostatic test~~	~~10 years~~	~~11.4.5.2~~
~~— Sight glass~~	~~10 years~~	~~11.4.5.1~~
~~Check valve(s)~~	-	~~Chapter 13~~

System/Component	Frequency	Reference [NFPA 25]
Control valve(s)	-	Chapter 13
Deluge/preaction valves	-	Chapter 13
Detector check valve(s)	-	Chapter 13
Fire pump system	-	Chapter 8
Foam concentrate pump operation	Monthly	11.4.7.1
Foam concentrate samples	Per manufacturer's recommendation	11.4.2
Foam concentrate strainer(s)	Quarterly	Section 11.4
In-line balanced pressure type	-	-
Balancing valve diaphragm	5 years	11.4.8.3
Foam concentrate pump(s)	5 years*	11.4.8.2
Foam concentrate tank	10 years	11.4.8.4
Line type	-	-
Foam concentrate tank — corrosion and pickup pipes	10 years	11.4.6.1
Foam concentrate tank — drain and flush	10 years	11.4.6.2
Pressure vacuum vents	5 years	11.4.9
Proportioning system(s) standard pressure type	-	-
Ball drip (automatic type) drain valves	5 years	11.4.4.1
Corrosion and hydrostatic test	10 years	11.4.4.4
Foam concentrate tank — drain and flush	10 years	11.4.4.2
Standard balanced pressure type	-	-
Balancing valve diaphragm	5 years	11.4.7.3
Foam concentrate pump(s)	5 years*	11.4.7.2
Foam concentrate tank	10 years	11.4.7.4
Strainer(s) — mainline	5 years	11.2.6.1
Water supply	Annually	11.2.5.2
Water supply tank(s)	-	Chapter 9

*Also refer to manufacturer's instructions and frequency. Maintenance intervals other than preventive maintenance are not provided, as they depend on the results of the visual inspections and operational tests. For foam-water sprinkler systems in aircraft hangars, refer to the inspection, test, and maintenance requirements of Table 11.1.1 in NFPA 409.

[**25:** Table 11.1.1.2]

13.1.2 Other System Components.

Fire pumps, water storage tanks, common components, and valves common to other types of water-based fire protection systems shall be inspected, tested, and maintained in accordance with Chapters 8, 9, and 13, respectively [of NFPA 25], and as specified in Table 13.1.1.2 . [**25:** 11.1.2]

13.1.3

Alarm and detection devices shall be tested and inspected in accordance with *NFPA 72* .

13.1.4

Systems shall be so arranged that tests and inspections can be made without discharging foam solution to the system piping in order to check operation of all mechanical and electrical components of the system.

13.1.5*

~~The system shall be arranged so that tests are performed with as little loss of foam concentrate as possible.~~

~~A.13.1.5~~

~~Samples of foam liquid concentrate should be referred to the manufacturer to check its condition annually. Samples should be submitted in accordance with the manufacturer's recommended sampling procedure.~~

~~13.1.6*~~

~~If during routine inspection and testing the system is determined to have been altered or replaced, it shall be determined whether the system operates properly.~~

~~A.13.1.6~~

~~Examples of system alterations include replaced or relocated equipment and replacement foam concentrate.~~

~~13.1.7~~

~~All persons who are expected to inspect, test, maintain, or operate apparatus shall be thoroughly trained, and training shall be kept current.~~

~~13.2~~ ~~Low-, Medium-, and High-Expansion Foam Systems.~~

~~13.2.1*~~ ~~General.~~

~~A.13.2.1~~

~~Flushing of the concentrate pump might be necessary at periodic intervals or following complete discharge of concentrate.~~

~~13.2.1.1~~

~~At least annually, all foam systems shall be thoroughly inspected and tested for correct operation.~~

~~13.2.1.2~~

~~The goal of this inspection and testing shall be to ensure that the system is in full operating condition and that it remains in that condition until the next inspection.~~

~~13.2.1.3~~

~~The inspection report, with recommendations, shall be filed with the owner.~~

~~13.2.1.4~~

~~Between the regular service contract inspections or tests, the system shall be inspected by competent personnel following an approved schedule.~~

~~13.2.2*~~ ~~Foam-Producing Equipment.~~

~~A.13.2.2~~

~~Regular service contracts are recommended.~~

~~13.2.2.1~~

~~Proportioning devices, their accessory equipment, and foam makers shall be inspected.~~

~~13.2.2.2~~

~~Fixed discharge outlets equipped with frangible seals shall be provided with inspection means to permit maintenance and for inspection and replacement of vapor seals.~~

~~13.2.2.2.1*~~

~~At least annually, water shall be discharged through each foam maker discharge outlet to confirm that foam makers and foam solution feed lines are not obstructed by debris.~~

~~A.13.2.2.2.1~~

~~In some cases the primary discharge outlet on foam chambers must be temporarily blocked to prevent flow into the hazard area.~~

~~13.2.2.2.2*~~

~~Alternative methods where approved by the AHJ shall be permitted.~~

~~A.13.2.2.2.2~~

~~See NFPA 25 , Chapter 14, for alternative methods.~~

~~13.2.2.3*~~

~~Proportioning equipment shall be tested annually in accordance with Section 13.2.6 .~~

~~A.13.2.2.3~~

~~Test results that deviate more than 10 percent from those recorded in acceptance testing should be investigated and, if necessary, discussed immediately with the manufacturer.~~

~~13.2.2.4 Compressed Air Foam-Producing Equipment.~~

~~13.2.2.4.1~~

~~Compressed air foam-generating equipment and accessories shall be inspected annually.~~

~~13.2.2.4.2~~

~~Discharge devices shall be visually inspected annually for evidence of mechanical damage.~~

~~13.2.3 Piping.~~

~~13.2.3.1~~

~~Aboveground piping shall be examined to determine its condition and to verify that proper drainage pitch is maintained.~~

~~13.2.3.2~~

~~Pressure tests of normally dry piping shall be made when visual inspection indicates questionable strength due to corrosion or mechanical damage.~~

~~13.2.3.3~~

~~Underground piping shall be spot-checked for deterioration at least every 5 years.~~

~~13.2.4 Strainers.~~

~~Strainers shall be inspected in accordance with manufacturer's instructions and shall be cleaned after each use and flow test.~~

~~13.2.5 Detection and Actuation Equipment.~~

~~Control valves, including all automatic and manual-actuating devices, shall be tested at regular intervals.~~

13.2.6 Foam Concentrate Inspection.

13.2.6.1

At least annually, an inspection shall be made of foam concentrates and their tanks or storage containers for evidence of excessive sludging or deterioration.

13.2.6.2

Samples of concentrates shall be sent to the manufacturer or qualified laboratory for quality condition testing.

13.2.6.3

When the foam type and brand of foam are known, the quality testing shall confirm the product meets the manufacturer's specifications.

13.2.6.4

Quantity of concentrate in storage shall meet design requirements, and tanks or containers shall normally be kept full, with space allowed for expansion.

13.2.7 High-Pressure Cylinders.

High-pressure cylinders used in compressed air foam systems shall not be recharged without a hydrostatic test (and remarking) if more than 5 years have elapsed from the date of the last test. Cylinders that have been in continuous service without discharging shall be permitted to be retained in service for a maximum of 12 years, after which they shall be discharged and retested before being returned to service.

13.2.8 Operating Instructions and Training.

Operation, system deactivation, and maintenance instructions and layouts shall be posted at control equipment with copies of each on file.

13.3 Foam-Water Sprinkler Systems.

13.3.1 General.

13.3.1.1*

If during routine inspection and testing the foam-water sprinkler system is determined to have been altered or replaced (e.g., equipment replaced, relocated, or foam concentrate replaced), it shall be determined whether the system operates properly. [**25:** 11.1.4.1]

A.13.3.1.1

To provide a means of periodically checking the performance of the proportioners used in foam sprinkler systems, a test connection should be provided. Typical test connections are illustrated in Figure A.6.4.10 . Two options are possible in locating the proportioning controller in the sprinkler riser: before the main sprinkler valve or after the main sprinkler valve. If the proportioning controller is located after the main sprinkler valve, an additional supervised OS valve is needed to isolate the sprinkler overhead during the proportioner test. This is done to eliminate the problems caused by air cushions in wet pipe sprinkler systems or the servicing delays caused during charging and draining of preaction or deluge sprinkler systems. The test connection should be routed to a drain area for easy disposal of the solution produced during the test. The manufacturer's test procedures should be followed closely.

13.3.1.2 Obstruction Investigations.

The procedures outlined in Chapter 14 [of NFPA 25] shall be followed where there is a need to conduct an obstruction investigation. [**25:** 11.1.5]

13.3.1.3 Impairments.

The procedures outlined in Chapter 15 [of NFPA 25] shall be followed where an impairment to protection occurs. [**25:** 11.1.6]

13.3.1.4 System Piping and Fittings.

System piping and fittings shall be inspected for the following:

- Mechanical damage (e.g., broken piping or cracked fittings)
- External conditions (e.g., missing or damaged paint or coatings, rust, and corrosion)
- Misalignment or trapped sections
- Low-point drains (automatic or manual)
- Location and condition of rubber-gasketed fittings

[**25:** 11.2.2]

13.3.1.5 Hangers, Braces, and Supports.

Hangers, braces, and supports shall be inspected for the following and repaired or replaced as necessary:

- Condition (e.g., missing or damaged paint or coating, rust, and corrosion)
- Secure attachment to structural supports and piping
- Damaged or missing hangers, braces, and supports

[**25:** 11.2.3]

13.3.2 Inspection.

13.3.2.1* Foam-Water Discharge Devices.

