NFPA® 302

Fire Protection Standard for Pleasure and Commercial Motor Craft

2025 Edition

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NFPA® 302

Fire Protection Standard for

Pleasure and Commercial Motor Craft

2025 Edition

This edition of NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*, was prepared by the Technical Committee on Motor Craft. It was issued by the Standards Council on April 22, 2024, with an effective date of May 12, 2024, and supersedes all previous editions.

This edition of NFPA 302 was approved as an American National Standard on May 12, 2024.

Origin and Development of NFPA 302

This *Fire Protection Standard for Pleasure and Commercial Motor Craft* represents the cumulative result of over 75 years of attention to fire safety of boats by the NFPA. The first edition of this standard was adopted by the association in 1937. Successive editions were adopted in 1939, 1948, 1950, 1951, 1952, 1953, 1954, 1955, 1957, 1960, 1964, 1966, 1968, 1972, 1980, 1984, 1989, 1994, and 1998. Prior to 1937, the information was contained in Appendix D of NFPA 301, *Fire Prevention Regulations for the Construction and Maintenance of Vessels*.

The 2004 edition of NFPA 302 contained a first-time requirement in the industry for smoke detectors on pleasure boats. The chapters on fire protection equipment and electrical systems were updated based on the latest technologies. NFPA 302 was completely revised for the 2004 edition to comply with the latest edition of the *Manual of Style for NFPA Technical Committee Documents*.

The 2010 edition included provisions for the mitigation of carbon monoxide hazards that include, but are not limited to, revised ventilation requirements and installation of carbon monoxide detection devices on certain vessels. New requirements addressing the fire hazard of portable heaters and dehumidifiers were added. Requirements that address electrical systems were updated. The 2010 edition offered guidance information for the installation of fire detection equipment in the engine rooms of commercial vessels that are 12 meters or more in length.

The 2015 edition incorporated ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, as the primary test method to be used for assessing the flame spread index. This edition of the standard introduced a requirement to limit, as far as practicable, the number of elbows and other restrictions in the exhaust systems of gasoline-fueled engines to minimize the production of carbon monoxide (CO). The standard also identified the test method to be used for determining the flame resistance properties of fabrics used in the construction of motor craft in accordance with NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*. The provisions in Chapter 10 of NFPA 780, *Standard for the Installation of Lightning Protection Systems*, to protect boats from lightning were referenced by NFPA 302. Annex E, *Extinguisher Inspection and Maintenance Information from NFPA Standards*, was updated.

The 2020 edition included revisions to the requirements for electrical systems and equipment, fuel systems, carbon monoxide detection equipment, and fire extinguishers and fire protection equipment for towing vessels under 300 gross tons. Due to the increasing popularity of lithium-ion-battery-powered equipment use in and on recreational watercraft, a requirement pertaining to the use of engine-starting and general power distribution lithium-ion batteries was added to the standard to prevent battery failure, thermal runaway, and catastrophic fire. Requirements for the installation of fuses and the use of ferrule connectors were added to prevent fires caused by overheating of such devices. Requirements to address hazards associated with 480-volt electrical distribution systems were also added.

The installation, maintenance and replacement requirements for carbon monoxide (CO) detectors within an accommodation compartment was made applicable to all boats.

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The definitions and requirements pertaining to portable fire extinguishers were revised to comply with those found in NFPA 10, *Standard for Portable Fire Extinguishers*.

For the 2025 edition, the Technical Committee on Motor Craft reviewed fire incidents that occurred on recreational vessels and vessels for hire. Based on the published findings of some of these incidents, the requirements for smoke detection and smoke alarms have been revised. Smoke detectors and alarms are now required in every sleeping area that is not open to a weather deck. New requirements for fire and heat detectors and smoke alarms for enclosed engine compartments have also been added to the standard.

Lithium-ion (L-I) battery technology is being used to replace many combustion engines and traditional lead-acid batteries on boats for propulsion and powering vessel equipment. Many appliances and portable devices, such as powered micromobility devices, are powered by L-I battery technology. Damaged or unstable L-I batteries and improper charging, storage, or disposal can cause these batteries to overheat, leading to fire incidents that can spread rapidly. Requirements for permanently installed lithium-ion battery systems and powered micromobility devices have been added to the standard.

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Committee Scope: This Committee shall have primary responsibility for documents on fire prevention and protection of motor craft and to encourage their use by designers, builders, and owners.

AVA Documents 2025 Edition Document Sharing Hub
Full document details: NFPA 302 2025

Contents

Chapter 1 Administration **302–** 6
1.1 Scope. **302–** 6
1.2 Purpose. **302–** 6
1.3 Application. **302–** 6
1.4 Retroactivity. **302–** 6
1.5 Equivalency. **302–** 6
1.6 Units. **302–** 6

Chapter 2 Referenced Publications **302–** 7
2.1 General. **302–** 7
2.2 NFPA Publications. **302–** 7
2.3 Other Publications. **302–** 7
2.4 References for Extracts in Mandatory Sections. **302–** 8

Chapter 3 Definitions **302–** 8
3.1 General. **302–** 8
3.2 NFPA Official Definitions. **302–** 8
3.3 General Definitions. **302–** 9

Chapter 4 Hull **302–** 11
4.1 General Arrangement. **302–** 11
4.2 Spaces Open to the Atmosphere. **302–** 11
4.3 Natural Ventilation. **302–** 11
4.4 Connecting Compartments or Spaces by a Natural Ventilation System. **302–** 12
4.5 Powered Ventilation System. **302–** 12
4.6 Arrangements of Openings. **302–** 13
4.7 Combustion Air. **302–** 13

Chapter 5 Engines **302–** 14
5.1 Exposed Engine Surface Temperatures. **302–** 14
5.2 Diaphragm-Type Gasoline Pumps. **302–** 14
5.3 Marine Carburetors. **302–** 14
5.4 Electrical Components. **302–** 14
5.5 Air-Cooled Engines. **302–** 14
5.6 Portable Gasoline Tanks. **302–** 14
5.7 Automatic Shutdown. **302–** 14
5.8 High-Tension Cable. **302–** 14
5.9 Distributors. **302–** 14

Chapter 6 Engine Exhaust Systems **302–** 15
6.1 General Requirements. **302–** 15
6.2 Materials. **302–** 15
6.3 Hose Connections. **302–** 15
6.4 Temperature Protection. **302–** 15

Chapter 7 Fuel Systems **302–** 15
7.1 General Requirements. **302–** 15
7.2 Fuel Tank Materials. **302–** 16
7.3 Fuel Tank Design and Construction. **302–** 16
7.4 Fuel Tank Installation. **302–** 17
7.5 Fuel Lines, Fittings, and Related Accessories. ... **302–** 17

Chapter 8 Cooking, Heating, and Auxiliary Appliances **302–** 19
8.1 General. **302–** 19
8.2 Cooking Appliance Installation. **302–** 19
8.3 Coal, Charcoal, and Wood-Burning Appliances. **302–** 20
8.4 Liquid Fuel Appliances Excluding Liquefied Petroleum Gas (LPG) Appliances. **302–** 20
8.5 Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) Systems for Permanently Installed Appliances. **302–** 21
8.6 Service Water Heating Units and Cabin Heaters. **302–** 24
8.7 Lamps. **302–** 24
8.8 Electric Stoves. **302–** 25
8.9 Portable Electric Heaters. **302–** 25
8.10 Portable Dehumidifiers. **302–** 25

Chapter 9 Electrical Systems Under 50 Volts **302–** 25
9.1 Scope. **302–** 25
9.2 General Requirements. **302–** 25
9.3 Batteries. **302–** 25
9.4 Power Distribution System Negative Connections. **302–** 26
9.5 Continuously Energized Parts. **302–** 26
9.6 Marking. **302–** 26
9.7 Ambient Temperature. **302–** 26
9.8 Ignition Sources. **302–** 27
9.9 Overcurrent Protection. **302–** 27
9.10 Switches. **302–** 28
9.11 Appliances and Equipment. **302–** 29
9.12 System Wiring. **302–** 29
9.13 Wiring Installation. **302–** 29
9.14 Wiring Connections. **302–** 31
9.15 Receptacles. **302–** 32
9.16 Plug Connectors. **302–** 32

Chapter 10 Alternating Current (ac) Electrical Systems on Boats **302–** 33
10.1 Scope. **302–** 33
10.2 General Requirements. **302–** 33
10.3 Marking. **302–** 33
10.4 System Voltage. **302–** 33
10.5 Ambient Temperature. **302–** 33
10.6 Ignition Source. **302–** 34
10.7 Overcurrent Protection. **302–** 34
10.8 Main Supply. **302–** 34
10.9 Branch Circuits. **302–** 35
10.10 Ground-Fault Circuit Interrupters (GFCIs). **302–** 35
10.11 Appliances and Equipment. **302–** 35
10.12 Conductors and Flexible Cords. **302–** 36
10.13 Installation. **302–** 36
10.14 Receptacles. **302–** 38
10.15 Main Panelboard. **302–** 38
10.16 Alternating-Current (ac) Generators. **302–** 39
10.17 Isolation of Galvanic Currents. **302–** 39
10.18 Shore Power. **302–** 39
10.19 Application of Types of Shore Power Circuits. .. **302–** 40

Chapter 11 Lightning Protection **302–** 45
11.1 General. **302–** 45

Chapter 12 Fire Protection Equipment **302–** 45
12.1 Fire Suppression Equipment. **302–** 45
12.2 Towing Vessels. **302–** 47

Chapter 13 Carbon Monoxide and Smoke Detection .. **302–** 47
13.1 Carbon Monoxide and Smoke Detection Systems. **302–** 47
13.2 Installation. **302–** 47
13.3 Engine Compartment Fire Detection. **302–** 47
13.4 Smoke Detection. **302–** 47

Annex A Explanatory Material **302–** 47

Annex B Portable Fire Extinguishers and Fixed Systems **302–** 58

Annex C Operation and Maintenance **302–** 59

Annex D Fire Warning Equipment **302–** 61

Documents
Document Sharing Hub
Full document details: NFPA 302 2025

Annex E **Extinguisher Inspection and Maintenance Information from NFPA Standards** **302–** 62

Annex F **Informational References** **302–** 67

Index **302–** 69

Documents 2025 Edition Document Sharing Hub

Full document details: NFPA 302 2025

NFPA 302

Fire Protection Standard for

Pleasure and Commercial Motor Craft

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall establish minimum requirements for the prevention of fire and explosion, for mitigation of carbon monoxide hazards, and for life safety in case of fire, on boats specified in Section 1.3.

