

NFPA® 301

**Code for Safety to Life
from Fire on
Merchant Vessels**

2018



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NFPA® 301

Code for

Safety to Life from Fire on Merchant Vessels

2018 Edition

This edition of NFPA 301, *Code for Safety to Life from Fire on Merchant Vessels*, was prepared by the Technical Committee on Merchant Vessels. It was issued by the Standards Council on August 1, 2017, with an effective date of August 21, 2017, and supersedes all previous editions.

This edition of NFPA 301 was approved as an American National Standard on August 21, 2017.

Origin and Development of NFPA 301

In 1993, the Coast Guard approached the NFPA Standards Council with a request to form a new committee that would develop a consensus standard on fire protection of merchant vessels, similar in format to the *Life Safety Code*®. The basis for this request was a Coast Guard initiative known as Maritime Regulatory Reform. One aspect of maritime regulatory reform involves greater use of industry standards in lieu of detailed design requirements contained in the Code of Federal Regulations.

The initial approach advocated by the Coast Guard was to develop a standard that was applicable to passenger vessels only and to add requirements for different vessel types in future editions. However, the committee agreed that it would not take much more effort to draft a standard that was applicable to passenger vessels, cargo vessels, and tank vessels. Towing vessels were added to this list in anticipation of a federal law mandating fire protection upgrades. Other vessel types might be added in future editions.

By shifting development and maintenance of regulations to standards-making organizations, the regulators (in this case, the Coast Guard) are assured of dynamic standards that are regularly updated. The marine industry benefits through increased input into the rules it would subsequently be required to follow. Similar efforts either have been completed or are in progress to add marine-specific criteria to existing fire protection system standards, such as automatic sprinklers, water mist extinguishing systems, foam, carbon dioxide, and clean agent alternatives to halons.

NFPA 301 provides minimum requirements for the design, operation, and maintenance of merchant vessels for safety to life from fire and similar emergencies. The document establishes occupancy classifications and then provides requirements for design and construction, access and egress, and fire protection. The document applies to passenger vessels, towing vessels, and cargo vessels.

The code underwent a complete revision in 2001 to implement *Manual of Style for NFPA Technical Committee Documents* changes, which reorganized the document and stressed the use of enforceable language. This revision incorporated changes to the testing requirements for interior finishes, deck coverings, mattresses and bedding, and electrical cable. The code expanded the vessels covered to include ocean-going towing vessels as part of the cargo vessel requirements. In the passenger vessel chapter, the code redefined the classification criteria for vessel categories. One outcome of this change was an attempt to modify the requirements for sprinkler protection on certain classes of passenger vessels so that the requirements more closely matched existing Coast Guard requirements, in order to encourage use of the code as an alternative to Coast Guard prescriptive regulations.

The code underwent another substantial change in the 2008 edition. A new chapter was added to allow vessel designers and other users to incorporate equivalencies and alternative design considerations in vessel construction that satisfy the fundamentals of fire prevention, fire protection, and means of egress. The chapter on towing vessels was completely revised to update requirements for all new-construction towing vessels regardless of length and horsepower, in accordance with current U.S. Coast Guard regulations and industry best practices.



During the revision cycle for the 2013 edition the committee recognized the code as an essential consensus standard on fire protection of merchant vessels per the U.S. Coast Guard's original request in 1993. The NFPA standards-making process and the code can address a new fire hazard or fire protection issue more urgently than can be done by the government's regulatory rulemaking process.

In the 2013 edition of the code, the Technical Committee on Merchant Vessels revised several definitions and updated the publications referenced within the document. The committee also changed the applicability requirements for automatic sprinkler systems and water mist systems to be limited to passenger vessels with overnight accommodations for more than 36 passengers (in addition to Group I and Group II passenger vessels). This change made mandatory automatic fire protection requirements for certain small passenger vessels equivalent to existing federal regulations.

In the 2018 edition of the code, the Technical Committee on Merchant Vessels has updated the references in Chapter 2 and Annex D. Chapter 3, Definitions, also has been reviewed by the committee and several changes have been incorporated. The term *fire endurance* has been removed from the code because it is an obsolete term that has been replaced throughout most of the NFPA system with *fire resistance*. Other revised definitions include: *furnishings*, *fire protection rating*, *fire resistance rating*, and *fire-rated glazing*.