A.13.3.2.1

Directional-type foam-water discharge devices are quite often located in heavy traffic areas and are more apt to be dislocated compared to ordinary sprinkler locations. Of particular concern are low-level discharge devices in loading racks in and around low-level tankage and monitor-mounted devices that have been pushed out of the way for convenience. Inspection frequency might have to be increased accordingly. [**25:** A.11.2.4]

13.3.2.1.1

Foam-water discharge devices shall be inspected visually and maintained to ensure that they are in place, continue to be aimed or pointed in the direction intended in the system design, and are free from external loading and corrosion. [**25:** 11.2.4.1]

13.3.2.1.2

Where caps or plugs are required, the inspection shall confirm they are in place and free to operate as intended. [**25:** 11.2.4.2]

13.3.2.1.3

Misaligned discharge devices shall be adjusted (aimed) by visual means, and the discharge patterns shall be inspected at the next scheduled flow test. [**25:** 11.2.4.3]

13.3.2.1.4*

Inspection shall verify that unlisted combinations of discharge devices and foam concentrate have not been substituted. [**25:** 11.2.4.4]

A.13.3.2.1.4

Discharge devices are listed or approved for particular foam concentrates. [**25:** A.11.2.4.4]

13.3.2.2 Water Supply.

~~**13.3.2.2.1**~~

~~The dependability of the water supply shall be ensured by regular inspection and maintenance, whether furnished by a municipal source, on-site storage tanks, a fire pump, or private underground piping systems. [**25:** 11.2.5.1]~~

~~**13.3.2.2.2***~~

~~Water supply piping shall be maintained free of internal obstructions. [**25:** 11.2.5.2]~~

~~**A.13.3.2.2.2**~~

~~Water supply piping should be free of internal obstructions that can be caused by debris (e.g., rocks, mud, tubercles) or by closed or partially closed control valves. See Chapter 5 [of NFPA 25] for inspection and maintenance requirements. [**25:** A.11.2.5.2]~~

~~**13.3.2.3** Strainers.~~

~~**13.3.2.3.1**~~

~~Mainline and individual discharge device strainers (basket or screen) shall be inspected every 5 years for damaged and corroded parts. [**25:** 11.2.6.1]~~

~~**13.3.2.3.2**~~

~~Other maintenance intervals shall be permitted, depending on the results of the visual inspection and operating tests. [**25:** 11.2.6.2]~~

~~**13.3.2.3.3**~~

~~Discharge device strainers shall be removed, inspected, and cleaned during the flushing procedure for the mainline strainer. [**25:** 11.2.6.3]~~

~~**13.3.2.3.4**~~

~~Foam concentrate strainers shall be inspected visually to ensure the blowdown valve is closed and plugged. [**25:** 11.2.6.4]~~

~~**13.3.2.3.5**~~

~~Baskets or screens shall be removed and inspected after each operation or flow test. [**25:** 11.2.6.5]~~

~~**13.3.2.4** Drainage.~~

~~The area beneath and surrounding a foam-water spray system shall be inspected to ensure that drainage facilities, such as trap sumps and drainage trenches, are not blocked, and retention embankments or dikes are in good repair. [**25:** 11.2.7]~~

~~**13.3.2.5*** Proportioning Systems.~~

~~**A.13.3.2.5**~~

~~Proportioning systems might or might not include foam concentrate pumps. If pumps are part of the proportioning system, the driver, pump, and gear reducer should be inspected in accordance with the manufacturer's recommendations, and the inspection can include items such as lubrication, fuel, filters, oil levels, and clutches. [**25:** A.11.2.8]~~

~~**13.3.2.5.1**~~

~~The components of the various proportioning systems described in 13.3.2.5 shall be inspected in accordance with the frequency specified in Table 13.1.1.2 . [**25:** 11.2.8.1]~~

~~**13.3.2.5.2**~~

~~Valves specified to be inspected shall be permitted to be open or closed, depending on specific functions within each foam-water sprinkler system. [**25:** 11.2.8.2]~~

~~**13.3.2.5.3**~~

~~The position (open or closed) of valves shall be verified in accordance with specified operating conditions. [**25:** 11.2.8.3]~~

~~**13.3.2.5.4***~~

~~Inspection of the concentrate tank shall include verification that the quantity of foam concentrate satisfies the requirements of the original design. [**25:** 11.2.8.4]~~

~~**A.13.3.2.5.4**~~

~~In some cases, an adequate supply of foam liquid is available without a full tank. This is particularly true of foam liquid stored in nonmetallic tanks. If liquid is stored in metallic tanks, the proper liquid level should be one-half the distance into the expansion dome. [**25:** A.11.2.8.4]~~

~~**13.3.2.5.5**~~

~~Additional inspection requirements shall be performed as detailed for the proportioning systems specified in 13.3.2.5 . [**25:** 11.2.8.5]~~

~~**13.3.2.5.5.1** Standard Pressure Proportioner.~~

~~**(A)***~~

~~The pressure shall be removed before the inspection to prevent injury. [**25:** 11.2.8.5.1.1]~~

~~**A.13.3.2.5.5.1(A)**~~

~~The standard pressure proportioner is a pressure vessel. Although under normal standby conditions this type of proportioning system should not be pressurized, some installations allow for inadvertent pressurization. Pressure should be removed before inspection. [**25:** A.11.2.8.5.1.1]~~

~~**(B)**~~

~~The inspection shall verify the following:~~

- ~~Ball drip valves (automatic drains) are free and opened.~~
- ~~External corrosion on foam concentrate storage tanks is not present.~~

~~[**25:** 11.2.8.5.1.2]~~

~~**13.3.2.5.5.2** Bladder Tank Proportioner.~~

~~**(A)***~~

~~The pressure shall be removed before the inspection to prevent injury. [**25:** 11.2.8.5.2.1]~~

~~**A.13.3.2.5.5.2(A)**~~

~~The bladder tank proportioner is a pressure vessel. Where inspecting for a full liquid tank, the manufacturer's instructions should be followed. If inspected incorrectly, the tank sight gauges could indicate a full tank when the tank actually is empty of foam liquid. Some foam liquids, due to their viscosity, might not indicate true levels of foam liquid in the tank where inspected via the sight glass.~~

~~**CAUTION:** Depending on system configuration, this type of proportioner system might be pressurized or nonpressurized under normal conditions. Pressure should be removed before inspection. [**25:** A.11.2.8.5.2.1]~~

(B)

The inspection shall include the following:

Water control valves to foam concentrate tank

An inspection for external corrosion on foam concentrate storage tanks

An inspection for the presence of foam in the water surrounding the bladder (annual)

[**25:** 11.2.8.5.2.2]

13.3.2.5.5.3 Line Proportioner.

The inspection shall include the following:

* Strainers

A.13.3.2.5.5.3(1) –

See 13.3.2.3.1 .

* Verification that pressure vacuum vent is operating freely

A.13.3.2.5.5.3(2) –

See Figure A.13.3.2.5.5.3(2) .

Figure A.13.3.2.5.5.3(2) Pressure Vacuum Vent. [25:Figure A.3.3.34]

DELETED

An inspection for external corrosion on foam concentrate storage tanks

[**25:** 11.2.8.5.3]

13.3.2.5.5.4 Standard Balanced Pressure Proportioner.

The inspection shall include the following:

* Strainers

A.13.3.2.5.5.4(1) –

See 13.3.2.3.1 .

* Verification that pressure vacuum vent is operating freely

A.13.3.2.5.5.4(2) –

See Figure A.13.3.2.5.5.3(2) .

Verification that gauges are in good operating condition

Verification that sensing line valves are open

Verification that power is available to foam liquid pump

[**25:** 11.2.8.5.4]

13.3.2.5.5.5 In-Line Balanced Pressure Proportioner.

The inspection shall include the following:

* Strainers

A.13.3.2.5.5.5(1) –

See 13.3.2.3.1 .

* Verification that pressure vacuum vent is operating freely

A.13.3.2.5.5.5(2) –

See Figure A.13.3.2.5.5.3(2) .

Verification that gauges are in good working condition

Verification that sensing line valves at pump unit and individual proportioner stations are open

Verification that power is available to foam liquid pump

[**25:** 11.2.8.5.5]

13.3.2.5.5.6 Orifice Plate Proportioner.

The inspection shall include the following:

- * Strainers

A.13.3.2.5.5.6(1) –

See 13.3.2.3.1 .

- * Verification that pressure vacuum vent is operating freely

A.13.3.2.5.5.6(2) –

See Figure A.13.3.2.5.5.3(2)

- Verification that gauges are in good working condition
- Verification that power is available to foam liquid pump

[**25:** 11.2.8.5.6]

13.3.3* Operational Tests.

Frequency of system tests shall be in accordance with Table 13.1.1.2 . [**25:** 11.3]

A.13.3.3

Operational tests generally should be comprised of the following:

- A detection/actuation test with no flow to verify that all components such as automated valves, foam and water pumps, and alarms operate properly
- A water-only flow test to inspect piping continuity, discharge patterns, pressures, and line flushing
- A foam flow test to verify solution concentration
- Resetting of system to its normal standby condition, including draining of lines and filling of foam liquid tank

[**25:** A.11.3]

13.3.3.1* Test Preparation.