1.1.2 This standard shall establish minimum requirements for the following:

(1) Elimination of ignition sources
(2) Ventilation of accommodation spaces, fuel tank compartments (if separate from machinery spaces), and machinery spaces
(3) Use of combustible materials
(4) Fire-extinguishing equipment and fire exits
(5) Control of fire-extinguishing agents in machinery spaces
(6) Mitigation of carbon monoxide hazards from all sources

1.2 Purpose.

1.2.1 The purpose of this standard shall be to minimize the loss of life and property due to fires, explosions, and carbon monoxide aboard pleasure and commercial vessels.

1.2.2 The intent of this standard shall be to make motor craft as free from the hazards of fire and carbon monoxide as practicable.

1.2.3 The requirements of this standard shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire, explosion, and carbon monoxide and reflect the conditions and the state of the art at the time the standard was issued.

1.3 Application.

1.3.1 This standard shall apply to the following boats of less than 300 gross tons that are used for pleasure or commercial purposes:

(1) Boats that use engines for propulsion
(2) Boats that use engines for generating power
(3) Boats that use cooking, heating, or auxiliary appliances
(4) Boats that have permanently installed ignition source(s)
(5) Boats that have permanently installed electrical systems

1.3.2 This standard shall not apply to personal watercraft.

1.3.3 No requirement of this standard shall be construed as reducing applicable federal regulations.

1.4 Retroactivity. It is not intended that the provisions of this standard be applied to boats constructed or equipment installed prior to the effective date of the standard.

1.5 Equivalency. Nothing in this standard shall prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety in place of those required by the standard, provided that technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency.

1.6* Units. 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 falls outside of but is recognized by SI, is used commonly in international fire protection. These units are listed in Table 1.6 with their conversion factors.

Table 1.6 Unit Conversion Factors

Name of Unit	Unit Symbol	Conversion Factor
Millimeter	mm	1 in. = 25.4 mm
Meter	m	1 in. = 0.0254 m
Square centimeter	cm^2	1 $in.^2$ = 6.452 cm^2
Square meter	m^2	1 ft^2 = 0.093 m^2
Cubic centimeter	cm^3	1 $in.^3$ = 16.39 cm^3
Cubic meter	m^3	1 ft^3 = 0.0283 m^3
Gram	g	1 oz = 28.35 g
Liter	L	1 gal = 3.785 L
Kilopascal	kPa gauge	1 psi = 6.89 kPa gauge
Bar	bar	14.50 psi = 1 bar
Cubic meters per minute	m^3/min	1 cfm = 0.0283 m^3/min

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1.6.1 If a value for a required measurement in this standard is followed by an equivalent value in metric units, the first stated value shall be regarded as the requirement, and the equivalent value that follows shall be approximate.

1.6.2 The metric unit value shall be the requirement for motor craft under the jurisdiction of Canadian authorities.

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 1, *Fire Code,* 2024 edition.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2022 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2022 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2022 edition.

NFPA 52, *Vehicular Natural Gas Fuel Systems Code,* 2023 edition.

NFPA 70®, National Electrical Code®, 2023 edition.

NFPA 303, *Fire Protection Standard for Marinas and Boatyards,* 2021 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films,* 2023 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 2023 edition.

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

NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems,* 2020 edition.

2.3 Other Publications.

N **2.3.1 ABS Publications.** American Bureau of Shipping, ABS Plaza, 1701 City Plaza Drive, Spring, TX 77389.

Publication 275, *Requirements for Use of Lithium-Ion Batteries in the Marine and Offshore Industries*, 2022.

Δ 2.3.2 ABYC Publications. American Boat & Yacht Council, Inc., 613 Third Street, Suite 10, Annapolis, MD 21403.

ABYC A-24, *Installation of Carbon Monoxide Detectors and Alarms*, 2020.

ABYC A-28, *Galvanic Isolators*, 2019.

ABYC A-31, *Battery Chargers and Inverters*, 2020.

ABYC E-11, *AC and DC Electrical Systems on Boats*, 2021.

ABYC E-13, *Lithium Ion Batteries*, 2022.

ABYC H-25, *Portable Marine Gasoline Fuel Systems*, 2019.

ABYC TE-4, *Lightning Protection*, 2019.

ABYC TH-23, *Design, Construction, and Testing of Boats in Consideration of Carbon Monoxide*, 2022.

2.3.3 AMCA Publications. Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, IL 60004-1893.

AMCA/ANSI 210, *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating*, 2016.

2.3.4 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

CSA/ANSI Z21.57, *Recreational Vehicle Cooking Gas Appliances*, 2010, revised 2021.

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

ASTM A463/A463M, *Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process*, 2015.

ASTM A653/A653M, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*, 2015e1.

ASTM B96/B96M, *Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels*, 2016.

ASTM B122/B122M, *Standard Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar*, 2016.

ASTM B127, *Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip*, 2005, reapproved 2014.

ASTM B152/B152M, *Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar*, 2013.

ASTM D471, *Standard Test Method for Rubber Property-Effect of Liquids*, 2016a.

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

N **2.3.6 Lloyd's Register Group Limited.** 71 Fenchurch Street, London, EC3M 4BS, United Kingdom.

Lloyd's Register Type Approval System – Test Specification Number 5, 2019.

Δ 2.3.7 NEMA Publications. National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, VA 22209.

NEMA/ANSI WD-6, *Wiring Devices — Dimensional Specifications*, 2021.

NEMA/ANSI 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)*, 2020.

Δ 2.3.8 SAE Publications. SAE International, Society of Automotive Engineers, 901 15th Street, NW, Suite 520, Washington, DC 20005.

SAE J378, *Marine Propulsion System Wiring*, 2018.

SAE J1127, *Low Voltage Battery Cable*, 2020.

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SAE J1128, *Low Voltage Primary Cable*, 2020.

SAE J1171, *External Ignition Protection of Marine Electrical Devices*, 2016.

SAE J1928, *Devices Providing Backfire Flame Control for Gasoline Engines in Marine Applications*, 2020.

SAE J2006, *Marine Exhaust Hose*, 2013.

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Δ **2.3.9 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 21, *Safety LP Gas-Hose*, 2014, revised 2017.

UL 94, *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*, 2013, revised 2022.

UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, 2017.

UL 217, *Safety for Single and Multiple Station Smoke Alarms*, 2015, revised 2021.

UL 248, *Series of Standards for Safety for Low Voltage Fuses*, 2011.

UL 268, *Smoke Detectors for Fire Alarm Systems*, 2021.

UL 310, *Safety for Electrical Quick-Connect Terminals*, 2014, revised 2019.

UL 489, *Safety for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures*, 2016.

UL 498, *Safety for Attachment Plugs and Receptacles*, 2017, revised 2021.

UL 723, *Test for Surface Burning Characteristics of Building Materials*, 2018.

UL 817, *Safety for Cord Sets and Power-Supply Cords*, 2015, revised 2021.

UL 858, *Safety for Household Electric Ranges*, 2014, revised 2019.

UL 943, *Safety for Ground-Fault Circuit-Interrupters*, 2016, revised 2017.

UL 1059, *Safety for Terminal Blocks*, 2019, revised 2021.

UL 1077, *Safety for Supplementary Protectors for Use in Electrical Equipment*, 2015, revised 2021.

UL 1128, *Safety for Marine Blowers*, 1997.

UL 1129, *Safety for Wet Exhaust Component for Marine Engines*, 1999.

UL 1426, *Safety for Electrical Cables for Boats*, 2010, revised 2019.

UL 1500, *Safety for Ignition-Protection Test for Marine Products*, 1997, revised 2007.

UL 4248, *Series of Standards for Safety for Fuseholders*, 2011.

UL 60335-2-40, *Household and Similar Electrical Appliances, Part 2: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers*, 2019.

Δ **2.3.10 US Government Publications.** US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401.

Title 33, Code of Federal Regulations, Part 183, "Boats and Associated Equipment."

Title 46, Code of Federal Regulations, Chapter I, Subchapter M, "Towing Vessels."

2.3.11 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2020.

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Fire Code,* 2024 edition.
NFPA 10, *Standard for Portable Fire Extinguishers,* 2022 edition.
NFPA 70®, National Electrical Code®, 2023 edition.
NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2022 edition.

Chapter 3 Definitions

Δ **3.1 General.**

N **3.1.1** The definitions contained in this chapter shall apply to the terms used in this code/standard.

N **3.1.2** Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used.

N **3.1.3** *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

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

3.2.5 Shall. Indicates a mandatory requirement.

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

3.2.7 Standard. An NFPA standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA manuals of style. When used in a generic sense, such as in the phrases "standards development process" or "standards development activities," the term "standards" includes all NFPA standards, including codes, standards, recommended practices, and guides.

3.3 General Definitions.

3.3.1 Accessible. Capable of being reached for inspection, maintenance, or removal without disturbing the permanent boat structure.

3.3.2 Accommodation Space. Space designed for living purposes.

3.3.3 Battery Cold Cranking Rating. The discharge load in amperes that a battery at 0°F (–17.8°C) can deliver for 30 seconds while maintaining a voltage of 1.2 volts per cell or higher.

3.3.4 Battery Reserve Capacity. The number of minutes for which a new, fully charged battery at 80°F (26.7°C) can be continuously discharged at 25 amperes while maintaining a voltage of 1.75 volts per cell or higher (10.5 volts for a 12-volt battery or 5.25 volts for a 6-volt battery).

3.3.5* Bonding Conductor. A normally non-current-carrying conductor that is intended to carry leakage current from either the ac or the dc system.