The committee has revised the requirements for backup lighting to reduce the total blackout time in spaces aboard a vessel that do not normally have any natural lighting (e.g., portholes, windows, and so on) to reduce the risk of panic and injury to passengers and crew.

In addition, it has been determined that the signage used on doors, passageways, ladders, or stairways that are neither an exit nor a way of exit access needs to be approved by the authority having jurisdiction (AHJ).

The technical committee also incorporated by reference the requirements from NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, to specify that insulation and coverings for pipes and ducts installed in areas where there is the potential for hot temperatures need to be assessed to ensure they perform properly when exposed to high temperatures.

For fire test requirements for draperies or other vertically hung textiles, users of the code are now directed to NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, or Part 7 of the *IMO Fire Test Procedures Code*.

Finally, the 2018 edition now requires that portable fire extinguishers be classed in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, or follow the requirements for portable extinguishers in Title 46 of the Code of Federal Regulations.

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

Committee Scope: This Committee shall have primary responsibility for documents on the protection of human life, property, and the marine environment from fires aboard merchant vessels.

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A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex D. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope.

1.1.1 Title. NFPA 301 shall be known as the *Merchant Vessel Code* and is referred to herein as "this code" or "the code."

1.1.2 The code addresses construction, arrangement, protection, and space utilization factors that are necessary to minimize danger to life from fire, smoke, fumes, or panic. It also provides for reasonable protection against property damage and avoidance of environmental damage consistent with the normal operation of vessels. Fundamental requirements applicable to all vessels are found in Chapters 1 through 9. These fundamental requirements are modified in Chapters 10 through 18 as applicable for any type of space. The requirements in Chapters 1 through 18 are modified in Chapters 19 through 21 as applicable for any given vessel type. For example,

a passenger vessel would follow the requirements of Chapters 1 through 18 and Chapter 21.

1.1.3 The code identifies the minimum criteria for the design of egress facilities so as to permit prompt escape of passengers and crew to safe areas aboard vessels and, where necessary, to survival craft embarkation stations.

1.1.4 The code recognizes that life safety is more than a matter of egress and, accordingly, deals with other considerations that are essential to life safety. It also recognizes the unique operating environment of merchant vessels and the relationships among life safety, property protection, and environmental protection and deals with these criteria accordingly.

1.1.5* Where permanently moored and occupied as buildings, merchant vessels shall be permitted to be treated as buildings and shall be permitted to be subject to the provisions of appropriate building codes and standards as specified by the local authority having jurisdiction (AHJ).

1.2 Purpose.

1.2.1 The purpose of this code is to provide minimum requirements, with due regard to function, for the design, operation, and maintenance of merchant vessels for safety to life from fire and similar emergencies.

1.2.2 As related to fire safety, the objective of this code is to protect the passengers and crew from loss of life. It is also intended that the code will provide for minimum loss of property and minimum impact on the environment.

1.2.3* The level of safety is achieved by the combination of design, prevention, protection, egress, and other features enumerated in the individual vessel occupancy classification with due regard to the capabilities and reliability of the features involved. Recognition is given to human factors and to the need for crew training and passenger instruction.

1.2.4 The code endeavors to avoid requirements that could involve unreasonable hardships or unnecessary inconvenience or interference with the normal use of a vessel, but it provides minimum requirements for fire safety consistent with the public interest.

1.3 Application.

1.3.1* This code shall apply to new construction merchant vessels to the extent described in Chapters 19 through 21. This code does not apply to pleasure craft or commercial craft covered by NFPA 302 or to warships.

1.3.2 Existing vessels undergoing major modification or conversion shall comply with all requirements of this code within the areas being modified and ancillary support systems.

1.3.3 Any alteration or any installation of new equipment, joinery, or furnishings shall comply with the requirements for new construction.

1.3.4 Where specific requirements contained in Chapters 10 through 18 differ from general requirements contained in Chapters 1 through 9, the requirements of Chapters 10 through 18 shall govern. Where the requirements in Chapters 19 through 21 differ from the requirements in Chapters 1 through 18, the requirements in Chapters 19 through 21 shall govern.

