Committee Input No. 24-NFPA 2001-2023 [Global Input]

Change from kPa to bar throughout the document.

Submitter Information Verification

Committee: GFE-AAA

Submittal Date: Wed May 24 10:20:40 EDT 2023

Committee Statement

Committee Statement: Tables use a mix of kPa and bar in different tables

Task Group has been formed to review metric conversion and provide recommendation for Second Draft.

Response Message: CI-24-NFPA 2001-2023

Public Input No. 36-NFPA 2001-2023 [Global Input]

Committee Input No. 20-NFPA 2001-2023 [Section No. 4.3.7]

4.3.7* Occupiable Spaces.

Systems protecting occupiable spaces where the clean agent design concentration and egress time exceeds the design concentration and corresponding egress time approved for use in normally occupied spaces in accordance with 4.3.2 for halocarbon agents or 4.3.3 for inert gas agents shall include the following:

(1) Supervised system lockout valves

(2) Pneumatic pre-discharge alarms

(3) Pneumatic time delays

(4) Warning signs

A.4.3.7

In applying this provision of the standard, it is important to understand the relationship between agent concentration and egress time. The agent concentration permitted for human exposure is linked to the amount of time for which a person could be exposed to the agent concentration. For example, exposure to an HFC-227ea concentration up to and including 10.5 percent is permitted if the maximum exposure time (egress time) is limited to not more than 5 minutes, but exposure to a concentration of 11 percent would be permitted only if the exposure time could be limited to not more than 1.13 minutes. Similarly, exposure to an inert gas agent concentration up to 43 percent is permitted if the exposure time is limited to not more than 5 minutes, while exposure to a concentration up to 52 percent is permitted only if the exposure time is limited to not more than 3 minutes.

4.3.7.1*

Pneumatic pre-discharge alarms shall be operated by an inert gas.

A.4.3.7.1

Inert gases used to operate pre-discharge alarms include inert gas clean agents, nitrogen, and carbon dioxide.

4.3.7.2

For an inert gas clean agent fire-extinguishing system, the quantity of inert gas discharged to operate a pneumatic pre-discharge alarm discharging into the protected space shall be considered, together with the quantity of agent discharged, when making a determination of post-discharge oxygen concentration with respect to compliance with the requirements of 4.3.3.

Submitter Information Verification

Committee: GFE-AAA

Submittal Date: Thu May 11 13:43:17 EDT 2023

Committee Statement

Committee Statement:	A task group was formed to research situations where a time delay may not be appropriate.
Response Message:	CI-20-NFPA 2001-2023

Committee Input No. 19-NFPA 2001-2023 [Chapter 13]

Chapter 13 Marine Systems

13.1 General.

This chapter outlines the deletions, modifications, and additions that are necessary for marine applications. All other requirements of NFPA 2001 shall apply to shipboard systems except as modified by this chapter. Where the provisions of Chapter 13 conflict with the provisions of Chapter 1 through Chapter 11, the provisions of Chapter 13 shall take precedence.

13.1.1 Scope.

This chapter is limited to marine applications of clean agent fire extinguishing systems on commercial and government vessels. Explosion inerting systems were not considered during development of this chapter.

13.2 Use and Limitations.

13.2.1*

Total flooding clean agent fire extinguishing systems shall be used primarily to protect hazards that are in enclosures or equipment that, in itself, includes an enclosure to contain the agent.

A.13.2.1

Some typical hazards that could be suitable include, but are not limited to, the following:

(1) Machinery spaces such as main machinery spaces

(2) Emergency generator rooms

(3) Pump rooms

(4) Flammable liquid storage and handling areas and paint lockers

(5) Control rooms and electronic equipment spaces

13.2.2*

In addition to the limitations given in 4.2.2, clean agent fire extinguishing systems shall not be used to protect the following:

(1) Dry cargo holds

(2) Bulk cargo

A.13.2.2

General cargo should not be protected with halocarbon agents due to the possibility of deep-seated cargo fires and due to wide variations in cargo materials. Dry cargoes, such as containerized cargoes, often comprise a wide mix of commodities that can include materials or storage arrangements not suited for protection with halocarbon agents. The volume of agent needed to protect cargo spaces varies depending on the volume of the cargo space minus the volume of the cargo carried. This quantity varies as cargo volume changes and can affect fire extinguishing effectiveness or agent toxicity.