3.3.6 Butane. See 3.3.31, Liquefied Petroleum Gas (LPG).

3.3.7 Candela (cd). A unit of measure used in measuring the effective intensity of a flashing light.

3.3.8 Clean Agent. Volatile or gaseous fire extinguishant that is electrically nonconducting and that does not leave a residue upon evaporation. [**2001,** 2022]

3.3.9* Compressed Natural Gas (CNG). A natural lighter-than-air gas compressed for use as a fuel that consists principally of methane in gaseous form plus naturally occurring mixtures of hydrocarbon gases.

3.3.10 Double Insulation System. An insulation system comprised of basic insulation and supplementary insulation, with the two insulations physically separated and so arranged that they are not simultaneously subjected to the same deteriorating influences (temperature, contaminants, and the like).

3.3.11* Engine Exhaust System. The means by which products of combustion are conducted from the engine exhaust manifold to an outboard terminus.

3.3.12 Engine Negative Terminal. The point on the engine at which the negative battery cable is connected.

3.3.13* Extinguisher Inspection. A quick check that a fire extinguisher is in its designated place, that it has not been actuated or tampered with, and that there is no obvious physical damage or condition to prevent its operation. [**10,** 2022]

3.3.14* Extinguisher Maintenance. A thorough examination of the fire extinguisher that is intended to give maximum assurance that a fire extinguisher will operate effectively and safely and to determine if physical damage or condition will prevent its operation, if any repair or replacement is necessary, and if hydrostatic testing or internal maintenance is required. [**10,** 2022]

3.3.15 Fixed Fire Extinguishing/Suppression System. An engineered or pre-engineered total flooding or local application system consisting of a fixed supply of extinguishing agent permanently connected for fixed agent distribution to fixed nozzles that are arranged to discharge an extinguishing agent into an enclosure (total flooding), directly onto a hazard (local application), or a combination of both; or an automatic sprinkler system.

3.3.16 Flammable Hydrocarbon Mixture. A mixture of gasoline vapor and air, or propane plus air, between the lower explosive limit (LEL) and upper explosive limit (UEL).

3.3.17 Galvanic Isolator. A device installed in series with the ac grounding (green, or green with yellow stripe) conductor of the shore power cable to block, in effect, the low-voltage dc galvanic current flow, yet permit the passage of ac current normally associated with the ac grounding (green, or green with yellow stripe) conductor.

3.3.18* Galvanically Compatible Metals. Metals that are related closely to each other in the galvanic series.

3.3.19 Gross Ton. A measure of internal volume equal to 100 ft^3.

3.3.20 Ground. The electrical potential of the earth's surface. The boat's ground is established by a conducting connection (intentional or accidental) with the earth, including any conductive part of the wetted surface of a hull.

3.3.21 Grounded Conductor.

3.3.21.1 ***Alternating Current (ac) Grounded Conductor.*** A current-carrying conductor that is intentionally maintained at ground potential.

3.3.21.2 ***Direct Current (dc) Grounded Conductor.*** A current-carrying conductor connected to the side of the power source that is intentionally maintained at boat ground potential.

3.3.22* Ground-Fault Circuit Interrupter (GFCI). A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a ground-fault current exceeds the values established for a Class A device. [**70,** 2023]

3.3.23 Ground-Fault Protector (GFP). A device intended to protect equipment by interrupting the electric current to the load when a fault current to ground exceeds a predetermined value that is less than that required to operate the overcurrent protection device of that supply circuit.

3.3.24 Grounding Conductor.

3.3.24.1 ***Alternating Current (ac) Grounding Conductor (green or green with yellow stripe).*** A conductor, not normally carrying current, used to connect the metallic non-current-

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carrying parts of electrical equipment to the ac system and engine negative terminal, or its bus, and to the shore ac grounding conductor through the shore power cable.

3.3.24.2 ***Direct Current (dc) Grounding Conductor.*** A normally non-current-carrying conductor used to connect metallic non-current-carrying parts of a direct current device to the engine negative terminal or its bus for the purpose of minimizing stray current corrosion.

3.3.25* Halocarbon Agent. An agent that contains as primary components one or more organic compounds containing one or more of the elements fluorine, chlorine, bromine, or iodine.

3.3.26* Halogenated Agent. Bromochlorodifluoromethane (Halon 1211), bromotrifluoromethane (Halon 1301), and mixtures of Halon 1211 and Halon 1301.

Δ **3.3.27 Hydrostatic Testing.** Pressure testing of the extinguisher cylinder and certain hose assemblies to verify strength against unwanted rupture. [**10,** 2022]

3.3.28* Ignition Protection. The design and construction of a device such that, under the designed operating conditions, the device does not initiate ignition when surrounded by a flammable hydrocarbon mixture if an ignition source causes an internal explosion, the device is incapable of releasing sufficient electrical or thermal energy to ignite a hydrocarbon mixture, and the source of ignition is hermetically sealed.

3.3.29 Ignition Source. Any item or substance capable of an energy release of a type and magnitude sufficient to ignite any flammable mixture of gases or vapors that could occur onboard the vessel.

3.3.30 Inboard Engine. Any internal combustion engine other than an outboard engine permanently mounted within the hull.

3.3.31* Liquefied Petroleum Gas (LPG). Terms "liquefied petroleum gas," "LP-Gas," and "LPG" that are synonymous and include any product composed predominantly of any of the following gaseous hydrocarbons: propane, propylene, butane, isobutane, butylenes, or a mixture thereof.

3.3.32 Machinery Space. Spaces that contain permanently installed engines for mechanical or electrical power or propulsion.

N **3.3.33* Micromobility Device, Powered.** Motorized bicycles, motorized scooters, or other personal transportation devices powered by lithium-ion or lithium metal batteries. [**1**, 2024]

3.3.34 Motor Craft. Any boat that is propelled by other than wind or human power.

3.3.35* Nonrechargeable (Nonrefillable) Fire Extinguisher. A fire extinguisher that is intended to be used one time and not capable of or intended to be recharged and returned to service. [**10,** 2022]

3.3.36 Open to the Atmosphere. A space or compartment that has at least 15 in.^{2} of net open area directly exposed to the atmosphere for each cubic foot of net compartment volume (0.34 m^2/m^3).

3.3.37 Overcurrent Protection Device. A device, such as a fuse or circuit breaker, designed to interrupt the circuit when the current flow exceeds a predetermined value.

3.3.38* Panelboard. An assembly of devices for the purpose of controlling or distributing, or both, electrical power on a boat.

3.3.39* Permanently Installed. Securely fastened so that tools must be used for removal.

3.3.40 Personal Watercraft. A vessel less than 13 ft (4 m) in length that uses an internal combustion engine powering a water jet pump as its primary source of propulsion and is designed to be operated by a person or persons sitting, standing, or kneeling on rather than within the confines of the hull.

3.3.41 Pigtail. An external conductor that originates within an electrical component or appliance installed by the manufacturer.

3.3.42* Polarized System (ac). A system in which the grounded (white) and ungrounded conductors are connected identically in relation to all terminals or fixture leads on all devices in the circuit, including the shore power connections.

3.3.43 Polarized System (dc). A system in which the grounded (negative) and ungrounded (positive) conductors are connected identically in relation to all terminals or leads on all devices in the circuit.

3.3.44 Portable Fire Extinguisher. A portable device, carried or on wheels and operated by hand, containing an extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing fire. [**10,** 2022]

3.3.45 Propane. See 3.3.31, Liquefied Petroleum Gas (LPG).

3.3.46 Readily Accessible. Capable of being reached quickly and safely for effective use under emergency conditions without the aid of tools.

3.3.47* Rechargeable (Refillable) Fire Extinguisher. A fire extinguisher capable of undergoing complete maintenance, including internal inspection of the pressure vessel, replacement of all substandard parts and seals, and hydrostatic testing. [**10,** 2022]

3.3.48 Self-Limiting. A device with a maximum output restricted to a specified value by its magnetic and electrical characteristics.

3.3.49* Sheath. A material used as a continuous protective covering around one or more insulated conductors.

3.3.50 Shore Power Inlet. A reverse service-type fitting designed for mounting on a boat that requires a female connector on the shore power cable in order to make the electrical connection.

3.3.51 Transformer.

3.3.51.1 ***Isolation Transformer.*** A transformer installed in the shore power supply circuit of a boat to isolate electrically all ac system conductors, including the ac grounding conductor (green, or green with yellow stripe) on the boat, from the ac system conductors of the shore power supply.

3.3.51.2 ***Polarization Transformer.*** An isolated winding transformer ("dry-type" encapsulated lighting transformer) installed in the shore power supply circuit of a boat to

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isolate electrically the normally current-carrying ac system conductors, but not the ac grounding conductor (green, or green with yellow stripe), from the normally current-carrying conductors of the shore power supply.

3.3.52 Trip-Free Circuit Breaker. A resettable overcurrent protection device designed so that the means of resetting cannot override the current interrupting mechanism.

3.3.53* Ventilation. The changing of air within a compartment by natural or powered means.

Δ **3.3.54 Watertight.** So constructed that water does not enter the enclosure under test conditions specified in NEMA/ANSI 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)*.

3.3.55* Weatherproof. Constructed or protected so that exposure to the weather does not interfere with successful operation.

Chapter 4 Hull

4.1 General Arrangement.

4.1.1 The hull shall be arranged so that all compartments are accessible and all escape hatches are unobstructed and readily accessible.

4.1.1.1 Every boat having enclosed accommodation spaces shall have a readily accessible and unobstructed means of egress.

4.1.1.2 Every boat having enclosed accommodation spaces shall have a second accessible means of egress if it is possible for one exit to be blocked by a fire in a galley or machinery area.

4.1.1.3 The means of egress in 4.1.1.1 and 4.1.1.2 shall provide for minimum clear opening dimensions of 14 in. × 18 in. (36.8 cm × 47 cm) (rectangular); or 18 in. (45.7 cm) diameter (circular); or 270 in.^{2} (1741 cm^2) with a minimum dimension of 14½ in. (36.8 cm) (oval).

4.1.1.4 Any hatch that is required for egress shall have a means of being operated from the inside and a means of being operated from the outside when not secured from the inside.

4.1.1.5 All hinged hatches shall have a means or method to support the hatch in an open position.

4.1.2* Bulkheads or enclosures shall be installed between machinery spaces and accommodation spaces.