1.3.5 Provisions in Excess of Code Requirements. Nothing in this code shall be construed to prohibit additional means of egress, or otherwise safer means of egress than those specified by the minimum requirements of this code.

1.3.6* This code is not intended for application in addition to *Safety of Life at Sea (SOLAS)* requirements to vessels in international trade.

1.4 Equivalency Concepts.

1.4.1 Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, durability, and safety as alternatives to those prescribed in this code.

1.4.2 The specific requirements of this code shall be permitted to be modified by the AHJ to allow alternative arrangements that will ensure, as much as practicable, an equivalent level of safety to life from fire, but in no case shall the modification afford less safety to life than that which, in the judgment of the AHJ, would be provided by compliance with the corresponding provisions contained in this code.

1.4.3 Vessels with alternative fire protection features accepted by the AHJ shall be considered as conforming with the code.

1.5 Units.

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

1.5.2 If a value for measurement as provided in this code is followed by an equivalent value in other units, the first stated value is to be regarded as the requirement. A given equivalent value might be an approximation.

1.6 Vessel Construction, Repair, and Alteration.

1.6.1* Vessels built or converted to meet this code shall comply with all of the provisions of the code.

1.6.2 Changes in Service. In any vessel, whether necessitating a physical alteration or not, a change in service from one use to another shall be permitted only if such vessel, or portion thereof, conforms with the requirements of this code that apply to new construction for the proposed new use.

1.6.3* Vessels or portions of vessels shall be permitted to be occupied during conversion, repair, alterations, or additions only if all means of egress and all fire protection features are in place and continuously maintained for the occupied portion. Temporarily installed fire protection features shall comply with Section 1.4 of this code.

1.7 Maintenance.

1.7.1 Whenever or wherever any device, equipment, system, condition, arrangement, level of protection, or any other feature is required for compliance with the provisions of this code, such device, equipment, system, condition, arrangement, level of protection, or other feature shall thereafter be permanently maintained unless the code exempts such maintenance.

1.7.2 Additional approved life safety features such as, but not limited to, automatic sprinklers, fire alarm systems, standpipes, and horizontal exits, if not required by the code, shall be permanently maintained or removed.

1.8 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (See *Annex C* for sample wording for enabling legislation.)

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code 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 10, *Standard for Portable Fire Extinguishers*, 2017 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2013 edition.

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

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

NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*, 2015 edition.

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

NFPA 72®, *National Fire Alarm and Signaling Code*, 2016 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2016 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2017 edition.

NFPA 99, *Health Care Facilities Code*, 2018 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2015 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, 2015 edition.

NFPA 270, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber*, 2013 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, 2015 edition.

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*, 2015 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2015 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2015 edition.

NFPA 1964, *Standard for Spray Nozzles*, 2013 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2015 edition.

2.3 Other Publications.

2.3.1 ABS Publications. American Bureau of Shipping, ABS Plaza, 16855 Northchase Drive, Houston, TX 77060.

Rules for Building and Classing Steel Vessels Under 90 Meters (295 Feet) in Length, 2012.

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

ABYC-H-25, *Marine Gasoline Fuel Systems*, 2010, reaffirmed 2013.

ABYC-P-1, *Installation of Exhaust Systems for Propulsion and Auxiliary Engines*, 2009.

2.3.3 ASME Publications. ASME International, Two Park Avenue, New York, NY 10016-5990.

ASME A17.1, *Safety Code for Elevators and Escalators*, 2013.

ASME A17.2, *Guide for Inspection of Elevators, Escalators, and Moving Walks*, 2012.

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

ASTM C411, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*, 2011.

ASTM D2859, *Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials*, 2016.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2016.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2016.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016.

ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 2015 e1.

ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Firestops*, 2013a.

ASTM E1317, *Standard Test Method for Flammability of Marine Surface Finishes*, 2012.

ASTM E1354, *Standard Test Method for Heat and Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, 2016.

ASTM E1537, *Standard Test Method for Fire Testing of Upholstered Furniture Items*, 2015.