13.2.3

The effects of agent decomposition products and combustion products on fire protection effectiveness and equipment shall be considered where using clean agents in hazards with high ambient temperatures (e.g., incinerator rooms, hot machinery and piping).

13.3 Hazards to Personnel.

13.3.1

Other than the engine rooms identified in 13.3.1.1, all other main machinery spaces shall be considered normally occupied spaces.

13.3.1.1

Engine rooms of 6000 ft^3 (170 m^3) or less that are accessed for maintenance only shall not be required to comply with 13.3.1.

13.3.2*

For marine systems, electrical clearances shall be in accordance with 46 CFR, Subchapter J, “Electrical Engineering.”

A.13.3.2

Subchapter J of 46 CFR 111.59 requires busways to comply with Article 368 of *NFPA 70*. Article 368 requires compliance with Article 300 for clearances around busways.

13.4 Agent Supply.

13.4.1

Reserve quantities of agent shall not be required by this standard.

13.4.2*

Storage container arrangement shall be in accordance with 5.1.3.1 and 5.1.3.3 through 5.1.3.5. Where equipment is subject to extreme weather conditions, the system shall be installed in accordance with the manufacturer’s design and installation instructions.

A.13.4.2

Agent cylinder storage spaces should be adequately ventilated. Entrances to such spaces should be from an open deck.

13.4.2.1

Except in the case of systems with storage cylinders located within the protected space, pressure containers required for the storage of the agent shall be in accordance with 13.4.2.2.

13.4.2.2

Where the agent containers are located outside a protected space, they shall be stored in a room that shall be situated in a safe and readily accessible location and shall be effectively ventilated so that the agent containers are not exposed to ambient temperatures in excess of 130°F (55°C). Common bulkheads and decks located between clean agent container storage rooms and protected spaces shall be protected with A-60 class structural insulation as defined by 46 CFR 72. Agent container storage rooms shall be accessible without having to pass through the space being protected. Access doors shall open outward, and bulkheads and decks, including doors and other means of closing any opening therein, that form the boundaries between such rooms and adjoining spaces shall be gastight.

13.4.3

Where agent containers are stored in a dedicated space, doors at exits shall swing outward.

13.4.4

Where subject to moisture, containers shall be installed such that a space of at least 2 in. (51 mm) between the deck and the bottom of the container is provided.

13.4.5

In addition to the requirements of 5.1.3.4, containers shall be secured with a minimum of two brackets to prevent movement from vessel motion and vibration.

13.4.6*

For marine applications, all piping, valves, and fittings of ferrous materials shall be protected inside and out against corrosion except as permitted in 13.4.6.1.

A.13.4.6

Corrosion resistance is required to prevent clogging of nozzles with scale. Examples of suitable materials are hot dipped galvanized steel piping inside and out or stainless steel.

13.4.6.1

Closed sections of pipe and valves and fittings within closed sections of pipe shall be required to be protected against corrosion only on the outside.

13.4.6.2

Other than as permitted in 13.4.6.1, prior to acceptance testing, the inside of the piping shall be cleaned without compromising its corrosion resistance.

13.4.7*

Pipes, fittings, nozzles, and hangers, including welding filling materials, within the protected space shall have a melting temperature greater than 1600°F (871°C). Aluminum components shall not be used.

A.13.4.7

Fittings conforming to ASTM F1387 and fire tested with zero leakage conform to the requirements of 13.4.7.

13.4.8

Piping shall extend at least 2 in. (51 mm) beyond the last nozzle in each branch line to prevent clogging.

13.5 Detection, Actuation, and Control Systems.

13.5.1 General.

13.5.1.1

Detection, actuation, alarm, and control systems shall be installed, tested, and maintained in accordance with the requirements of the authority having jurisdiction.

13.5.1.2*

For spaces greater than 6000 ft^3 (170 m^3), automatic release of the fire extinguishing agent shall not be permitted where actuation of the system can interfere with the safe navigation of the vessel. Automatic release of the fire extinguishing agent shall be permitted for any space where actuation of the system will not interfere with the safe navigation of the vessel.

A.13.5.1.2

The intent of this paragraph is to ensure that a suppression system will not interfere with the safe navigation of the vessel. Many internal combustion propulsion engines and generator prime movers draw combustion air from the protected space in which they are installed. Because these types of engines are required to be shut down prior to system discharge, an automatically discharged system would shut down propulsion and electricity supply when needed most. A nonautomatic system gives the ship's crew the flexibility to decide the best course of action. For example, in a high-density shipping channel, a ship's ability to maneuver can be more important than immediate system discharge. For small vessels, the use of automatic systems is considered appropriate, taking into consideration the vessel's mass, cargo, and crew training.