4.1.2.1 Openings such as crevices, holes, joints, and penetrations for wiring, cable, and hose, etc., in bulkheads or decks between accommodation compartment(s) that are adjacent to or above a compartment(s) that contains a gasoline engine shall be constructed to minimize the flow of gas or vapors from the machinery space by means such as, but not limited to, flexible compounds.

4.1.3 Bulkheads or enclosures required in 4.1.2 shall be continuous, except for necessary penetrations, to minimize the escape of fire-extinguishing agents discharged into the machinery space.

4.1.4 The requirements of 4.1.4 shall apply to boats other than boats using diesel fuel only.

4.1.4.1 Bilges of spaces containing fuel lines and fuel line fittings shall be separated from bilges of accommodation spaces and other enclosed spaces containing sources of ignition by bulkheads that shall not permit more than 0.25 fl oz (7.4 ml) of leakage per hour when the liquid in the bilge is at a height of 12 in. (30 cm) or one-third the maximum height of the bulkhead, whichever is less.

4.1.4.2 Above heights of 12 in. (30 cm) or one-third the maximum height, the bulkhead shall be permitted to have openings for the passage of conductors, piping, ventilation ducts, mechanical equipment, doors, hatches, and access panels, provided that the maximum annular space around each item is not greater than ¼ in. (6.4 mm).

4.1.5 Machinery spaces shall be readily accessible.

4.1.6 Thermal and Acoustical Insulation.

4.1.6.1 Materials used for thermal and acoustical insulation in any compartment or enclosure containing an internal combustion engine or heater shall have a flame spread index of 75 or less, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

4.1.6.2 Material shall be labeled or listed as having been tested to meet the requirements of ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

4.1.6.3 Materials used for thermal and acoustical insulation shall not disintegrate in the presence of hydrocarbon vapor.

4.1.6.4 Materials used for thermal and acoustical insulation shall be designed and installed such that hydrocarbon vapors cannot accumulate within the material and thereby reduce its flame spread rate.

4.2 Spaces Open to the Atmosphere.

4.2.1 Spaces Connected to Spaces Open to the Atmosphere.

4.2.1.1 Compartments or spaces connecting with engine or portable fuel tank spaces that are open to the atmosphere shall require ventilation if the connecting space has an open area of less than 15 in.^{2}/ft^3 (0.34 m^2/m^3) of its net volume.

4.2.1.2 The open area in 4.2.1.1 shall be open either to the atmosphere or to another open space, provided that, for the combined net volumes of the connecting spaces, there is a total area open to the atmosphere of at least 15 in.^{2}/ft^3 (0.34 m^2/m^3).

4.2.2 Long, narrow spaces formed by side panels or accommodation floors shall have openings at both ends or along the sides if they are to be considered open to the atmosphere.

4.3* Natural Ventilation.

4.3.1 Each compartment not open to the atmosphere shall be provided with a natural ventilation system where such a compartment contains any of the following:

(1) Permanently installed gasoline engine
(2) Portable fuel tank that vents into the compartment
(3) Gasoline tank and an electrical component without ignition protection

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4.3.2* Space under a motor well in outboard boats not open to the atmosphere, that is large enough to accommodate a 6 gal (23 L) portable fuel tank but is not intended for such usage, shall be labeled to prohibit its use for fuel storage.

4.3.3 Each natural ventilation system shall be constructed with at least one intake and one exhaust opening that shall be located on the boat's exterior surface.

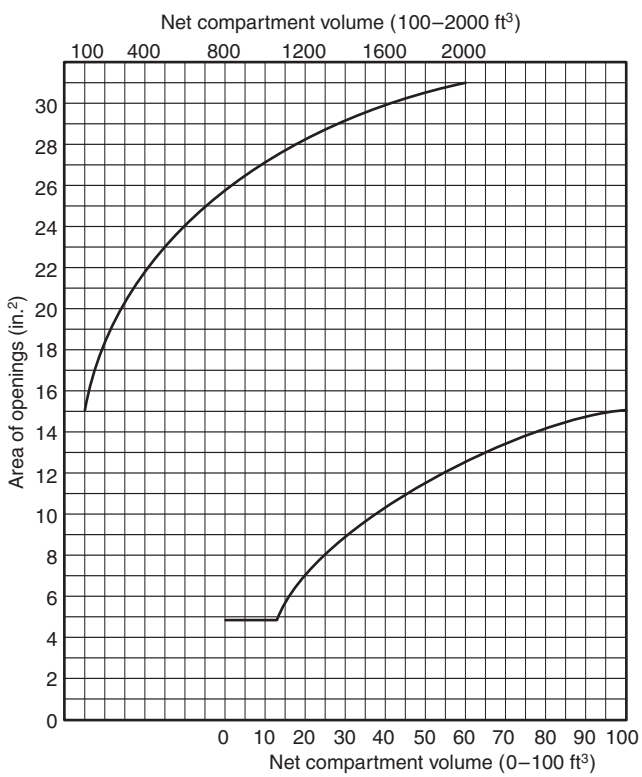
4.3.4* Each compartment requiring natural ventilation shall be equipped with an exhaust duct(s) originating in the lower third of the compartment, with the duct opening permanently fixed above the normal accumulation of bilge water.

4.3.5 If the compartment requiring natural ventilation is an engine compartment, the exhaust duct(s) shall be located as near below the engine(s) as practicable.

4.3.6 An exhaust duct fitted with a cowl or its equivalent shall face aft.

4.3.7 Air intake openings inside a compartment shall be separated from exhaust duct openings inside the compartment by at least 24 in. (610 cm), compartment dimensions permitting.

4.3.8 The minimum aggregate internal cross-sectional area of intake ducts or openings shall be as shown in Figure 4.3.8.



Notes:
The values in Figure 4.3.8 are based on the following equation: $A = 5 \log_e \left(\frac{V}{5}\right)$

Engine room ventilation in accordance with this chart might not be adequate for combustion air requirements IAW Section 4.6.1.

FIGURE 4.3.8 Area of Openings.

4.3.9 The minimum aggregate internal cross-sectional area of exhaust ducts or openings shall be calculated in the same manner as for intakes. *(See 4.3.8.)*

4.3.10* Duct size shall be based on nominal diameters and shall be at least 2½ in. (64 mm) in diameter.

4.3.11* Duct openings shall be of at least equivalent cross-sectional area of the duct.

4.3.12 The minimum cross-sectional area of terminal fittings for flexible ventilation ducts shall be not less than 80 percent of the required internal cross-sectional area of the flexible ventilation duct.

4.4 Connecting Compartments or Spaces by a Natural Ventilation System.

4.4.1 A natural ventilation system shall be provided for each compartment in a boat, except those open to the atmosphere, that contains any of the following:

(1) Permanently installed gasoline engine
(2) Permanently installed fuel tank and an electrical component without ignition protection
(3) Portable fuel tank
(4) Nonmetallic fuel tank that has an aggregate permeability rate exceeding 0.04 oz (1.2 g) of fuel loss in 24 hours per cubic foot of net compartment volume using reference fuel "C" at 104°F ± 36°F (40°C ± 2°C) from ASTM D471-16a, *Standard Test Method for Rubber Property-Effect of Liquids*
(5) If no tank described in 4.4.1(4) is present, openings between the compartment and a compartment that requires ventilation where the aggregate area of such openings exceeds 2 percent of the area between the compartments

4.4.2 Each required supply opening shall be located on the exterior surface of the boat.

4.4.3 An accommodation compartment located above a compartment requiring ventilation that is separated from the compartment requiring ventilation by a deck or other enclosure shall not be considered a connecting compartment.

4.5 Powered Ventilation System.

4.5.1 Each compartment not open to the atmosphere that has a permanently installed internal combustion engine with a cranking motor and a fixed fire extinguishing system shall be ventilated by an exhaust blower to remove any by-products of combustion or remaining extinguishing agent after the discharge of a fixed fire extinguishing system.

4.5.2 Blowers.

4.5.2.1 Blowers shall be designed for continuous operation at 120 percent of nominal voltage.

Δ **4.5.2.2*** Blowers shall meet the external ignition protection requirements of UL 1128, *Safety for Marine Blowers*, or UL 1500, *Safety for Ignition-Protection Test for Marine Products.*

4.5.2.3 Blowers shall be rated for airflow in cubic feet per minute, at nominal voltage, in accordance with Figure 12 of AMCA/ANSI 210, *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating. (See Figure 4.5.3.1.)*

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4.5.3 Installation of Powered Ventilation.

4.5.3.1 Blower(s) capacity shall be selected in accordance with the blower capacity curve in Figure 4.5.3.1.

4.5.3.2 More than one blower shall be permitted to be installed to meet the requirements of 4.5.3.1.

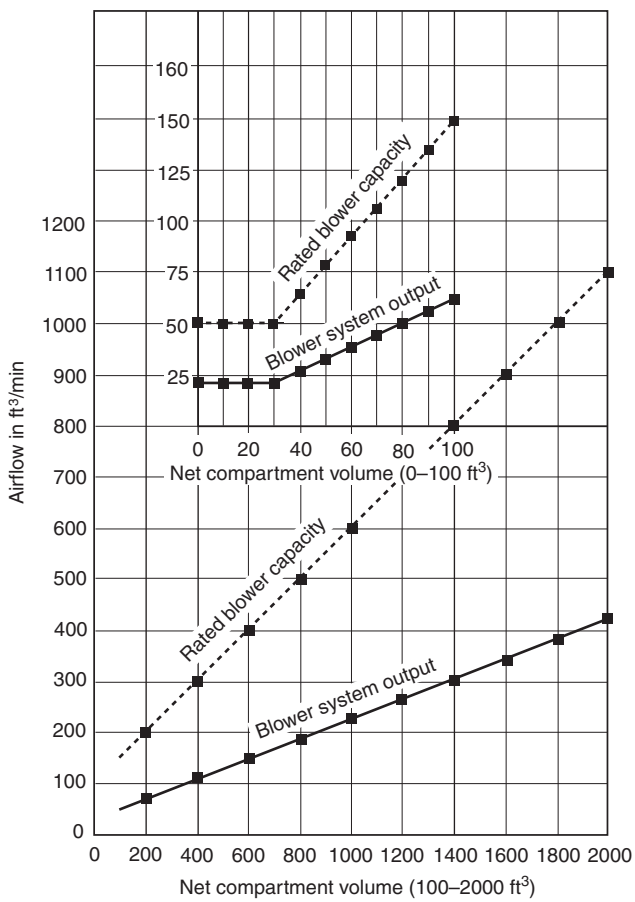
4.5.3.2.1 Each blower shall be separately circuited and protected internally at the equipment or by branch-circuit overcurrent devices suitable for motor current.