Precautions shall be taken to prevent damage to property during the test. [**25:** 11.3.1]

A.13.3.3.1

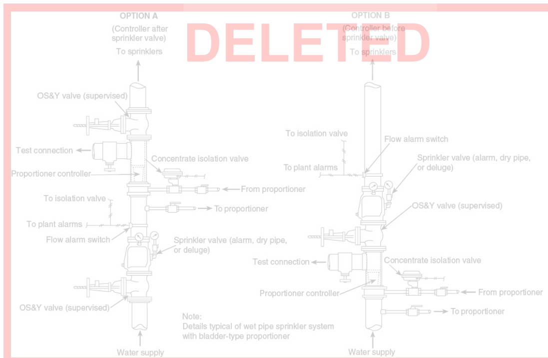
The property owner or designated representative should take care to prevent damage to equipment or the structure during the test. Damage could be caused by the system discharge or by runoff from the test site. It should be verified that there is adequate and unobstructed drainage. Equipment should be removed or covered as necessary to prevent damage. Means such as curbing or sandbagging should be used to prevent entry of the foam-water solution. [**25:** A.11.3.1]

13.3.3.2* Operational Test Performance.

A.13.3.3.2

An alternative method for achieving flow can be permitted to be an installation as shown in Figure A.13.3.3.2 . This type of testing does not verify system pipe conditions or discharge device performance but only the water supply, foam concentrate supply, and proportioning accuracy. [**25:** A.11.3.2]

Figure A.13.3.3.2 Foam System/Test Header Combination. [25:Figure A.11.3.2]



13.3.3.2.1

Operational tests shall be conducted to ensure that the foam-water sprinkler system(s) responds as designed, both automatically and manually. [**25:** 11.3.2.1]

13.3.3.2.2

The test procedures shall simulate anticipated emergency events so the response of the foam-water sprinkler system(s) can be evaluated. [**25:** 11.3.2.2]

13.3.3.2.3

Where discharge from the system discharge devices would create a hazardous condition or conflict with local requirements, an approved alternate method to achieve full flow conditions shall be permitted. [**25:** 11.3.2.3]

13.3.3.2.4 Response Time.

Under test conditions, the automatic fire detection systems, when exposed to a test source, shall operate within the requirements of *NFPA 72* for the type of detector provided, and the response time shall be recorded. [**25:** 11.3.2.4]

13.3.3.2.5 Discharge Time.

The time lapse between operation of detection systems and water delivery time to the protected area shall be recorded for open discharge devices. [**25:** 11.3.2.5]

13.3.3.2.6 Discharge Patterns.

13.3.3.2.6.1

The discharge patterns from all of the open spray devices shall be observed to ensure that patterns are not impeded by plugged discharge devices and to ensure that discharge devices are correctly positioned and that obstructions do not prevent discharge patterns from covering surfaces to be protected. [**25:** 11.3.2.6.1]

13.3.3.2.6.2

Where obstructions occur, the piping and discharge devices shall be cleaned and the system retested. [**25:** 11.3.2.6.2]

13.3.3.2.6.3

Discharge devices shall be permitted to be of different orifice sizes and types. [**25:** 11.3.2.6.3]

13.3.3.2.7* Pressure Readings.

A.13.3.3.2.7

Specific foam concentrates typically are listed or approved with specific sprinklers. Part of the approval and listing is a minimum sprinkler operating pressure. Sprinkler operating pressure affects foam quality, discharge patterns, and fire extinguishment (control) capabilities. Discharge pressures less than this specified minimum pressure should be corrected immediately; therefore, it is necessary to test under full flow conditions. [**25:** A.11.3.2.7]

13.3.3.2.7.1

Pressure readings shall be recorded at the most hydraulically demanding discharge device.

13.3.3.2.7.2

It shall be permissible to test the full flow discharge from foam-water deluge systems using water only in lieu of foam. [**25:** 11.3.2.7.2]

13.3.3.2.7.3

A second pressure reading shall be recorded at the main control valve. [**25:** 11.3.2.7.3]

13.3.3.2.7.4

Readings shall be compared to the hydraulic design pressures to ensure the original system design requirements are met. [**25:** 11.3.2.7.4]

13.3.3.3 Multiple Systems.

The maximum number of systems expected to operate in case of fire shall be tested simultaneously to inspect the adequacy of the water supply and concentrate pump. [**25:** 11.3.3]

13.3.3.4 Manual Actuation Devices.

Manual actuation devices shall be tested annually. [**25:** 11.3.4]

13.3.3.5 Concentration Testing.

13.3.3.5.1

During the operational test, a foam sample shall be taken. [**25:** 11.3.5.1]

13.3.3.5.2

Where approved by the authority having jurisdiction, simulated foam concentrates or alternative test systems shall be permitted to be substituted for actual foam concentrate, but system pressures and flows shall remain as described above and meet manufacturer's system requirements and recommendations. [**25:** 11.3.5.2]

13.3.4* Maintenance.

A.13.3.4

The maintenance items specified in the body of this standard are in addition to the typical inspection and test procedures indicated. Foam-water sprinkler systems are, as are all fire protection systems, designed to be basically maintenance free. There are, however, some areas that need special attention. Foam concentrate shelf life varies between liquids and is affected by factors such as heat, cold, dilution, contamination, and many others. As with all systems, common sense dictates those maintenance-sensitive areas that should be given attention. Routine testing and inspection generally dictate the need for additional maintenance items. Those maintenance items specified are key procedures that should be performed routinely. [**25:** A.11.4]

13.3.4.1

Maintenance of foam-water sprinkler systems shall be in accordance with the requirements of those chapters covering the specific component parts. [**25:** 11.4.1]

13.3.4.2 Foam Concentrate Samples.

Samples of foam concentrates shall be sent to the manufacturer or qualified laboratory for quality condition testing at the frequency recommended by the manufacturer. [**25:** 11.4.2]

13.3.4.3 Foam Components.

Maintenance of specific foam components shall be in accordance with 13.3.4.4 through 13.3.4.8 . [**25:** 11.4.3]

13.3.4.4 Standard Pressure Proportioner.

13.3.4.4.1

The ball drip (automatic-type) drain valves shall be disassembled, cleaned, and reassembled. [**25:** 11.4.4.1]

13.3.4.4.2*

The foam liquid storage tank shall be drained of foam liquid and flushed. [**25:** 11.4.4.2]

A.13.3.4.4.2

Foam concentrates tend to settle out over time. Depending on the specific characteristics of the foam concentrate, sedimentation accumulates in the bottom of the storage vessel. This sediment can affect proportioning and foam concentrate integrity. Some concentrates tend to settle out more rapidly than others. If the annual samples indicate excessive sediment, flushing the tank could be required more frequently. [**25:** A.11.4.4.2]

13.3.4.4.3

Foam liquid shall be permitted to be salvaged and reused. [**25:** 11.4.4.3]

13.3.4.4.4

The foam liquid tank shall be inspected for internal and external corrosion and hydrostatically tested to the specified working pressure. [**25:** 11.4.4.4]

13.3.4.5 Bladder Tank Proportioner.

13.3.4.5.1

Sight glass, where provided, shall be removed and cleaned. [**25:** 11.4.5.1]

13.3.4.5.2*

The foam concentrate bladder tank shall be hydrostatically tested at system working pressure. [**25:** 11.4.5.2]

A.13.3.4.5.2

When hydrostatically testing bladder tanks, the generation of a pressure differential across the diaphragm could cause damage to the diaphragm. Tanks should be filled with agent to no less than the normal fill capacity and air should be vented from inside and outside the bladder before pressurizing. [**25:** A.11.4.5.2]

13.3.4.5.2.1

The hydrostatic test shall not create a pressure differential across the diaphragm. [**25:** 11.4.5.2.1]

~~**13.3.4.5.2.2**~~

~~While under system working pressure, the exterior of the foam concentration bladder tank shall be inspected for leaks. [**25:** 11.4.5.2.2]~~

~~**13.3.4.6** Line Proportioner.~~

~~**13.3.4.6.1**~~

~~The foam concentrate tank shall be inspected for internal corrosion. [**25:** 11.4.6.1]~~

~~**13.3.4.6.2**~~

~~Pickup pipes inside the tank shall be inspected for corrosion, separation, or plugging. [**25:** 11.4.6.2]~~

~~**13.3.4.6.3**~~

~~The foam concentrate tank shall be drained and flushed. [**25:** 11.4.6.3]~~

~~**13.3.4.6.4**~~

~~Foam concentrate shall be permitted to be salvaged and reused. [**25:** 11.4.6.4]~~

~~**13.3.4.7** Standard Balanced Pressure Proportioner.~~

~~**13.3.4.7.1** Pump Operation.~~

~~**13.3.4.7.1.1**~~

~~Foam concentrate shall be circulated back to the tank. [**25:** 11.4.7.1.2]~~

~~**13.3.4.7.2** Servicing.~~

~~Foam pumps, drive train, and drivers shall be serviced in accordance with the manufacturer's instructions and frequency but not at intervals of more than 5 years. [**25:** 11.4.7.2]~~