13.5.1.2.1

Automatic release shall be permitted for any space of 6000 ft^3 (170 m^3) or less.

13.5.2 Automatic Detection.

13.5.2.1

Electrical detection, signaling, control, and actuation system(s) shall have at least two sources of power. The primary source shall be from the vessel's emergency bus. For vessels with an emergency bus or battery, the backup source shall be either the vessel's general alarm battery or an internal battery within the system. Internal batteries shall be capable of operating the system for a minimum of 24 hours. All power sources shall be supervised.

13.5.2.1.1

For vessels without an emergency bus or battery, the primary source shall be permitted to be the main electrical supply.

13.5.2.2

In addition to the requirements set forth in Section 9.3, actuation circuits shall not be routed through the protected space where manual electrical actuation is used in marine systems.

13.5.2.2.1

For systems complying with 13.5.2.4, actuation circuits shall be permitted to be routed through the protected space.

13.5.2.3*

Manual actuation for systems shall not be capable of being put into operation by any single action. Other than as identified in 13.5.2.3.1, manual actuation stations shall be housed in an enclosure.

A.13.5.2.3

The intent is to prevent accidental or malicious system operation. Some examples of acceptable manual actuation stations are the following:

(1) Breaking a glass enclosure and pulling a handle

(2) Breaking a glass enclosure and opening a valve

(3) Opening an enclosure door and flipping a switch

13.5.2.3.1

Manual actuation shall be permitted to be local manual actuation at the cylinder(s) location.

13.5.2.4

Systems protecting spaces larger than 6000 ft^3 (170 m^3) shall have a manual actuation station located in the main egress route outside the protected space. In addition, systems protecting spaces larger than 6000 ft^3 (170 m^3) having cylinders within the protected space and systems protecting unattended main machinery spaces shall have an actuation station in a continuously monitored control station outside the protected space.

13.5.2.4.1

Systems protecting spaces of 6000 ft^3 (170 m^3) or less shall be permitted to have a single actuation station at either of the locations described in 13.5.2.4.

13.5.2.5

Emergency lighting shall be provided for remote actuation stations serving systems protecting main machinery spaces. All manual operating devices shall be labeled to identify the hazards they protect. In addition, the following information shall be provided:

(1) Operating instructions

(2) Length of time delay

(3) Actions to take if system fails to operate

(4) Other actions to take such as closing vents and taking a head count

13.5.2.5.1

For systems having cylinders within the protected space, a means of indicating system discharge shall be provided at the remote actuation station.

13.6 Additional Requirements for Systems Protecting Class B Hazards Greater Than 6000 ft^3 (170 m^3) with Stored Cylinders Within the Protected Space.

13.6.1*

An automatic fire detection system shall be installed in the protected space to provide early warning of fire to minimize potential damage to the fire extinguishing system before it can be manually actuated. The detection system shall initiate audible and visual alarms in the protected space and on the navigating bridge upon detection of fire. All detection and alarm devices shall be electrically supervised for continuity, and trouble indication shall be annunciated on the navigating bridge.

A.13.6.1

Heat detectors are typically used in machinery spaces and are sometimes combined with smoke detectors. Listed or approved optical flame detectors can also be used, provided they are in addition to the required quantity of heat and/or smoke detectors.

13.6.2*

Electrical power circuits connecting the containers shall be monitored for fault conditions and loss of power. Visual and audible alarms shall be provided to indicate this, and the alarms shall be annunciated on the navigating bridge.

A.13.6.2

This requirement is derived from SOLAS Regulation II-2/Regulation 5.3.

13.6.3*

Within the protected space, electrical circuits essential for the release of the system shall be heat resistant, such as mineral-insulated cable compliant with Article 332 of *NFPA 70*, or the equivalent. Piping systems essential for the release of systems designed to be operated hydraulically or pneumatically shall be of steel or other equivalent heat-resistant material.

A.13.6.3

This requirement is derived from SOLAS Regulation II-2/Regulation 5.3.

13.6.4*

The arrangements of containers and the electrical circuits and piping essential for the release of any system shall be such that in the event of damage to any one power release line through fire or explosion in a protected space (i.e., a single-fault concept) the entire fire extinguishing charge required for that space can still be discharged.