4.5.3.3 As installed, the blower system(s) shall exhaust air from the boat at a rate in accordance with the system performance curve (blower system output) in Figure 4.5.3.1 when the engine is not operating and the blower is operating at the electrical system's nominal voltage.

4.5.3.4 Blowers that are not submersible blower motors shall be mounted above the normal level of accumulated bilge water.

4.5.3.5 Blowers shall be installed with ducts having intake openings that meet the following criteria:

(1) They shall be permanently secured.
(2) They shall be located in the lower third of the compartment.
(3) They shall be located above the normal level of accumulated bilge water with the boat at rest.
(4) They shall be located as near below the engine(s) that they serve as practicable.



Note: The blower capacity curve is included for informational purposes and represents the average relationship of capacity to performance.

FIGURE 4.5.3.1 Minimum Blower Capacity and System Performance.

4.5.3.6 Electrical wiring shall be installed in accordance with Chapter 9 or Chapter 10.

4.5.3.7 Warning Label.

4.5.3.7.1 Each boat that requires a powered ventilation system shall display a warning label located in plain view of the operator and located as close as practicable to each ignition switch (including auxiliary equipment).

4.5.3.7.2 The warning label required by 4.5.3.7.1 shall contain at a minimum the following informational elements:

WARNING
Gasoline vapors can explode, resulting in injury or death.
Before starting engine:
(1) Check engine compartment bilge for gasoline or vapors.
(2) Operate blower for 4 minutes.
(3) Verify blower operation.

4.6 Arrangements of Openings.

4.6.1 Ventilation openings shall be located to prevent the entrance of water in amounts that could impair the stability or handling of the vessel or that could cause machinery malfunction under normal operating conditions.

4.6.2 External openings of intakes and exhausts shall be located to minimize the re-entry of exhausted fumes.

4.6.2.1 On boats with accommodation compartments there shall be no engine ventilation system openings in aft-facing surfaces at the stern.

Exception: Where testing in accordance with ABYC TH-23, Design, Construction, and Testing of Boats in Consideration of Carbon Monoxide, indicates that machinery or tank compartments connected to these openings do not have sustained accumulated levels of carbon monoxide (CO) in excess of 125 ppm.

4.6.3* Fuel Vapors.

4.6.3.1 External openings of intakes and exhausts shall be located and oriented to prevent entry of fuel vapors.

4.6.3.2 The location of intake and exhaust ventilation openings shall be no less than 15 in. (38 cm) from the fuel fill and fuel vent fittings, as measured in a straight line or across any intervening surface(s).

4.6.4 Ventilation openings shall be unobstructed by side curtains, cockpit enclosures, dodgers, and other weather enclosures.

4.7* Combustion Air. Ventilating provisions and openings to the machinery space provided for supplying combustion air shall accommodate at least the sum of the maximum air requirements specified by the engine manufacturer(s) for each propulsion and auxiliary engine(s) in that space.

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Chapter 5 Engines

5.1 Exposed Engine Surface Temperatures.

5.1.1 Piping and machinery components that exceed 428°F (220°C), including fittings, flanges, valves, exhaust manifolds and turbochargers, shall be insulated.

5.1.2 Measures shall be in place to prevent flammable or combustible liquid piping leaks from coming into contact with the components listed in 5.1.1.

5.1.3 Alarms.

5.1.3.1 Marine propulsion and auxiliary engines shall be equipped with an audible or visible means to notify the operator of low oil pressure, high cooling temperature, and high exhaust temperature.

5.1.3.2 The alarms shall be visible and audible at each operating station.

5.2 Diaphragm-Type Gasoline Pumps.

5.2.1 Gasoline engine fuel pumps of the diaphragm type shall be designed so that fuel shall not be released to the engine space if a primary diaphragm failure occurs.

5.2.2 Gasoline engine fuel pumps of the diaphragm type shall be provided with a means to determine that a diaphragm failure has occurred without dismantling the fuel pump.

5.3* Marine Carburetors.

5.3.1 Marine carburetors shall not leak more than 0.17 fl oz (5 ml) of fuel in 30 seconds under either of the following conditions:

(1) When the float valve is open, the carburetor is at half throttle, and the engine is cranked without having been started
(2) When the fuel pump is delivering the maximum pressure specified by its manufacturer

5.3.2 Each updraft and horizontal draft carburetor shall have a device that performs the following functions:

(1) Collects and holds fuel that flows out of the carburetor venturi section toward the air intake
(2) Prevents collected fuel from being carried out of the carburetor assembly by the shock wave of a backfire or by reverse airflow
(3) Returns collected fuel to the engine induction system after the engine starts

5.3.3* Spark ignition engine air intakes shall be fitted with one of the following means of backfire flame control:

(1) Backfire flame control approved by the US Coast Guard and bearing a US Coast Guard approval number
(2) Backfire flame control meeting the requirements of SAE J1928, *Devices Providing Backfire Flame Control for Gasoline Engines in Marine Applications*
(3) An engine-air and fuel induction system that provides adequate protection from propagation of backfire flame to the atmosphere equivalent to that provided by an acceptable backfire flame arrester and includes a reed valve assembly

5.4 Electrical Components. Electrical components for engines shall comply with the applicable provisions of Chapter 9 and Chapter 10.

5.5 Air-Cooled Engines.

5.5.1 Permanently installed air-cooled engines with self-contained fuel systems shall be located only on open decks or on cabin tops.

5.5.2 Any housing over engines addressed in 5.5.1 shall be open whenever the engine is operating.

5.5.3 Enclosed Air-Cooled Engines.

5.5.3.1 Factory-installed engine air-cooling shrouding shall be constructed and mounted for enclosed air-cooled engines to trap all engine-cooling air and lead it to a point from which it can be discharged outside the hull or engine box by means of ducting.

5.5.3.2 Duct Material.

5.5.3.2.1 Ducts for engine-cooling air shall have a flame spread index of 75 or less, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

5.5.3.2.2 Material used for ducts for engine-cooling air shall be labeled or listed as having been tested to meet the requirements of ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

5.5.3.3 Engine-cooling air shall not be used as a direct source for heating accommodation spaces.

5.6 Portable Gasoline Tanks. Portable gasoline engines with integral fuel tanks or portable gasoline fuel tanks shall be stowed securely in an open or ventilated space in accordance with Sections 4.2 and 9.8 so that fuel or vapors cannot reach interior spaces.

5.7 Automatic Shutdown. Nonpropulsion engines intended for automatic operation shall be equipped with an automatic shutdown device actuated by low oil pressure, excessive engine overheat, and excess heat from exhaust pipe or exhaust gas ducting.

Δ **5.8* High-Tension Cable.** High-tension cable assemblies shall conform to SAE J2031, *High Tension Ignition Cable*.

Δ **5.9* Distributors.** Ignition distributors shall conform to UL 1500, *Safety for Ignition-Protection Test for Marine Products*.

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Full document details: NFPA 302 2025

Chapter 6 Engine Exhaust Systems

6.1 General Requirements.

6.1.1 Exhaust systems shall comply with the following:

(1) They shall be gastight to hull interiors.
(2) All connections shall be accessible.
(3) They shall be supported to minimize failure from vibration, shock, expansion, and contraction.
(4) They shall have no threaded fittings into nonmetallic exhaust system components.
(5) They shall have no discharge from other devices into the exhaust other than from engine-cooling water.

6.1.1.1 In addition to the requirements of 6.1.1, exhaust systems on gasoline engines shall be designed and installed to reduce the production of carbon monoxide by providing the minimum restrictions to exhaust gas flow practicable.

6.1.2 Wherever personnel or combustibles can come in contact with hot surfaces, effective protection shall be provided by water-jacketing, lagging, or shielding, or by guards or engine enclosures.

6.1.3 Exhaust Supports.

6.1.3.1 For wet exhaust systems, hangers, brackets, or other means used to support metallic exhaust systems shall be noncombustible within 6 ft (1.8 m) of the engine connection(s).

6.1.3.2 For dry exhaust systems, hangers, brackets, or other means used to support metallic exhaust systems shall be noncombustible.

6.1.4 Except for outboard engines, a means to indicate loss of exhaust-cooling water shall be provided so that it is effective at all helm positions.

6.1.5 Non-propulsion engines shall be permitted to use an automatic shutdown device to meet the requirements of 6.1.4.

6.1.6 A separate exhaust system shall be provided for each engine.

6.2 Materials.

6.2.1 Materials used in engine exhaust systems, except in components addressed in 6.2.3 and 6.2.4, shall be resistant to fuels, heat, water, corrosion, and the products of combustion.

Δ **6.2.2** Nonmetallic exhaust system components, except for those components addressed in 6.2.3 and 6.2.4, shall meet the requirements of UL 1129, *Safety for Wet Exhaust Components for Marine Engines*, or SAE J2006, *Marine Exhaust Hose*, and shall be so marked.

6.2.3 The requirements of 6.2.1 and 6.2.2 shall not apply to components furnished as part of an original equipment manufactured (OEM) engine assembly.

6.2.4 The requirements of 6.2.1 and 6.2.2 shall not apply to components of stern-drive and jet-drive installations where exhaust is discharged through the drive system.

6.2.5 Copper shall not be used in contact with dry diesel exhaust gases or within six pipe diameters downstream from the point of water entry in water-cooled exhaust systems.

6.2.6 As installed, nonmetallic exhaust system components shall retain watertight integrity for 2 minutes after a total loss of cooling water, with the engine operating at full power.

6.3 Hose Connections. Except for single-clamped hose furnished for specific use as part of an OEM engine assembly, hose connections shall be double clamped.