~~**13.3.4.7.3** Flushing.~~

~~The diaphragm balancing valve shall be flushed through the diaphragm section with water or foam concentrate until fluid appears clear or new. [**25:** 11.4.7.3]~~

~~**13.3.4.7.4** Corrosion and Sediment.~~

~~**13.3.4.7.4.1**~~

~~The foam concentrate tank shall be inspected internally for corrosion and sediment. [**25:** 11.4.7.4.1]~~

~~**13.3.4.7.4.2**~~

~~Excessive sediment shall require draining and flushing of the tank. [**25:** 11.4.7.4.2]~~

~~**13.3.4.8** In-Line Balanced Pressure Proportioner.~~

~~**13.3.4.8.1** Pump Operation.~~

~~**13.3.4.8.1.1**~~

~~The foam concentrate pump shall be operated. [**25:** 11.4.8.1.1]~~

~~**13.3.4.8.1.2**~~

~~Foam concentrate shall be circulated back to the tank. [**25:** 11.4.8.1.2]~~

~~**13.3.4.8.2** Servicing.~~

~~Foam pumps, drive train, and drivers shall be serviced in accordance with the manufacturer's instructions and frequency but not at intervals of more than 5 years. [**25:** 11.4.8.2]~~

~~**13.3.4.8.3** Flushing.~~

~~The diaphragm balancing valve shall be flushed through the diaphragm section with water or foam concentrate until fluid appears clear or new. [**25:** 11.4.8.3]~~

~~**13.3.4.8.4** Corrosion and Sediment.~~

~~**13.3.4.8.4.1**~~

~~The foam concentrate tank shall be inspected internally for corrosion and sediment. [**25:** 11.4.8.4.1]~~

~~**13.3.4.8.4.2**~~

~~Excessive sediment shall require draining and flushing of the tank. [**25:** 11.4.8.4.2]~~

~~**13.3.4.9** Pressure Vacuum Vents.~~

~~The procedures specified in 13.3.4.9.1 through 13.3.4.9.13 shall be performed on pressure vacuum vents every 5 years. [**25:** 11.4.9]~~

~~**13.3.4.9.1**~~

~~The vent shall be removed from the expansion dome. [**25:** 11.4.9.1]~~

~~**13.3.4.9.2**~~

~~The vent shall be inspected to ensure that the opening is not blocked and that dirt or other foreign objects do not enter the tank. [**25:** 11.4.9.2]~~

~~**13.3.4.9.3**~~

~~The vent bonnet shall be removed. [**25:** 11.4.9.3]~~

~~**13.3.4.9.4**~~

~~The vacuum valve and pressure valve shall be lifted out. [**25:** 11.4.9.4]~~

~~**13.3.4.9.5**~~

~~The vent body shall be flushed internally, and the vacuum valve and the pressure valve shall be washed thoroughly. [**25:** 11.4.9.5]~~

~~**13.3.4.9.6**~~

~~The vent shall be inspected to ensure that the screen is not clogged, and the use of any hard, pointed objects to clear the screen shall be avoided. [**25:** 11.4.9.6]~~

~~**13.3.4.9.7**~~

~~If the liquid has become excessively gummy or solidified, the vent body and parts shall be soaked in hot soapy water. [**25:** 11.4.9.7]~~

~~**13.3.4.9.8**~~

~~The vent body shall be turned upside down and drained thoroughly. [**25:** 11.4.9.8]~~

~~**13.3.4.9.9**~~

~~Parts shall be dried by placing them in a warm and dry area or by using an air hose. [**25:** 11.4.9.9]~~

~~**13.3.4.9.10**~~

~~Parts shall be sprayed with a light Teflon® coating, and the vent shall be reassembled. [**25:** 11.4.9.10]~~

~~**13.3.4.9.11**~~

~~The use of any type of oil for lubrication purposes shall not be permitted. [**25:** 11.4.9.11]~~

~~**13.3.4.9.12**~~

~~The vent bonnet shall be replaced, and the vent shall be turned upside down slowly a few times to ensure proper freedom of the movable parts. [**25:** 11.4.9.12]~~

~~**13.3.4.9.13**~~

~~The vent shall be attached to the liquid storage tank expansion dome. [**25:** 11.4.9.13]~~

~~**13.3.5** Component Action Requirements.~~

~~13.3.5.1~~

~~Whenever a component in a foam-water sprinkler system is adjusted, repaired, reconditioned, or replaced, the action required in Table 13.3.5.1 shall be performed. [**25:** 11.5.1]~~

~~Table 13.3.5.1 Summary of Component Action Requirements~~

~~**Component**~~	~~**Adjust**~~	~~**Repair/Recondition**~~	~~**Replace**~~	~~**Required Action**~~
~~**Water Delivery Components**~~	-	-	-	-
~~Discharge devices~~	X	-	X	~~(1) Inspect for leaks at system working pressure~~
-	-	-	-	~~(2) Inspect for impairments at orifice~~
~~Fire department connections~~	X	X	X	~~See Chapter 13~~
~~Manual release~~	X	X	X	~~(1) Operational test~~
-	-	-	-	~~(2) Inspect for leaks at system working pressure~~
-	-	-	-	~~(3) Test all alarms~~
~~Pipe and fittings on closed-head system~~	X	X	X	~~Hydrostatic test in conformance with NFPA 16~~
~~Pipe and fittings on open-head system~~	X	X	X	~~Operational flow test~~
~~**Foam Components**~~	-	-	-	-
~~Ball drip (automatic-type) drain valves~~	-	-	-	~~See Chapter 13~~
~~Bladder tank~~	X	X	X	~~Inspect water jacket for presence of foam concentrate~~
~~Foam concentrate~~	X	-	X	~~Submit a sample for laboratory analysis for conformance with manufacturer's specifications~~
~~Foam concentrate pump~~	-	-	-	~~See Chapter 8~~
~~Foam concentrate strainer(s)~~	-	-	-	~~See Chapter 13~~
~~Foam concentrate tank~~	X	X	X	~~Inspect for condition; repair as appropriate~~
~~Proportioning system(s)~~	X	X	X	~~Conduct flow test and inspect proportioning by refractometer test or equivalent~~
~~Water supply tank(s)~~	-	-	-	~~See Chapter 9~~
~~**Alarm and Supervisory Components**~~	-	-	-	-
~~Detection system~~	X	X	X	~~Operational test for conformance with NFPA 16 and/or *NFPA 72*~~
~~Pressure-switch-type waterflow~~	X	X	X	~~Operational test using inspector's test connection~~
~~Valve supervisory device~~	-	-	X	~~Test for conformance with NFPA 16 and/or *NFPA 72*~~

Component	Adjust	Repair/Recondition	Replace	Required Action
Vane-type waterflow	X	X	X	Operational test using inspector's test connection
Water motor gong	-	-	X	Operational test using inspector's test connection
Status-Indicating Components	-	-	-	-
Gauges	X	-	X	Verify at 0 psi (0 bar) and system working pressure; see Chapter 13 regarding calibration
Testing and Maintenance Components	-	-	-	-
Auxiliary drains	X	X	X	Inspect for leaks at system working pressure
Inspector's test connection	X	X	X	Inspect for leaks at system working pressure
Main drain	X	X	X	Full-flow main drain test
Structural Components	-	-	-	-
Hanger/seismic bracing	X	X	X	Inspect for conformance with NFPA 16 and/or NFPA 13
Pipe stands	X	X	X	Inspect for conformance with NFPA 16 and/or NFPA 13
Informational Components	-	-	-	-
General information sign	X	X	X	Inspect for conformance with NFPA 16 and/or NFPA 13
Hydraulic information sign	X	X	X	Inspect for conformance with NFPA 16 and/or NFPA 13
Valve signs	X	X	X	Inspect for conformance with NFPA 16 and/or NFPA 13

[**25:** Table 11.5.1]

13.3.5.2

Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted. [**25:** 11.5.2]

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Tue May 10 14:07:32 EDT 2022

Committee Statement

Committee Statement: Comprehensive inspection, testing, and maintenance criteria has been added to NFPA 25 and is therefore removed from NFPA 11. Deleted associated Annex A sections.

Response FR-20-NFPA 11-2022

Message:

Public Input No. 26-NFPA 11-2022 [Sections A.13.1.1.1, A.13.1.5, A.13.1.6, A.13.2.1, A.13.2.2...]

Public Input No. 25-NFPA 11-2022 [Sections 13.1, 13.2, 13.3]

First Revision No. 53-NFPA 11-2022 [Section No. A.1.1]

Global FR-47

A.1.1

Firefighting foam is an aggregate of air-filled bubbles formed from aqueous solutions and is lower in density than ~~flammable~~ignitible liquids. It is used principally to form a cohesive floating blanket on ~~flammable and combustible~~ignitible liquids and prevents or extinguishes fire by excluding air and cooling the fuel. It also prevents reignition by suppressing formation of ~~flammable~~ignitible vapors. It has the property of adhering to surfaces, which provides a degree of exposure protection from adjacent fires. Foam can be used as a fire prevention, control, or extinguishing agent for ~~flammable~~ignitible liquid hazards. Foam for these hazards can be supplied by fixed piped systems or portable foam-generating systems. Foam can be applied through foam discharge outlets, which allow it to fall gently on the surface of the burning fuel. Foam can also be applied by portable hose streams using foam nozzles or large-capacity monitor nozzles or subsurface injection systems.