A.13.6.4

This requirement is derived from SOLAS Regulation II-2/Regulation 5.3.

13.6.5*

The containers shall be monitored for decrease in pressure due to leakage and discharge. Visual and audible signals in the protected area and either on the navigating bridge or in the space where the fire control equipment is centralized shall be provided to indicate a low-pressure condition.

A.13.6.5

This requirement is derived from SOLAS Regulation II-2/Regulation 5.3.

13.6.6*

Within the protected space, electrical circuits essential for the release of the system shall be Class A rated in accordance with *NFPA 72*.

A.13.6.6

This requirement is derived from SOLAS Regulation II-2/Regulation 5.3.

13.7 Enclosure.

13.7.1*

To prevent loss of agent through openings to adjacent hazards or work areas, openings shall be one of the following designs:

(1) Permanently sealed

(2) Equipped with automatic closures

(3) Equipped with manual closures outfitted with an alarm circuit to indicate when these closures are not sealed upon activation of the system

A.13.7.1

A well-sealed enclosure is vital to proper operation of the system and subsequent extinguishment of fires in the protected space. Gastight boundaries of the protected space, such as those constructed of welded steel, offer a highly effective means for holding the fire extinguishing gas concentration. Where the space is fitted with openings, avenues for escape of the gas exist. Automatic closure of openings is the preferred method of ensuring enclosure integrity prior to discharge. Manually closed openings introduce added delay and an added human element into the chain of proper operation of the system. Failure of personnel to properly close all openings has been a recurring cause of gaseous systems not performing as intended. It is recognized that some openings in the enclosures, such as maintenance hatches and watertight doors, cannot be fitted with automatically operated closers due to personnel hazards or other limitations. In those cases, an indicator is required to alert the system operator that an opening has not been closed as required and thus the system is not ready for operation.

13.7.1.1

Where confinement of agent is not practical, or if the fuel can drain from one compartment to another, such as via a bilge, protection shall be extended to include the adjacent connected compartment or work areas.

13.7.2*

Prior to agent discharge, all ventilating systems shall be closed and isolated to preclude passage of agent to other compartments or the vessel exterior. Automatic shutdowns or manual shutdowns capable of being closed by one person from a position co-located with the agent discharge station shall be used.

A.13.7.2

Automatic shutdowns are the preferred method for shutting down a ventilation system. Shutdowns requiring personnel to find and manually close dampers far from the fire extinguishing system discharge station should not be permitted.

13.8 Design Concentration Requirements.

13.8.1 Combinations of Fuels.

For combinations of fuels, the design concentration shall be derived from the flame extinguishment value for the fuel requiring the greatest concentration.

13.8.2 Design Concentration.

For a particular fuel, the design concentration referred to in 13.8.3 shall be used.

13.8.3 Flame Extinguishment.

The minimum design concentration for Class B flammable and combustible liquids shall be as determined following the procedures described in IMO MSC/Circ. 848, *Revised Guidelines for the Approval of Equivalent Fixed Gas Fire-Extinguishing Systems as Referred to in SOLAS 74, for Machinery Spaces and Cargo Pump-Rooms*, as amended by IMO MSC.1/Circ. 1267, *Amendments to Revised Guidelines for the Approval of Equivalent Fixed Gas Fire-Extinguishing Systems, as Referred to in SOLAS 74, for Machinery Spaces and Cargo Pump-Rooms (MSC/Circ. 848)*.

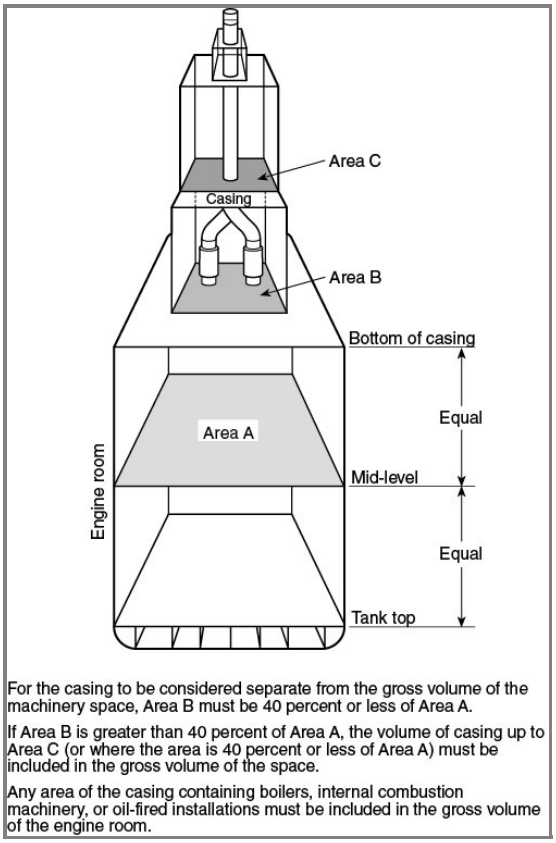
13.8.4* Total Flooding Quantity.