6.4 Temperature Protection. The exhaust turbine side of non-water-jacketed turbochargers and unjacketed, single-wall, dry exhaust components shall be installed so that the temperature of adjacent combustible surfaces shall not exceed 200°F (94°C).

Chapter 7 Fuel Systems

7.1 General Requirements.

7.1.1 Scope.

7.1.1.1 The requirements of this chapter shall apply to the design, construction, choice of materials, and installation of permanently installed fuel systems, except compressed gas, that run from the fuel fill opening to the connections at each engine or at auxiliary equipment.

7.1.1.2 Alternative fuel systems shall be designed and inspected to a recognized standard that is applicable to the system installed.

7.1.1.3 The requirements of this chapter shall apply to all tanks that are permanently installed.

7.1.2 Fuel Tanks.

7.1.2.1 Any tanks with a capacity of more than 7 gal (27 L) shall be permanently installed.

7.1.2.2 Portable fuel tanks and related portable fuel handling equipment shall comply with ABYC H-25, *Portable Marine Gasoline Fuel Systems*.

7.1.3 Fuel systems shall be liquidtight and vaportight with respect to hull interiors.

7.1.4 Individual system components and the system as a whole shall be designed and installed to withstand the stresses of and exposure to marine service including pressure, vibration, shock, movement, grease, lubricating oil, bilge solvents, high aromatic fuels, and corrosive environments.

7.1.5 Exposure Fire Protection.

7.1.5.1 As installed in the boat, all individual components of the fuel system, except for the components identified in 7.1.5.2 and 7.1.5.3, shall be capable of withstanding a 2½-minute exposure to free-burning fuel without a failure that results in leakage of liquid or vapor.

7.1.5.2 Fuel distribution lines on boats shall not be required to comply with 7.1.5.1 if a break at any point in the line will cause a discharge of not more than 5.0 fl oz (150 ml) of fuel within 2½ minutes. *(See 7.5.1.5.)*

7.1.5.3 Self-draining fuel tank vent hose located outside the engine compartment shall not be required to comply with 7.1.5.1.

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Full document details: NFPA 302 2025

7.1.6 To ground static electricity, the resistance between ground and each metallic or metallic-plated component of the fuel fill system and fuel tank that is in contact with fuel shall be less than 1 ohm.

7.1.7 Pressurized fuel tanks shall not be used.

7.2 Fuel Tank Materials.

7.2.1 Hull Integration.

7.2.1.1 Gasoline Tanks. Gasoline fuel tanks shall not be integral with the hull structure.

7.2.1.2 Diesel Tanks.

7.2.1.2.1 Diesel tanks shall be permitted to be integral with the hull structure.

7.2.1.2.2 If composite construction is used where the tank is integral with the hull structure, the materials used shall not deteriorate due to contact with diesel fuel and shall not permit diesel fuel to migrate.

7.2.2 Corrosion Resistance.

7.2.2.1 Materials for fuel tanks shall be corrosion resistant.

7.2.2.2 Materials shall meet the specifications of Table 7.2.2.2.

7.2.2.3 The following shall apply to steel tanks used for fuel:

(1) Unless constructed of aluminized steel, they shall be galvanized inside and outside by the hot-dip process for other than diesel fuel tanks.
(2) Unless constructed of aluminized steel, they shall be galvanized on the outside only by the hot-dip process for diesel fuel tanks.
(3) They shall not be constructed of terneplate steel.

7.2.2.4 Aluminized steel tanks with a wall thickness of less than 0.0785 in. (2 mm) shall be installed only above the cockpit floor or above the deck if no clearly defined cockpit exists.

7.2.2.5 Stainless Steel Diesel Fuel Tanks.

7.2.2.5.1 Stainless steel diesel fuel tanks, except those identified in 7.2.2.5.2, shall have a wall thickness of not less than 0.0747 in. (14 gauge).

7.2.2.5.2 Stainless steel fuel tanks that are both less than 20 gal (76 L) capacity and of cylindrical construction with domed heads shall require a wall thickness of not less than 0.031 in. (22 gauge).

7.2.2.5.3* Stainless steel tanks shall be supported to avoid crevice and pitting corrosion from entrapment of moisture by means of welded brackets of like material or other support material permanently bonded to the tank surface with impermeable nonhygroscopic adhesive.

7.2.3 Nonmetallic materials meeting the applicable requirements of Chapter 4 and Chapter 7 shall be permitted to be used for tanks. *[See 4.4.1(4).]*

7.3 Fuel Tank Design and Construction.

7.3.1 The following shall apply to fuel tanks other than diesel fuel tanks:

(1) The bottom, sides, and ends shall not have openings.
(2) Openings for fill, vent, and feed pipes and level gauges, if installed, shall be at or above the topmost surface of tanks.
(3) Clean-out plates shall not be installed.
(4) Plates used for fittings shall be secured in such a manner that they cannot be used for clean-out purposes.

7.3.2 Tanks shall be constructed so that, when installed, exterior surfaces shall not trap water.

7.3.3 Threaded fittings shall conform to Table 7.3.3.

Table 7.3.3 Minimum Thread Engagement

Thread Engagement (in.)	Minimum Length of IPS (in.)
1/4	3/8
3/8	3/8
1/2	1/2
3/4	9/16
1	5/8
1 1/4	5/8
1 1/2	5/8
2	11/16

For SI units, 1 in. = 2.5 cm.

Δ Table 7.2.2.2 Metallic Fuel Tank Material and Fabrication Requirements for Corrosion Resistance

Material[a]	Specification	Minimum Nominal Sheet Thickness	Gauge
Nickel-copper	ASTM B127, Class A	0.031 in. (0.79 mm)	22 US Std.
Copper-nickel	ASTM B122/B122M	0.045 in. (1.14 mm)	17 AWG
Copper	ASTM B152/B152M, Type E.T.P.	0.057 in. (1.45 mm)	15 AWG
Copper-silicon	ASTM B96/B96M, Types A, B, and G	0.050 in. (1.27 mm)	16 AWG
Steel sheet	ASTM A653/A653M	0.0747 in. (1.90 mm)	14 Mfrs.
Aluminized steel	ASTM A463/A463M	0.0478 in. (1.21 mm)	18 Mfrs.
Aluminum	Alloy 5052, 5083, or 5086	0.090 in. (2.29 mm)	—
Stainless steel	316L or 317L	0.0747 in. (1.90 mm)	14 Mfrs.
		0.031 in. (0.79 mm)[b]	22 US Std.[b]

[a]See American Welding Society recommendations for welding processes.
[b]Only cylindrical stainless steel tanks with domed heads and a capacity of less than 20 gal (76 L) are permitted.

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Full document details: NFPA 302 2025

7.3.4 Fuel tanks with a capacity of 25 gal (95 L) or greater shall not leak when subjected to the pressure impulse test requirement of 33 CFR 183.586.

7.3.5 Fuel tanks with a capacity of less than 25 gal (95 L) shall not leak when subjected to the shock test requirement of 33 CFR 183.584.

7.3.6 Fuel tanks with a capacity of 200 gal (760 L) or more shall not leak when subjected to the slosh test requirement of 33 CFR 183.588.

7.3.7 All metal tanks and the metal fitting plates of nonmetallic fuel tanks shall be provided with a bonding terminal suitable for the attachment of a No. 8 AWG bonding conductor.

7.3.8 Indentations for labeling or other identification shall not weaken the fuel tank.

7.3.9 Fuel tanks shall be marked or identified permanently with the following information in a location that is visible and readable for inspection after installation:

(1) Manufacturer's name or logo and address
(2) Month (or lot or serial number) and year of manufacture
(3) Capacity in US gallons (capacity also shall be permitted to be expressed in liters)
(4) Construction material and thickness
(5) Fuel for which tank is intended
(6) Maximum test pressure
(7) Model number, if applicable
(8) Statement on tanks other than diesel tanks that reads, "This tank has been tested under 33 CFR 183.510(a)."
(9) Statement that reads, "Must be installed aft of the half-length of the boat," if the tank has been tested under 33 CFR 183.584, at less than 25 G vertical accelerations

7.3.10 Fuel tank(s) shall be tested by the manufacturer or builder for fuel tightness at 3.0 psi (21 kPa gauge) or 1½ times the maximum static head to which the tank(s) can be subjected during service as specified by the boat manufacturer, whichever is greater.

7.3.11 The design of the pickup tube shall preclude damage to the tank bottom as the tank flexes while in service.

7.3.12 The use of gauge glasses shall be restricted to day tanks and service tanks of diesel fuel systems.

7.4 Fuel Tank Installation.

7.4.1 Fuel tank connections and fittings shall be accessible.

7.4.2 Fuel tanks, other than diesel fuel tanks integral with the hull, shall be installed in such a manner that means for maintenance or replacement is provided or indicated so that it can be accomplished without compromising the structural integrity of the vessel.

7.4.3 Fuel tanks shall be installed in a manner that prevents permanent deformation.

7.4.4 Fuel tanks shall be installed in a manner that provides immobilization to the extent practicable.

7.4.5 Nonmetallic fuel tanks that expand dimensionally after exposure to fuel shall comply with the following:

(1) They shall be installed in accordance with the fuel tank manufacturer's instructions.
(2) The fuel tank manufacturer's instructions shall indicate the installation clearances required for the tank in diagram form.
(3) They shall be provided with a warning label that contains at a minimum the following informational elements:

CAUTION
To prevent hull and tank damage due to expansion of the tank while in service, installation shall be in accordance with the manufacturer's instructions.

7.4.6 Contact between metallic fuel tanks and other structures shall be limited to necessary structural supports and shall permit free circulation of air.

7.4.7 Abrasive surfaces and absorbent surfaces of tank supports and braces shall be insulated effectively from contact with tank surfaces by a nonabrasive and nonabsorbent material.

7.4.8 Aluminized steel tanks of thicknesses less than 0.0785 in. (2 mm) shall be installed above the cockpit deck or above deck if there is no clearly defined cockpit.