Foam can be supplied by overhead piped systems for protection of hazardous occupancies associated with potential ~~flammable~~ignitible liquid spills in the proximity of high-value equipment or for protection of large areas. The foam used for ~~flammable~~ignitible liquid spills is in the form of a spray or dense “snowstorm.” The foam particles coalesce on the surface of the burning fuel after falling from the overhead foam outlets, which are spaced to cover the entire area at a uniform density. *(For systems required to meet both foam and water spray design criteria, see ~~NFPA 16~~Chapter 6 .)*

Large-spill ~~flammable~~ignitible liquid fires can be fought with mobile equipment, such as an aircraft crash truck or industrial foam truck equipped with agent and equipment capable of generating large volumes of foam at high rates. Foam for this type of hazard can be delivered as a solid stream or in a dispersed pattern. Standards for industrial foam trucks include NFPA 1901, and standards for aircraft crash trucks include NFPA 414.

Foam does not break down readily and, when applied at an adequate rate, has the ability to extinguish fire progressively. As application continues, foam flows easily across the burning surface in the form of a tight blanket, preventing reignition on the surfaces already extinguished. Foam is not suitable for three-dimensional flowing liquid fuel fires or for gas fires.

To determine where foam protection is required, see applicable standards such as NFPA 30. Foam can be applied to protect the surface of ~~a flammable~~an ignitible liquid that is not burning. The foam concentrate manufacturer should be consulted to determine the optimum method of application, rate of discharge, application density, and frequency of reapplication required to establish and maintain the integrity of the foam blanket.

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Fri Jul 15 16:42:03 EDT 2022

Committee Statement

Committee Statement: NFPA 16 has been withdrawn and this information is now located in Chapter 6 of NFPA 11.

Response Message: FR-53-NFPA 11-2022

First Revision No. 22-NFPA 11-2022 [Section No. A.5.4]

A.5.4

Within the scope of this standard, a covered (internal) floating roof tanks are tank is defined as a vertical cylindrical tanks with a fixed metal roofs (cone or geodesic dome) equipped with the following: ventilation at the top and containing a metal double-deck or pontoon-type floating roof or a metal floating cover supported by liquidtight metal flotation devices. They are constructed in accordance with the requirements of NFPA 30 . *(See Figure 5.4 .)*

(1) A fixed metal roof with ventilation at the top and roof eaves constructed in accordance with API STD 650 or pressure vacuum valves in combination with an inert gas blanketing system constructed in accordance with API STD 650 and containing a closed-top pontoon or double-deck metal floating roof meeting the requirements of API STD 650

(2) A fixed metal roof with ventilation at the top and roof eaves constructed in accordance with API STD 650 or pressure vacuum valves in combination with an inert gas blanketing system constructed in accordance with API STD 650 and containing a metal floating cover supported by liquidtight metal floating devices that provide buoyancy to prevent the liquid surface from being exposed when half of the flotation is lost

(3) A fixed metal roof with ventilation at the top and roof eaves constructed in accordance with API STD 650 or pressure vacuum valves in combination with an inert gas blanketing system constructed in accordance with API STD 650 and containing a composite sandwich roof/seal system constructed in accordance with API STD 650

They are Covered (internal) floating roof tanks should be constructed in accordance with the requirements of NFPA 30. *(See Figure 5.4.)*

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Tue May 10 14:46:49 EDT 2022

Committee Statement

Committee Statement: This revision brings the annex material in line with NFPA 30, section 22.2.2 to provide additional clarification.

Response Message: FR-22-NFPA 11-2022

Public Input No. 53-NFPA 11-2022 [Section No. A.5.4]

First Revision No. 54-NFPA 11-2022 [Section No. A.5.5.1]

A.5.5.1

For other types of indoor hazards, see the design criteria requirements of ~~NFPA 16~~ Chapter 6 .

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Fri Jul 15 16:43:27 EDT 2022

Committee Statement

Committee Statement: NFPA 16 has been withdrawn and the information is now located in Chapter 6 of NFPA 11.
Response Message: FR-54-NFPA 11-2022

First Revision No. 44-NFPA 11-2022 [Section No. A.5.6]

A.5.6

To minimize life and property loss, the automation of foam systems protecting a truck loading rack should be taken into account. Per NFPA 16 6.2.1.1 , states "Foam-water deluge and preaction systems shall be provided with automatic and auxiliary manual tripping means." [16: 4.1.1]

Manual operation can only can be provided where acceptable to the AHJ.

There The following are the two methods of automating foam monitor systems for this application:

(1) Completely automatic detection and actuation *(See applicable sections of NFPA 72 for design criteria)*

(2) Actuation by push-button stations or other means of manual release

The speed of system operation is always critical in minimizing life and property loss.

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun Jun 05 09:30:00 EDT 2022

Committee Statement

Committee Statement: Revised to refer to the language as it exists in NFPA 11, as NFPA 16 has been withdrawn and does not need to be referenced.

Response Message: FR-44-NFPA 11-2022

First Revision No. 38-NFPA 11-2022 [Section No. A.6.4.11.1]

A.6.4.11.1

~~A minimum of two sprinklers of each type and temperature rating should be provided.~~ It is the intent of this section to require spare sprinklers and associated manufacturer's sprinkler wrenches based on the facility as opposed to individual buildings or systems. Spare sprinklers for campus arrangements such as schools, hospitals, or multifamily complexes should be located under the owner's control and are not necessarily required to be provided at each building or riser location. [**13:**A.16.2.7.1]

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Sun Jun 05 09:10:15 EDT 2022

Committee Statement

Committee Statement: Revised to align the extracted text with revisions made in the latest edition of NFPA 13.

Response Message: FR-38-NFPA 11-2022

First Revision No. 34-NFPA 11-2022 [Chapter E]

Annex E Foam Health, Safety, and Environmental Issues

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

E.1 General.

There has been a significant shift in the emphasis on environmental and health concerns associated with legacy foam products. The purpose of this annex is to provide the foam user community with high-level ~~information~~ findings and information on the regulatory authorities that are objectively developing suggested solutions ~~to the questions being asked about~~ for the issues related to firefighting foam health, safety, and environmental issues.

In general, the chemicals contained in legacy fluorinated foams, such as AFFF, AR-AFFF, FFFP, etc. (i.e., fluorinated surfactants that are classified as PFAS), have come under significant health and environmental scrutiny.

The approach of dilution and release into the environment and/or wastewater treatment systems is obsolete and unacceptable going forward for all fluorinated foams. International, federal, state, and local jurisdictions are limiting the use of legacy AFFF as a result of these concerns.

~~US~~ U.S. Department of Defense (DoD) and civil aviation authorities are also researching and implementing new restrictions on the use of these legacy products.

Most NFPA standards that cover foam fire suppression agents and systems are being revised to address these new trends and ~~to~~ allow for flexibility going forward.

~~Currently the~~ The criteria for defining an environmentally/toxicologically acceptable alternative is still changing. Once ~~defined~~ an alternative is found , the industry will ~~also~~ need to define the testing and metrics needed to validate ~~the acceptability of such criteria~~ it . With that said, there has been a significant shift to the use of synthetic fluorine-free foam (SFFF).

The following are key issues that should be evaluated when using existing legacy fluorinated foams, switching to AFFF C6 foams, or switching to SFFF foams:

Firefighter ~~health and safety~~ Health and Safety . First responder exposure should be minimized using safer work practices and personal protective equipment (PPE) . In addition, rinsing procedures should be developed ~~for rinsing if the~~ in case foam comes into contact with a person's eyes or skin. AFFF foams are believed to be primarily an ingestion hazard, with lower risks related to inhalation and only eye/skin irritation risk from dermal/skin contact. The following information is from the Interstate Technology Regulatory Council (ITRC) *PFAS Technical and Regulatory Guidance Document.*

Personal Protective Equipment. The use of PPE is highly recommended when exposure to AFFF or other firefighting foams is possible. A critical aspect of PPE is ensuring the proper use of the equipment. The equipment should be used correctly and maintained and decontaminated routinely.

During the application or immediate cleanup of AFFF foam, the use of a self-contained breathing apparatus or positive pressure-supplied air respirator is recommended to avoid respiratory exposure. Dermal exposure should also be avoided, as skin contact can result in irritation and dryness. When responding to fires, first responders should wear appropriate turnout gear or proximity gear per their specific department requirements.

PPE cleanup after using AFFF and other foams is discussed in the Decontamination section.

Decontamination. Although PPE will prevent initial exposure to AFFF, contamination of the PPE itself can present health risks. Decontamination of PPE and personal hygiene are crucial preventative measures in reducing or avoiding exposure to AFFF and avoiding cross-contamination.

When handling AFFF concentrate or foam, it is imperative to avoid hand-to-mouth contact. After the use or cleanup of AFFF, responders should wash their hands and use other decontamination procedures to remove any residual AFFF from their skin. Responders should also remove contaminated clothing and launder it before reuse.

PPE should be placed in a bag and container after exposure to AFFF and other foams. In 2020, NFPA released its latest edition of NFPA 1851 , which provides guidance for the proper care of firefighting protective gear as well as the health hazards associated with improper maintenance or contamination of protective equipment. The standard outlines different decontamination measures for turnout gear and proximity gear.