The quantity of agent shall be based on the net volume of the space and shall be in accordance with the requirements of paragraph 5 of IMO MSC/Circular 848, *Revised Guidelines for the Approval of Equivalent Fixed Gas Fire-Extinguishing Systems as Referred to in SOLAS 74, for Machinery Spaces and Cargo Pump-Rooms*, Annex.

A.13.8.4

When the net volume of the machinery space is being calculated, the net volume should include the volume of the bilge and the volume of the stack uptake. The volume calculation should be permitted to exclude the portions of the stack uptake that have a horizontal cross-sectional area less than 40 percent of the horizontal cross-sectional area of the main machinery space. The horizontal cross-sectional area of the main machinery space should be measured midway between the lowest level (tank top) and the highest level (bottom of the stack casing). *(See Figure A.13.8.4.)*

Figure A.13.8.4 Machinery Space and Stack Uptake.



The objects that occupy volume in the protected space should be subtracted from the volume of the space. These objects include, but are not necessarily limited to, the following:

(1) Auxiliary machinery

(2) Boilers

(3) Condensers

(4) Evaporators

(5) Main engines

(6) Reduction gears

(7) Tanks

(8) Trunks

The Maritime Safety Committee, at its 67th session (December 2–6, 1996), approved guidelines for the approval of equivalent fixed gas fire extinguishing systems, as referred to in SOLAS 74, for machinery spaces and cargo pump rooms, as MSC/Circ. 776.

The Subcommittee on Fire Protection, at its 42nd session (December 8–12, 1997), recognized the need for technical improvement to the guidelines contained in MSC/Circ. 776 to assist in their proper implementation and, to that effect, prepared amendments to the guidelines.

The committee, at its 69th session (May 11–20, 1998), approved revised guidelines for the approval of equivalent fixed gas fire extinguishing systems, as referred to in SOLAS 74, for machinery spaces and cargo pump rooms, as set out in the annex, to supersede the guidelines attached to MSC/Circ. 776.

Member governments are invited to apply the annexed guidelines when approving equivalent fixed gas fire extinguishing systems for use in machinery spaces of category A and cargo pump rooms.

The quantity of extinguishing agent for the protected space should be calculated at the minimum expected ambient temperature using the design concentration based on the net volume of the protected space, including the casing.

The net volume of a protected space is that part of the gross volume of the space that is accessible to the free extinguishing agent gas.

In the calculation of the net volume of a protected space, the net volume should include the volume of the bilge, the volume of the casing, and the volume of free air contained in air receivers that in the event of a fire is released into the protected space.

The objects that occupy volume in the protected space should be subtracted from the gross volume of the space. They include, but are not necessarily limited to, the following:

(1) Auxiliary machinery

(2) Boilers

(3) Condensers

(4) Evaporators

(5) Main engines

(6) Reduction gears

(7) Tank

(8) Trunks

Subsequent modifications to the protected space that alter the net volume of the space require the quantity of extinguishing agent to be adjusted to meet the requirements of 13.8.4 and 13.8.5.

No fire suppression agent should be used that is carcinogenic, mutagenic, or teratogenic at concentrations expected during use. No agent should be used in concentrations greater than the cardiac sensitization NOAEL, without the use of controls as provided in SOLAS Regulation II-2/Regulations 5.2. In no case should an agent be used above its LOAEL nor approximate lethal concentration (ALC) calculated on the net volume of the protected space at the maximum expected ambient temperature.

13.8.5* Duration of Protection.

It is important that the agent design concentration not only shall be achieved, but also shall be maintained for a sufficient period of time to allow effective emergency action by trained ship's personnel. In no case shall the hold time be less than 15 minutes.