7.4.9 Nonferrous and nonmetallic fuel tanks shall be permitted to be foamed in place if they comply with the requirements of 33 CFR 183.516. *(See 7.4.5.)*

7.4.10 Fuel tanks shall not be installed above the engine and shall not be installed above sources of ignition.

7.4.11 Fuel tank(s) shall not support a deck, a bulkhead, or other structure.

7.5 Fuel Lines, Fittings, and Related Accessories.

7.5.1 General.

7.5.1.1 For the purposes of Section 7.5, fuel lines shall mean all pipes, tubing, or hose that conduct fuel from the deck fill plate to the engine connection.

7.5.1.2 For the purposes of Section 7.5, related accessories shall include any attachments to fuel lines such as valves, filters, strainers, pumps, and connecting fittings.

7.5.1.3 All fuel tank fittings shall be galvanically compatible with the fuel tank material.

7.5.1.4 Copper-bearing fittings shall be isolated from aluminum tanks by a galvanic barrier including, but not limited to, a 300 series stainless steel fitting.

7.5.1.5 Flexible nonmetallic fuel hose shall be one of the following:

(1) USCG Type A-1 or A-1-15 or Type A-2 hose where 2½-minutes minimum fire resistance is required
(2) USCG Type A-1 or A-1-15, Type A-2, Type B-1 or B-1-15, or Type B-2 hose where 2½-minutes minimum fire resistance is not required *(see 7.1.5)*

7.5.1.6 Fuel lines, connections, and accessories shall be accessible.

7.5.1.7* Plastic Components.

7.5.1.7.1 Plastic pipe and plastic fittings shall not be used in fuel distribution lines, vent lines, and fill lines unless permitted by 7.5.1.7.2 or 7.5.1.7.3. *(See 7.1.5.)*

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Full document details: NFPA 302 2025

7.5.1.7.2 Components of deck fill fittings, vent fillings, carburetor fittings, fuel pump fittings, and fuel filter fittings shall be permitted to be of plastic.

7.5.1.7.3 Engineering-grade plastics, such as glass-reinforced nylons, shall be permitted to be used in fuel distribution lines, vent lines, and fill lines.

7.5.1.8 Fuel lines shall be secured against movement or vibration by the use of noncombustible clips or straps without rough surfaces or sharp edges.

7.5.1.9 Clips and straps used to hold fuel lines in position to maintain anti-siphon protection shall be capable of withstanding a 2½-minute fire test.

7.5.1.10 Gasoline-resistant sealing compound or tape shall be used in making up threaded pipe connections.

7.5.1.11 Where making flared tubing connections, the following criteria shall be met:

(1) Tubing shall be cut squarely and flared by tools designed for that purpose.
(2) Tubing shall be deburred prior to being flared.
(3) Copper tubing shall be annealed prior to being flared.

7.5.1.12 Outlets.

7.5.1.12.1 Outlets for drawing fuel from the system are prohibited unless permitted by 7.5.1.12.2.

7.5.1.12.2 Filter bowl plugs provided for the purpose of servicing only shall be permitted.

7.5.1.13 Manually Operated Valves.

7.5.1.13.1 Manually operated multiposition valves shall be required to indicate only their open and closed positions.

7.5.1.13.2 Manually operated stop valves shall be designed with positive stops in the open and closed positions.

7.5.2 Installation of Fill and Vent Pipes.

7.5.2.1 Fuel tank fill and vent pipes shall be located in the following manner:

(1) To prevent the escape of liquid and vapor overflow to the inside of the hull
(2) To provide protection from the flow of vapors escaping into the hull

7.5.2.2 No liquid fuel shall enter the boat from the fill due to an overflow rate of 5 gpm (19 L/min) for 5 seconds when the boat is in its static floating position.

7.5.2.3 The vent pipe shall terminate at least 15 in. (38 cm) from any hull opening.

7.5.2.4* The vent shall be installed to minimize the intake of water without resisting the release of vapor.

7.5.2.5 Overflow from the vent at a rate of 2 gpm (7.7 L/min) shall not enter the boat.

7.5.2.6 The inside diameter of the fill pipe system shall be no less than 1¼ in. (3.2 cm) and shall have a hose diameter of no less than 1½ in. (3.8 cm).

7.5.2.7 The fuel fill shall be self-draining from the fuel fill inlet to the tank connection.

7.5.2.8 The fuel fill plate shall be identified by a permanent marking indicating the type of fuel.

7.5.2.9* Bonding wire ends shall not be clamped between the fill pipes and the flexible tubing. *(See 7.1.6.)*

7.5.2.10 No blow-back of fuel through the fill fitting shall occur while filling at a rate of 9 gpm (35 L/min) and to a level of one-quarter to three-quarters of the capacity indicated by the tank label.

7.5.2.11 As installed in the boat, the vent pipe connection shall be at the highest point of the tank under conditions of normal trim.

7.5.2.12 The inside diameter at any location in the vent line system shall be not less than 7/16 in. (11 mm).

7.5.2.13 The fittings at the hull vent line opening shall be corrosion resistant.

7.5.2.14 Each fuel tank vent system shall have a flame arrester that can be cleaned unless one of the following conditions is met:

(1) The vent system itself is a flame arrester.
(2) Metallic vent lines are used and serve as effective flame arresters.

7.5.2.15 Hose Clamps.

7.5.2.15.1 If a nonmetallic hose is used in the fill pipe system, it shall be secured tightly with a minimum of two corrosion-resistant metal clamps of ½ in. (12.7 mm) minimum width at each end of the hose.

7.5.2.15.2 Clamps depending solely on spring tension shall not be used to meet the requirements of 7.5.2.15.1.

7.5.3* Installation of Fuel Feed Lines and Accessories.

7.5.3.1* Electric fuel supply pumps, other than priming pumps in outboard motor fuel systems, shall operate only under the following conditions:

(1) The engine is operating.
(2) The cranking motor is energized.
(3) The supply pump is operated by a momentary switch for priming and is located either on or within 12 in. (30 cm) of the engine.

7.5.3.2 Hose installed on the pressure side of an electric fuel supply pump shall be USCG Type A-1 or A-1-15.

7.5.3.3 Fuel lines shall be run with as few connections as practicable.

7.5.3.4 Fuel lines that run over dry sections of the engine exhaust system shall be metallic and shall contain no joints, fittings, or components other than at the point of termination.

7.5.3.5 Gasoline fuel distribution systems shall be provided with anti-siphon protection by at least one of the following methods:

(1) All parts of fuel distribution and return lines are installed above the level of the tank top from the tank to the carburetor inlet or its equivalent (e.g., throttle body, port fuel injection).
(2) All parts of fuel distribution and return lines are installed above the level of the tank top from the tank to a location

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where fuel leakage cannot enter the boat when the boat is in a static floating position.

(3) An anti-siphon device is installed at the tank withdrawal fitting, or along the line, with a rated siphon protection head and flow rate greater than required for the installation.

(4) An electrically operated valve is installed at the tank fitting, or along the line, that is to be energized open only when the engine ignition switch is on and the engine is running, with a momentary-type override permitted to be used for starting.

(5)* A manual shutoff valve is installed directly at the fuel tank connection, arranged to be readily accessible for operation from outside the compartment if the fuel tank top is located below the level of the carburetor inlet, the fuel line is rigid metal or USCG Type A-1 or A-1-15 hose, and the length of the fuel line from the tank outlet to the engine inlet is no more than 12 ft (3.6 m).

(6) A manual shutoff valve shall be installed directly at the fuel tank connection, arranged to be readily accessible for operation from outside the compartment if the fuel tank top is located below the level of the carburetor inlet, the fuel line is rigid metal or USCG Type A-1 or A-1-15 hose, a manual shutoff valve is installed at the fuel inlet connection to the engine, and the length of the fuel line from the tank outlet to the engine inlet is more than 12 ft (3.6 m).

7.5.3.6 Systems Without Anti-Siphon Protection.

7.5.3.6.1* A readily accessible manual shutoff valve shall be installed on all fuel tanks directly at the tank connection where the fuel system is without anti-siphon protection.

7.5.3.6.2 If the fuel tank is located in a machinery space, a remotely operated means of closing the valve required in 7.5.3.6.1, without opening machinery spaces, shall be provided.

7.5.3.7 A flexible section, meeting the requirements of 7.5.1.5, shall be installed to separate the part of the fuel feed line secured to the hull members from the part of the fuel feed line secured to the engine.

7.5.3.8 The fixed fuel line shall be fastened to structures within 4 in. (10 cm) of the connection to the flexible section to secure against vibration and movement.

Chapter 8 Cooking, Heating, and Auxiliary Appliances

8.1* General.

8.1.1 Instructions.

8.1.1.1 Printed instructions for proper installation, operation (including refueling, where applicable), and maintenance shall be provided with each appliance.

8.1.1.2 The instructions required in 8.1.1.1 shall include the following information:

(1) The hazards associated with appliance air consumption
(2) Installer information regarding the proper display of a warning label

8.1.2 Appliances using gasoline in liquid or solid form for priming or fuel shall be prohibited.

8.1.3* The design and installation of appliances shall address the air consumption of the appliances and the venting of exhaust products.

8.1.4 An appliance shall be mounted in accordance with the manufacturer's instructions.

8.1.5 Appliances shall be fastened securely when in use or stored.

8.1.6 A burner system shall meet the following criteria:

(1) It shall be capable of operation without creating a fire hazard during periods of boat pitch and roll at angles up to 30 degrees from horizontal in any direction sustained for 15 seconds.
(2) It shall be capable of continuous operation at angles of heel up to 30 degrees.

8.1.7 Label.

8.1.7.1 A durable and permanently legible label shall be provided detailing the proper operation and any unique hazards of the appliance.

8.1.7.2 The label required in 8.1.7.1 shall be mounted in plain view of the appliance operator.

8.1.8 Appliance operating controls shall be located to reduce the likelihood of injury from burners or elements while in use.

8.1.9 Glow Plugs and Pilot Lights.

8.1.9.1 Appliances with automatic igniter glow plugs or continuously lighted pilot lights for burner ignition shall be prohibited unless permitted by 8.1.9.2 or 8.1.9.3.