Turnout gear is the general PPE for firefighting. It should be machine washed in warm water in the normal cycle. Turnout gear should be spot treated with warm water, a soft brush, and mild detergent prior to being machine washed. When hand washing and spot treating PPE, wear protective gloves—either latex or PVC—to avoid skin contact with any residual AFFF. No fabric softener or bleach should be used. Turnout gear should never be washed in home washing machines, as this practice has the potential to contaminate personal clothing. Advanced cleaning is suggested on at least a yearly basis (Avsec, 2015).

Although PPE decontamination prior to reuse is important, it is equally important to recognize when decontamination is not possible. In that case, gear should be discarded in accordance with local, state, and federal regulations.

When decontaminating or laundering PPE, the disposition of the waste stream should be considered. The potential for environmental impacts due to laundering in washing machines is not well-defined, but the potential does exist. Regulatory agencies should consider implementing decontamination procedures when working with firefighters, refinery safety personnel, and other potential first responders to develop best management practices.

The following health information summary was developed after reviewing several safety data sheets for widely used AFFF and SFFF foams.

The following outlines the recommendations for PPE when handling firefighting foam. This applies to both foam concentrate and foam solutions.

General Precautions. Handle PPE in accordance with good industrial hygiene and safety practices for harmful chemicals. Avoid contact with skin; if the foam concentrate or solution gets on the skin, wash it off as soon as possible. Do not ingest the foam solution or concentrate. Take off contaminated clothing and wash it before reuse.

All foam types, when used in the foam concentrate state such as loading and uploading, concentrated foam, during cleanup of foam spills or after use, during decontamination of personnel, PPE, or equipment after exposure (direct contact with foam concentrate or foam solution).

Respiratory Protection . Do not inhale vapors/fumes. Respiratory protection is not needed under typical handling conditions of firefighting foam concentrate. If vapors reach irritating levels, wear a NIOSH-approved respirator equipped with organic vapor cartridges.

Eye Protection. Wear a full-face shield with safety glasses or a full-face respirator.

Skin Protection. To protect skin from exposure to foam, use the following:

(1) Protective gloves and footwear

(2) Rubber, butyl rubber, or PVC gloves or equivalent impervious gloves

(3) Impervious boots

(4) Disposable Class C protective clothing (e.g., Tyvek) over normal work clothing (where large quantities or heavy contamination is likely)

Note: Fluorine-free foam chemicals have not been listed as carcinogenic by the U.S. National Toxicology Program, the International Agency for Research on Cancer (IARC), or the Occupational Safety and Health Administration (OSHA).

Review the firefighting foam manufacturer's SDS and hazard information for the specific foam being used and its applicable precautions. Follow the instructions on the SDS provided by the firefighting foam concentrate manufacturer if they are more protective than these minimum requirements. Such considerations should include the following:

(1) *Collection of firefighting foam after use*. Industry best practice is ~~that~~ for all foams and fire water/foam runoff ~~should~~ to be contained, collected, and disposed of based on federal, state, and local requirements ~~and~~ , as well as the most current technical information as suggested in the references listed in the next two paragraphs . Foam discharge is ~~more easily handled where~~ easier to handle when there is an in-place collection capability~~,~~ (i.e., primary and secondary containment) . This ~~situation~~ setup might be found in warehouses, tank farms, and firefighting training facilities. Where these facilities are not available, temporary diking is an alternative where time and resources permit.

The overall environmental impact of foam discharge requires additional evaluation and development of generally recognized guidance. Until recognized guidance is promulgated, users should rely on the manufacturer~~s'~~ data and guidance from policy makers such as the ~~Interstate Technology and Regulatory Council (ITRC)~~ ITRC and LASTFIRE. In all situations, discussions with environmental regulatory authorities are ~~appropriate~~ important .

Work is continuing to identify the appropriate policy and criteria to protect facilities that have typically been protected by foam suppression systems. These efforts are ~~focusing~~ focusing on identifying the applicable codes and standards, analyzing the environmental impact, evaluating the alternatives, and revisiting the containment options.

(2) *Disposal of firefighting foams*. ~~Currently, high-temperature incineration by an accredited environmental firm should be considered the default for disposing of legacy AFFF products (concentrates, solutions, and effluents).~~ Legacy AFFF must be disposed of according to federal, state, and local regulations. As a general practice, AFFF waste (i.e., foam discharge, rinsate water, wastewater) should be contained and stored prior to disposal. AFFF and PFAS waste can be either destroyed through a high-energy process or safely stored in a highly contained long-term waste facility.

In December 2020, the EPA released interim guidance on the destruction and disposal of PFAS and AFFF. This guidance included the following disposal recommendations based on current data:

(a) Interim storage (2–5 years) while alternative thermal destruction methods are developed

(b) Permitted deep well injection (Class I)

(c) Storage in permitted hazardous waste landfills (RCRA Subtitle C)

(d) Storage in solid waste landfills (RCRA Subtitle D) that have composite liners and leachate collection and treatment systems

The EPA plans to release revised recommendations for destruction technologies as early as 2023 via an updated guidance document. The EPA does not recommend incineration as a form of destruction. Multiple states established regulations restricting incineration of AFFF as a disposal method and more restrictions are being proposed.

Several states have implemented take-back programs for PFAS-containing foams. Consult with your state environmental protection agency to obtain more details on available take-back programs. Some programs offer free pickup, transport, and safe disposal of all forms of legacy AFFF.

(3) *Documentation* . Due to the increasing restrictions and regulations related to AFFF, documentation is often required for any foam discharge, both accidental and intentional. Check your local and statewide regulations to determine the reporting required for any release of AFFF. This usually includes reporting details specific to the release of any AFFF (intentional or accidental) to state environmental agencies. The information required might include the type of foam, amount of foam released, fuel type, location, and containment measures used.

(4) *Procedures for decontaminating legacy equipment and acceptable levels of cleanliness*. Trying to determine ~~how clean is clean~~ the level of cleanliness required continues to be an issue and might need to be determined based on the regulators' direction or manufacturers' information. Unless equipment is properly cleaned, it ~~might~~ could allow ~~the~~ a new foam to continue to contaminate the environment. Clean levels might be in the parts per billion to trillion range. Testing and metrics will ~~also~~ need to be defined to validate the level of cleanliness.

Equipment containing legacy AFFF needs to be cleaned prior to transitioning to a new foam or when it is being decommissioned. This might include storage tanks, fixed installation piping, fire trucks, or other aircraft rescue and firefighting equipment. The most common method of cleaning AFFF from firefighting equipment is rinsing with water. This method requires the draining and collection of the AFFF solution followed by a triple-rinse with PFAS-free water to ensure no foam concentrate remains.

As of the end of 2021, there was no clear guidance for how clean final rinsate water needs to be to satisfy local regulators. All rinsate should be stored and disposed of per all required local, state, and federal regulations. The European Chemicals Agency proposed a PFAS concentration of 1 ppm. This can be achieved using a relatively simple cleaning process and would prevent the majority of emissions. Additional guidance for U.S.-based agencies is still being developed.

The environmental/health concerns associated with these chemicals are challenging for both toxicologists and regulators, ~~requiring~~ as they require continued research and updated regulatory requirements ~~that~~ are still changing. Any users of firefighting foam should research the latest procedures and precautions for their use and disposal prior to placing it into service. The following are ~~two~~ three organizations that have developed technically up-to-date and accurate information on this subject~~.~~ :

(1) The ITRC is a state-led coalition working to reduce barriers to the use of innovative air, water, waste, and remediation environmental technologies and processes. ITRC produces documents and training that can help broaden and deepen technical knowledge and expedite quality regulatory decision making while protecting human health and the environment. With public and private sector members from all 50 states and the District of Columbia, ITRC provides a national perspective. The issues associated with AFFF and the changes in the environmental/use landscape are well documented on the ITRC website. https://pfas-1.itrcweb.org/.

(2) The Office of the Secretary of Defense Strategic Environmental Research and Development Program and the Environmental Security Technology Certification Program (SERDP/ESTCP) are funding research for PFAS-free AFFF; detection, fate, and transport of PFAS~~ in the environment~~ ; ecotoxicity; and PFAS treatment technologies, including equipment clean out. More information is available at https://www.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs.

(3) The LASTFIRE Project provided an independent and comprehensive assessment of fire-related risk in large, open-top, floating roof storage tanks, ~~resulting~~ which resulted in a methodology~~,~~ by which site-specific fire hazard management policies can be developed and implemented. It, therefore, represents a major advancement in the knowledge about this risk. The LASTFIRE Foam Position Paper is available at http://lastfire.org.uk.

~~The LASTFIRE Foam Position Paper is available at http://lastfire.org.uk.~~

Global FR-47

E.2 Discharge Scenarios.

The following are examples of scenarios that might include the use of foam, which are presented here to provide the user with ideas on how to handle these~~ types of~~ situations. The examples are not intended to be complete, as the science on how to handle these ~~scenarios~~ situations is changing very rapidly. Look at the information provided by ITRC, DoD, and LASTFIRE and sources of current discharge handling approaches. The discharge of a foam-water solution is most likely to be the result of one of the four following scenarios:

(1) Manual firefighting or fuel-blanketing operations

(2) Training

(3) Foam equipment system and foam fire apparatus tests

(4) Fixed system releases

These four scenarios include events at such places as aircraft facilities, firefighter training facilities, and special hazards facilities (such as flammable/hazardous warehouses, bulk ~~flammable~~ ignitible liquid storage facilities, and hazardous waste storage facilities). Each scenario is considered separately in E.2.1 through E.2.4.