A.13.8.5

Maintaining the design concentration is equally important in all classes of fires because a persistent ignition source, such as an electric arc, boiler front, heat source, engine exhaust, turbo charger, hot metal, or deep-seated fire, can lead to resurgence of the initial event once the clean agent has dissipated.

13.9 Distribution System.

13.9.1 Rate of Application.

The minimum design rate of application shall be based on the quantity of agent required for the desired concentration and the time allowed to achieve the desired concentration.

13.9.2 Discharge Time.

13.9.2.1

The discharge time for halocarbon agents shall not exceed 10 seconds or as otherwise required by the authority having jurisdiction.

13.9.2.2

For halocarbon agents, the discharge time period shall be defined as the time required to discharge from the nozzles 95 percent of the agent mass [at 70°F (21°C)] necessary to achieve the minimum design concentration.

13.9.2.3

The discharge time for inert gas agents shall not exceed 120 seconds for 85 percent of the design concentration or as otherwise required by the authority having jurisdiction.

13.10 Nozzle Choice and Location.

For spaces other than those identified in 13.10.1, nozzles shall be of the type listed for the intended purpose. Limitations shall be determined based on testing in accordance with IMO MSC/Circular 848, *Revised Guidelines for the Approval of Equivalent Fixed Gas Fire-Extinguishing Systems as Referred to in SOLAS 74, for Machinery Spaces and Cargo Pump-Rooms*. Nozzle spacing, area coverage, height, and alignment shall not exceed the limitations.

13.10.1

For spaces having only Class A fuels, nozzle placement shall be in accordance with the nozzles' listed limitations.

13.11 Inspection and Tests.

At least annually, all systems shall be inspected and tested for proper operation by competent personnel. Discharge tests shall not be required.

13.11.1

An inspection report with recommendations shall be filed with the vessel's master and the owner's agent. The report shall be available for inspection by the authority having jurisdiction.

13.11.2

At least annually, the agent quantity of refillable containers shall be checked by competent personnel. The container pressure shall be verified and logged at least monthly by the vessel's crew.

13.11.3*

For halocarbon clean agents, if a container shows a loss in agent of more than 5 percent or a loss in pressure, adjusted for temperature, of more than 10 percent, it shall be refilled or replaced.

A.13.11.3

For determination of container pressure, the original container fill density should be obtained from the system manufacturer and the temperature/pressure relation should be obtained from tables published by the system manufacturer. For determination of container liquid level, the liquid level–temperature relationship should be obtained from the system manufacturer.

13.11.3.1*

If an inert gas clean agent container shows a loss in pressure, adjusted for temperature, of more than 5 percent, it shall be refilled or replaced. Where container pressure gauges are used for this purpose, they shall be compared to a separate calibrated device at least annually.

A.13.11.3.1

For inert gas clean agents that are not liquefied, pressure is an indication of agent quantity.

13.11.4

The installing contractor shall provide instructions for the operational features and inspection procedures specific to the clean agent system installed on the vessel.

13.12 Approval of Installations.

Prior to acceptance of the system, technical documentation, such as the system design manual, test reports, or the listing report, shall be presented to the authority having jurisdiction. This documentation shall show that the system and its individual components are compatible, employed within tested limitations, and suitable for marine use.

13.12.1

The listing organization shall perform the following functions:

(1) Verify that fire tests were conducted in accordance with a predetermined standard

(2) Verify that component tests were conducted in accordance with a predetermined standard

(3) Review the component quality assurance program

(4) Review the design and installation manual

(5) Identify system and component limitations

(6) Verify flow calculations

(7) Verify the integrity and the reliability of system as a whole

(8) Have a follow-up program

(9) Publish a list of equipment

13.13 Periodic Puff Testing.

A test in accordance with 10.4.15 shall be performed at 24-month intervals. The periodic test program shall include a functional test of all alarms, controls, and time delays.

13.14 Compliance.

Electrical systems shall be in accordance with 46 CFR Subchapter J. For Canadian vessels, electrical installations shall be in accordance with TP 127 E, *Ship Safety Electrical Standards*.

Submitter Information Verification

Committee: GFE-AAA

Submittal Date: Thu May 11 13:08:59 EDT 2023

Committee Statement

Committee Statement: A task group has been formed to review chapter 13 in its entirety to update information to align with the US Coast Guard requirements. There are references that should be aligned with how they are used within the US Maritime Organization.

Response Message:	CI-19-NFPA 2001-2023