8.1.9.2 Automatic igniter glow plugs in appliances using sealed combustion chambers shall be permitted.

8.1.9.3 An oven control flame that operates only when the stove is in use shall be permitted.

8.1.10 Appliances shall be marked or identified permanently with the following information in a location visible after installation:

(1) Manufacturer's name or trademark
(2) Model number
(3) Serial number (if applicable)
(4) Fuel/energy used
(5) Maximum power consumption in kW when operating at capacity

8.2 Cooking Appliance Installation.

8.2.1 Exposed materials and finishes within 24 in. (61 cm) of heat-generating surfaces of appliances shall have a flame spread index of not more than 75 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

8.2.2 Fabrics located above and within 39 in. (1 m) of a galley stove top, used for decorative or other purposes, shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

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Full document details: NFPA 302 2025

Δ **8.2.3** With the appliance installed, the temperature of vertical combustible surfaces below and surrounding heat-generating surfaces shall not rise more than 150°F (65°C) above the compartment's ambient temperature when using the temperature test of UL 858, *Safety for Household Electric Ranges*.

8.3 Coal, Charcoal, and Wood-Burning Appliances.

8.3.1 Appliances that burn solid fuel shall not be installed in gasoline-powered boats.

8.3.2 Installed stoves shall be mounted by one of the following methods:

(1) On a noncombustible base (preferably hollow tile)
(2) On legs providing a clearance of at least 5 in. (13 cm) between the stove bottom and the deck, and the deck insulated with a noncombustible material or sheathing

8.3.3 Stove Clearance.

8.3.3.1 The sides and backs of uninsulated stoves shall have a minimum clearance of 9 in. (23 cm) from the exposed materials and finishes, which shall meet the requirements of 8.2.1, or shall be separated by fire-resistant thermal insulation.

8.3.3.2 The sides and backs of insulated stoves shall have a minimum clearance from the exposed materials and finishes as specified by the manufacturer.

8.3.4 Smoke Pipe and Stack Clearance.

8.3.4.1 Single-wall smoke pipes and stacks on decks not equipped with water irons shall have a minimum clearance of 9 in. (23 cm) from combustible materials, including painted surfaces, or shall be separated by fire-resistant thermal insulation.

8.3.4.2 Listed and labeled double- or triple-wall smoke pipes and stacks on decks not equipped with water irons shall be installed with a minimum clearance from combustible materials, including painted surfaces, specified by the manufacturer.

8.3.5 Permanently installed solid-fuel burning appliances, other than solidified-alcohol galley stoves and exterior mounted grills, shall be equipped with a double- or triple-wall smoke pipe or stack that shall terminate above deck, and with smoke heads designed to minimize water entry, spark emission, and backdraft.

Δ **8.3.6** Where double- or triple-wall smoke pipe or stacks are installed, they shall meet the requirements of UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, and installed in accordance with the specifications of the manufacturer.

8.3.7 Charcoal stored on the boat shall be kept dry and stored in a closed, dry metal container.

8.4 Liquid Fuel Appliances Excluding Liquefied Petroleum Gas (LPG) Appliances.

8.4.1 Both pressure-fed and gravity-fed burners shall be permitted.

8.4.2 Fuel Tanks.

8.4.2.1 Fuel supply tanks shall be constructed of corrosion-resistant metal or of metal having a corrosion-resistant finish or coating.

8.4.2.2 Pressurized Tanks.

8.4.2.2.1 Appliances with pressurized liquid fuel tanks that are integral with an appliance shall comply with the following criteria:

(1) Tanks shall withstand an internal pressure of four times the relief valve setting or 100 psi (700 kPa gauge), whichever is greater.
(2) Tank shall be shielded or insulated so that, under continuous operation at maximum heat, the pressure in the tank shall not exceed 50 percent of the relief valve setting.
(3) The complete system shall be tested up to the pressure of the relief valve setting.

8.4.2.2.2 Pressure tanks not integral with an appliance shall comply with the following criteria:

(1) Tanks shall be able to withstand a test pressure of at least 100 psi (700 kPa gauge) or twice the appliance relief valve setting, whichever is greater.
(2) Tanks shall be secured rigidly in an accessible location that permits convenient filling and pump operation.

8.4.2.2.3 Pressurized fuel tanks shall be equipped with relief valves.

8.4.2.3 Gravity Tanks.

8.4.2.3.1 Gravity tanks installed in the compartment with the appliance shall be located or shielded so that, when installed and under continuous operation at maximum heat output, the fuel temperature shall not rise more than 25°F (14°C) above the compartment temperature.

8.4.2.3.2 Gravity tanks shall have a capacity no more than 2.1 gal (8 L), unless the tank meets the requirements of Section 7.2 and is capable of withstanding a pressure of 3 psi (21 kPa gauge).

8.4.2.3.3 Non-integral gravity tanks shall have provisions for filling and venting at a distance of at least 39 in. (1 m) from open flame unless separated by a vaportight partition or bulkhead.

8.4.2.3.4 Where appliances burning liquid fuels have remote gravity tanks, provisions shall be made to relieve any excess pressure in the fuel line between the tank shutoff valve and the burner valve.

8.4.2.4 A readily accessible shutoff valve, not integral with the appliance, shall be installed near gravity tanks and at or on all non-integral pressure tanks.

8.4.2.5 Where a valve is required by 8.4.2.4, the valve shall close against fuel flow and shall clearly indicate the closed and open positions.

8.4.2.6 Liquid fuel supply lines from non-integral tanks shall be installed as a continuous run from the shutoff valve at the tank to the appliance or to the flexible section located immediately before a gimbaled stove.

8.4.2.7 Flexible liquid fuel supply hose sections shall be compatible with the fuel used.

8.4.2.8* The fill openings for non-integral fuel tanks shall be identified to indicate the type of fuel to be used with the system, and the word "fuel" shall not be used alone.

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8.4.2.9 Liquid-fuel priming pans or troughs shall be secured to the burner or generator so that their mutual function is maintained.

8.4.2.10 A liquidtight, nonflammable drip pan at least ¾ in. (19 mm) deep shall be provided below all burners and shall be readily accessible for cleaning.

8.4.2.11 Appliances with integral tanks supplying fuel by gravity or pressure shall display a permanently affixed, legible warning label that contains at a minimum the following informational elements:

CAUTION
Fire and explosion hazard; severe burns.
Before filling, turn off burners.

8.4.2.12 Unpressurized stoves with fuel held in absorbent matter and designed with a fuel container removed for filling shall display a permanently affixed, legible label that contains at a minimum the following informational elements:

CAUTION
Fire and explosion hazard; severe burns.
Before filling, turn off all stove burners.
Remove fuel container from stove.
Fill fuel container away from stove.
Follow filling instructions provided.

8.4.3 If solidified alcohol is used as stove fuel, the container shall be secured on a fixed base to prevent sliding or overturning due to a sudden roll of the vessel.

8.4.4 Stacks and stoves shall comply with the applicable requirements of Section 8.3.

8.4.5 Sealed Combustion Chamber Heaters.

8.4.5.1 Sealed combustion chamber heaters that burn fuel oil shall be permitted to be used if they are designed to provide complete separation of the combustion system from the atmosphere in the boat.

8.4.5.2 A combustion air inlet and flue gas outlet shall be provided as integral parts of the appliance.

8.4.6* Means shall be provided on stove-top cooking surfaces to prevent both deep and shallow cooking utensils from sliding across or off the stove.

8.4.7 Oven doors shall be provided with a means to prevent their unintentional opening due to the force of sliding food and utensils.

8.4.8 A permanent, legible label shall be affixed in a conspicuous location on or adjacent to fuel burning stoves or ranges and shall contain at a minimum the following informational elements:

CAUTION
Open-flame cooking appliances consume oxygen.
Lack of oxygen can cause asphyxiation
or death. Maintain open ventilation when
appliance is in use.
Do not use appliances for comfort heating.

8.4.9 Stove operating controls shall be located to be easily accessible and to minimize possible injury from burners or elements while in use.

8.4.10 The operation of controls shall not require reaching over or across burners or heated elements.

8.5* Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) Systems for Permanently Installed Appliances.

8.5.1 The installation for use and storage of stoves with attached (integral) LPG containers of more than 8 oz (230 g) capacity weight of gas shall be prohibited in accommodation spaces in the boat interior.

8.5.2 LPG and CNG appliances, other than the appliances addressed in 8.5.3, shall be permanently installed.

8.5.3 Appliances employing integral butane cylinders containing no more than 8 oz (230 g) of fuel, and that comply with 8.5.14.9, shall not be required to be permanently installed.

8.5.4 Components of LPG systems subject to cylinder pressure shall have a rated working pressure of no less than 250 psi (1725 kPa gauge).

8.5.5 Components of CNG systems subject to cylinder pressure shall have a working pressure of no less than 133 percent of the maximum fill pressure of the cylinder.

8.5.6* Ignition Protection of Electrical Devices.

8.5.6.1 Electrical devices on boats equipped with LPG or CNG systems, which can function or cycle on and off automatically without the presence of a person and that are located below the main deck, shall be provided with ignition protection in accordance with UL 1500, *Safety for Ignition-Protection Test for Marine Products*, if located in compartments other than those in 8.5.6.2 and 8.5.6.3, that contain LPG or CNG appliances, cylinders, fittings, valves, or regulators.

8.5.6.2 The requirements of 8.5.6.1 shall not apply to electrical devices in accommodation spaces.

8.5.6.3 The requirements of 8.5.6.1 shall not apply to electrical devices in open compartments having at least 15 in.^{2} (97 cm^2) of open area per cubic foot of net compartment volume exposed to the open atmosphere outside the craft.

8.5.7 Systems shall use cylinders of the vapor withdrawal type.

8.5.8 Cylinders designed or installed to admit LPG into any other part of the system shall be prohibited.

8.5.9 Labels.

8.5.9.1 With each LPG or CNG system installed on a boat, at least two labels in accordance with 8.1.1 and 8.1.7 shall be installed and include the following:

(1) The signal word "WARNING"
(2) The introductory statement "To Avoid Fire and Explosion"

8.5.9.2 Labels at appliances shall include the statement, "This system is designed for use with (insert LPG or CNG) only. Do not connect (insert LPG or CNG) to this system."

8.5.9.3 Labels at containers shall include the following instructions where no leak detection device is installed:

(1) Close container valves when the boat is unattended and in case of a leak or fire.
(2) Close all appliance valves before opening container valves.

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