E.2.1 Firefighting Operations.

Fires occur in many locations and under many different circumstances. In some cases, it is possible to collect the foam solution used to douse a fire after it has been put out; ~~and~~ in others, such as in marine firefighting, it is not. These incidents include aircraft rescue and firefighting operations, vehicular fires (i.e., cars, boats, train cars), structural fires involving hazardous materials, and ~~flammable~~ignitible liquid fires. A foam-water solution that has been used in firefighting operations will probably be heavily contaminated with the fuel or fuels involved in the fire. It is also likely to have been diluted with water discharged for cooling purposes.

In some cases, the foam solution used during fire department operations can be collected. However, it is not always possible to control or contain the foam~~;~~. ~~therefore~~In situations in which it is not possible to control or contain foam due to the location, size, or circumstances of the incident, a non-persistent foam, such as SFFF, should be considered. ~~This could be a result of the location of the incident, size of the incident, or the circumstances surrounding the incident.~~

Event-initiated manual containment measures are usually executed by the responding fire department to contain the flow of a foam-water solution when conditions and manpower permit. Those operations include the following measures:

(1) *Blocking sewer drains*. This is a common practice used to prevent a contaminated foam-water solution from entering the sewer system unchecked. It is then diverted to an area suitable for containment.

(2) *Portable dikes*. These are generally used for land-based operations. They can be set up by fire department personnel during or after extinguishment to collect runoff.

(3) *Portable booms*. These are used for marine-based operations in the absence of better techniques and are set up to contain foam in a defined area. These operations generally involve the use of floating booms within a natural body of water. The boom contains the foam bubbles, but as the bubbles drain, the foam solution might not be contained and could spread into the rest of the body of water.

E.2.2 Training.

Legacy training facilities that have previously used AFFF are under significant environmental scrutiny due to potential groundwater contamination. Consequently, the use of fluorinated foams for training has been banned in a number of states and other areas of the world, with additional states likely to follow.

Going forward, and independent of the local, state, and federal requirements, using AFFF for training is strongly discouraged for several reasons, including the following:

(1) Repeated personal exposure to AFFF can increase a firefighter's risk of health impacts, including cancer

(2) Repeated application of AFFF to a training site can contaminate soil and groundwater

(3) Use of AFFF near wells or surface water bodies could contaminate drinking water

It is also recommended that fire departments make their firefighters aware of the dangers detailed above and track any exposure during training or at emergency scenes.

Over the past decade or so, training has transitioned away from using foam fire extinguishing products on large liquid fuel fires to using water hose lines to extinguish propane burner fires. This trade-off minimizes environmental exposure/contamination but is less effective for training, so it might need to be revisited.

Although the efficacy of the new SFFFs has been demonstrated in numerous research and development programs, the results also suggest that these new foams are not as forgiving as AFFF and could require more finesse when used manually. However, this performance gap can be reduced with the proper equipment, tactics, and training.

If the consensus is to revisit training with liquid fuels and foam products, the training should be conducted under circumstances conducive to the collection of effluent (i.e., fuel and spent foam). Only environmentally acceptable foam products should be used for training (i.e., no AFFF of any kind).

Some fire training facilities have elaborate systems designed and constructed to contain and collect effluent, separate fuel from the foam/water solution, treat it, and, in some cases, reuse the treated water. These types of capabilities will be required going forward.

After the fuel and foam solution has been separated, the foam solution must be analyzed to determine if it can be diluted and discharged into a wastewater treatment facility for disposal. This requires the training facility to consult and work with the public works and wastewater management organizations. If the effluent foam solution cannot be disposed of in the local wastewater treatment facility, it must be handled as hazardous waste and collected by a credible hazardous waste collection and disposal company, which can be very expensive.

The new SFFFs do not present a PFAS contamination risk; however, their chemical compositions need to be assessed on a case-by-case basis.

There are specially designed training foams available from most foam manufacturers that simulate firefighting foam during live training but ~~do not contain fluorosurfactants~~have some level of environmental acceptance. These foams are biodegradable, have minimal environmental impact, and can be safely treated at a local wastewater treatment plant. ~~Because they do not contain fluorosurfactants,~~These training foams ~~also~~ have reasonable firefighting capabilities but typically provide reduced burnback ~~resistance that allows for more repeat fire training sessions~~protection. Firefighters and other foam users should work with the authority having jurisdiction (AHJ) to ensure that the use of training foams meets all the local and application-specific live training requirements. In some cases, training foams can also be used as substitutes for legacy fluorinated foams in vehicle and equipment testing.

~~Training should be conducted under circumstances conducive to the collection of spent foam. Some fire training facilities have elaborate systems designed and constructed to collect foam solution, separate it from the fuel, treat it, and, in some cases, reuse the treated water. At a minimum, most fire training facilities collect the foam solution for discharge to a wastewater treatment facility. Training can include the use of special training foams or actual firefighting foams. Training facility designs should include containment systems.~~

~~Note: The use of fluorinated foams for training is banned in a number of nations and states in the United States.~~

E.2.3 System Tests.

Testing primarily involves engineered, fixed foam fire-extinguishing systems. Two types of tests are generally conducted on foam systems: acceptance tests, which are conducted pursuant to the installation of the system, and maintenance tests, which are usually conducted annually to ensure the operability of the system.

In the execution of both acceptance and maintenance tests, only a small amount of foam concentrate should be discharged to ensure the correct concentration of foam in the foam-water solution. Designated foam-water test ports can be included in the piping system so that the discharge of the foam-water solution ~~could~~can be directed to a controlled location. The controlled location ~~can~~might consist of a portable tank that ~~would be~~is transported to an approved disposal site by a licensed contractor. The remainder of the acceptance test and maintenance test should be conducted using only water.

NFPA 11 explicitly recognizes proportioning test methods that limit or eliminate the need to discharge foam concentrate. These methods are permitted in 12.6.4.

~~Note the use of fluorinated foams for system testing is banned in a number of nations and states in the United States.~~

E.2.4 Fixed System Releases.

This type of release is generally uncontrolled, whether it is the result of a fire incident or a malfunction in the system. The foam solution discharge in this ~~type of~~ scenario can be dealt with via event-initiated operations or engineered containment systems.

Event-initiated operations encompass the same temporary measures that ~~would be~~are taken during fire department operations: portable dikes, floating booms, and so forth. Engineered containment is based mainly on the location and type of facility and ~~would consist~~consists of holding tanks or areas where the contaminated foam-water solution ~~would~~can be collected, treated, and disposed of properly.

E.3 Fixed Systems.

Facilities can be divided into those without an engineered containment system and those with an engineered containment system.

E.3.1 Facilities Without Engineered Containment.

Given the absence of any past requirements for containment, many existing facilities ~~have allowed~~ allow foam-water solutions to flow out of the ~~facility~~ facilities and evaporate into the atmosphere or percolate into the ground. Steps should be taken to avoid this as part of future foam management planning.

The choices for containment of foam-water solutions at such facilities fall into two categories: event-initiated manual containment measures and the installation of engineered containment systems. Selecting the appropriate option depends on the location of the facility, the risk to the environment, the risk of an automatic system discharge, the frequency of automatic system discharges, and any applicable rules or regulations.

Event-initiated manual containment measures are the most likely option for existing facilities without engineered containment systems. This can fall under the responsibility of the responding fire department and include such measures as blocking storm sewers, constructing temporary dikes, and deploying temporary floating booms. The degree of such measures should be dictated by the facility's location, as well as the available resources and manpower.

The installation of engineered containment systems is an option for existing facilities, and ~~.~~ ~~There~~ there are cases~~, however,~~ that might warrant the design and installation of such systems.

E.3.2 Facilities with Engineered Containment.

Any engineered containment system usually includes an oil/water separator. During normal drainage conditions (i.e., no foam solution runoff), the separator functions to remove any fuel particles from drainage water. However, when a foam-water solution is flowing, the oil/water separator should be bypassed so that the solution is diverted directly to storage tanks.

The size of the containment system should be dependent on the duration of the foam-water flow, the flow rate, and the maximum anticipated rainfall in the area . Most new containment systems only accommodate individual facilities. However, some containment systems can accommodate multiple facilities depending on the topography of the land and early identification during the overall site planning process.

The specific type of containment system selected should also depend on the location, desired capacity, and function of the facilities in question. The available systems include earthen retention systems, belowground tanks, open-top inground tanks, and sump and pump designs (i.e., lift stations) piped to aboveground or in-ground tanks. Storing spent foam below ground is not advisable due to the potential for leaks. Regular checks can reduce the risk of leaks, but even a small leak over time could result in contaminated soil.

~~The earthen~~ Earthen retention designs consist of open-top earthen berms~~, which~~ that usually rely on gravity-fed drainage piping from a protected facility. They allow the foam-water solution to be collected in an impermeable liner. Legacy foams should not be contained using earthen retention, as the soil can become contaminated.

Closed-top, belowground storage tanks usually consist of a gravity-fed piping arrangement ~~and can be~~ that can also be used to suction ~~pumped~~ pump contents out.

Open-top, belowground storage tanks are usually lined concrete tanks that ~~can~~ rely on gravity-fed drainage piping or a sump and pump arrangement. These can accommodate individual or multiple facilities. They must also accommodate the maximum anticipated rainfall.

Aboveground tanks incorporate a sump and pump arrangement to closed, aboveground tanks. Such designs usually incorporate the use of one or more submersible or vertical shaft large-capacity pumps. These can accommodate individual or multiple facilities.

E.3.3 New Facilities.

The decision to design and install a fixed foam-water solution containment system ~~is~~ should be dependent on the location of the facility, the risk to the environment, the possible impairment of facility operations, the design of the fixed foam system (i.e., automatically or manually activated), the ability of the responding fire department to execute event-initiated containment measures, and any pertinent regulations.

Where conditions warrant the installation of engineered containment systems, there are a number of considerations~~. They include~~ to take into account, including the size of the containment system, the design and type of containment system, and the capability of the containment system to handle individual or multiple facilities. Engineered containment systems can be used in facilities where foam extinguishing systems are installed ~~in facilities that are~~ immediately adjacent to a natural body of water. These systems might also be prudent at new facilities, where site conditions permit, to avoid impairment of facility operations.

Supplemental Information

File Name	Description	Approved
FR-34_FDM_AnnexE_Clean.docx	For staff use only.	

Submitter Information Verification

Committee: FOM-AAA

Submittal Date: Sat Jun 04 11:40:21 EDT 2022

Committee Statement

Committee Statement: Updates were made to Annex E based on a review of the FPRF roadmap on foam transition.

Response Message: FR-34-NFPA 11-2022

Public Input No. 5-NFPA 11-2021 [Chapter E]

First Revision No. 26-NFPA 11-2022 [Chapter J]

Annex J Informational References

J.1 Referenced Publications.

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

J.1.1 NFPA Publications.

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

NFPA 13, *Standard for the Installation of Sprinkler Systems*, ~~2019~~ 2022 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, ~~2017~~ 2022 edition.

~~NFPA 16 , *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems* , 2019 edition.~~

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, ~~2019~~ 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, ~~2020~~ 2023 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2021~~ 2024 edition.

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*, ~~2019~~ 2023 edition.

NFPA 70®, *National Electrical Code®*, ~~2020~~ 2023 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®*, ~~2019~~ 2022 edition.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, 2019 edition.

NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, 2018 edition.

NFPA 409, *Standard on Aircraft Hangars*, ~~2021~~ 2022 edition.

NFPA 414, *Standard for Aircraft Rescue and Fire-Fighting Vehicles*, 2020 edition.

NFPA 1851 , *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* , 2020 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, ~~2021~~ 2016 edition.

J.1.2 Other Publications.

J.1.2.1 AGA Publications.

American Gas Association, 400 North Capitol Street, NW, Washington, DC 20001.

Project IS-3-1, *LNG Spills on Land* , November ~~15~~ 1973. ~~LNG Spills on Land.~~

~~Project IS-100-1. February 1974. An Experimental Study on the Mitigation of Flammable Vapor Dispersion and Fire Hazards Immediately Following LNG Spills on Land.~~ Project IS-100-1, *An Experimental Study on the Mitigation of Flammable Vapor Dispersion and Fire Hazards Immediately Following LNG Spills on Land* , February 1974.

J.1.2.2 AIChE Publications.

American Institute of Chemical Engineers, 120 Wall Street, ~~FL~~ Floor 23, New York, NY 10005-4020.

Guidelines for Safe Warehousing of Chemicals, Center for Chemical Process Safety, 1998.

J.1.2.3 API Publications.

American Petroleum Institute, ~~1220 L Street, NW, Washington, DC 20005-4070~~ 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001-5571 .

API STD 650, *Welded Tanks for Oil Storage*, ~~12th edition, 2013, addendum 3, 2018~~ 2020 .

J.1.2.4 ASTM Publications.

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

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester* , 2021.

ASTM D1141, *Standard Practice for the Preparation of Substitute Ocean Water*, 1998, reapproved ~~2013~~ 2021 .

J.1.2.5 AWS Publications.

American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672.

AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*, ~~2014~~ 2021 .

J.1.2.6 CENELEC Publications.

CENELEC, European Committee for Electrotechnical Standardization, CEN-CENELEC Management Centre, Rue de la Science 23, B-1040 Brussels, Belgium.

EN1568, *Fire extinguishing media — Foam concentrates* , 2018.

J.1.2.7 FM Publications.

FM Approvals LLC, 1151 Boston-Providence Turnpike, P.O. Box 9102, Norwood, MA 02062.

FM Approvals 5130, *Foam Extinguishing Systems*, 2011.

FM Approvals 5138, *Assessment Standard for Proportioning Testing*, April 2011.

J.1.2.8 IEEE Publications.

IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE 45, *Recommended Practice for Electric Installations on Shipboard*, 2002.

J.1.2.9 IMO Publications.

International Maritime Organization, 4 Albert Embankment, London, SE1 7SR, United Kingdom.

IBC Code, *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk*, 2007.

Safety of Life at Sea (SOLAS), Regulation 61, Chapter 212.

J.1.2.10 ISO Publications.

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

ISO 9001, *Quality Management Systems—Requirements*, ~~2008~~ 2015 .

J.1.2.11 TC Publications.

Transport Canada, 330 Sparks Street, Ottawa, ON K1A 0N5, Canada.

TP 127 E, *Ships Electrical Standards*, Revision 02, May 2018.

J.1.2.12 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 139, *Outline of Investigation for Medium- and High-Expansion Foam-Extinguishing System Equipment and Concentrates*, 2018.

UL 162, *Foam Equipment and Liquid Concentrates*, ~~2018~~ 2022 .

J.1.2.13 U.S. Government Publications.

U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001 Washington, DC 20402 .

Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 42 U.S.C. 1906 et seq.

Federal Specification O-F-555C, *Foam Liquid, Fire Extinguishing Mechanical* (out of print).

Federal Specification VV-G-1690, "Gasoline, Automotive, Leaded or Unleaded," 1989.

Federal Register Volume 60, Issue 112, pp. 30926–30962, July 12, 1995.

NVIC 11-82, *Deck Foam Systems for Polar Solvents* , U.S. Coast Guard Navigation and Vessel Inspection Circulars. , 1982. NVIC 11-82, *Deck Foam Systems for Polar Solvents* .

J.1.2.14 Other Publications.

Conch Methane Services, Ltd. 1962. , "Liquefied Natural Gas/Characteristics and Burning Behavior. ," 1962.

Gremeles, A. E., and E. M. Drake, . October 1975. "Gravity Spreading and Atmospheric Dispersion of LNG Vapor Clouds. ," Jacksonville, FL: Fourth International Symposium on Transport of Hazardous Cargoes by Sea and Inland Waterways, October 1975 .

Humbert-Basset, R. and A. Montet, . September 1972. "Flammable Mixture Penetration in the Atmosphere from Spillage of LNG. ," Washington, DC: Third International Conference on LNG, September 1972 .

Johnson, D. W., et al., *Control and Extinguishment of LPG Fires*, Applied Technology Corp., DOEEV-6020–1, August 1980.

LASTFIRE Foam Position Paper, LASTFIRE, Issue 2, October 2016.

LASTFIRE Ongoing Testing of New Generation Foams DFW Large Scale Extended Flow Test Report, LASTFIRE, November 2018.

Mine Safety Appliances Research Corp. , "LNG Vapor Concentration Reduction and Fire Control with MSAR High Expansion Foam. ," Evans City, PA.

The Montreal Protocol on Substances that Deplete the Ozone Layer , United Nations Environment Programme, Nairobi, Kenya, 2000.

Persson, H., et al., *ETANKFIRE — Fire extinguishing tests of ethanol tank fires in reduced scale*, SP Technical Institute of Sweden, 2016.

PFAS Technical and Regulatory Guidance Document , Interstate Technology Regulatory Council, December 2021.

Schneider, A. L., December 1978. " Liquefied Natural Gas Safety Research Overview," Springfield, VA: National Technical Information Service, December 1978 .

Welker, J. et al., January 1976. "Fire Safety Aboard LNG Vessels. ," January 1976.

Wesson, H. R., J. R. Welker, and L. E. Brown, . December 1972. "Control LNG Spill Fires. ," *Hydrocarbon Processing*. , December 1972.

J.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

U.S. Coast Guard Navigation and Vessel Inspection Circulars. 1992. *Guidance for Acceptance of the National Board of Boiler and Pressure Vessel Inspectors (NBBI) National Board Inspection Code (NBIC) for Repairs and Alterations to Boilers and Pressure Vessels*. , U.S. Coast Guard Navigation and Vessel Inspection Circulars, 1992.

J.3 References for Extracts in Informational Sections.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, ~~2019~~ 2022 edition.

~~NFPA 16 , *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems* , 2019 edition.~~

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2018~~ 2021 edition.

Supplemental Information

File Name	Description	Approved
FR-26_AnnexJ_Clean.docx	For staff use only	

Submitter Information Verification

Committee: FOM-AAA
Submittal Date: Sun May 22 18:42:56 EDT 2022

Committee Statement

Committee Statement: Revised references to conform to latest editions.
Response Message: FR-26-NFPA 11-2022

Public Input No. 18-NFPA 11-2021 [Section No. J.1.2.11]

Public Input No. 4-NFPA 11-2021 [Section No. J.1.2.13]