ASTM E1590, *Standard Test Method for Fire Testing of Mattresses*, 2013.

ASTM E1591, *Standard Guide for Obtaining Data for Deterministic Fire Models*, 2013.

ASTM E1995, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single-Closed Chamber, with the Specimen Oriented Horizontally*, 2012.

ASTM E2231, *Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics*, 2015.

ASTM E2257, *Standard Test Method Room Fire Test of Wall and Ceiling Materials and Assemblies*, 2016.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2016.

ASTM F840, *Standard Specification for Ladders, Fixed, Vertical, Steel, Ship's*, 1983 (2003) (withdrawn).

ASTM F1384, *Standard Test Method for Fire Tests of Marine Joiner Doors*, 1993 (withdrawn).

ASTM F1626, *Standard Practice for Preparing Shipboard Fire Control Plans*, 1995 (2006) (withdrawn).

2.3.5 CGA Publications. Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-1788.

CGA G-7.1, *Commodity Specifications for Air*, G-7.1, 2011.

2.3.6 CSA Publications. Canadian Standards Association, 5060 Spectrum Way, Mississauga, ON, L4W 5N6, Canada.

CSA C 22.2, No. 0.3, *Test Methods for Electrical Wires and Cables*, 2009, reaffirmed 2014.

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

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

IEEE 515, *Standard for Testing, Design Installation, and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications*, 2011.

IEEE 844, *Recommended Practice for Electrical Impedance, Induction, and Skin Effect Heating of Pipelines and Vessels*, 2000, reaffirmed 2006.

IEEE 1202, *Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies*, 2012.

IEEE 1580, *Recommended Practice for Marine Cable for Use on Shipboard and Fixed or Floating Facilities*, 2010.

2.3.8 IMO Publications. International Maritime Organization, 4 Albert Embankment, London, SE1 7SR.

Assembly Resolution A752(18), *Guidelines for the Evaluation, Testing, and Application of Low-Location Lighting on Passenger Ships*, 1993.

Assembly Resolution A757(18), *Standard for the Calculation of the Width of Stairways Forming Means of Escape on Passenger Ships*, 1993.

Assembly Resolution A760(18), *Symbols Related to Life-Saving Appliances and Arrangements*, 1993.

Fire Test Procedures Code: International Code for the Application of Fire Test Procedures (FTP Code), 2012.

IMO International Code of Safety for the High-Speed Craft (HSC Code), 2008.

IMO International Maritime Dangerous Goods (IMDG) Code, 2014.

International Convention for Safety of Life at Sea (SOLAS), Chapter II-2, 1974 as amended (consolidated edition 2014).

Maritime Safety Committee Circular (MSC/Circ.) 732, *Interim Guidelines on the Test Procedure for Demonstrating the Equivalence of Composite Materials to Steel Under the Provisions of the 1974 SOLAS Convention*, 2000.

2.3.9 ISO Publications. International Organization for Standardization, ISO Central Secretariat, 8, Chemin de Blondonne, Case Postale 401, 1214 Vernier, Geneva, Switzerland.

ISO 834-1, *Fire Resistance Tests — Elements of Building Construction, Part 1: “General Requirements,”* 2012.

ISO 1716, *Reaction to Fire Tests for Products — Determination of the Gross Heat of Combustion*, 2010.

ISO 9705, *Fire Tests — Full Scale Room Test of Surface Products*, 1993.

ISO 15370, *Ships and Marine Technology — Low-Location Lighting (LLL) on Passenger Ships — Arrangement*, 2010.

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

ANSI/UL 13, *Standard for Power-Limited Circuit Cables*, 2011.

ANSI/UL 19, *Standard for Safety Lined Fire Hose and Hose Assemblies*, 2013.

ANSI/UL 217, *Single and Multiple Station Smoke Alarms*, 2012.

ANSI/UL 444, *Standard for Communications Cables*, 2010.

ANSI/UL 555S, *Smoke Dampers*, 2014.

UL 1309, *Standard for Marine Shipboard Cable*, 2014.

ANSI/UL 1581, *Reference Standard for Electrical Wires, Cables and Flexible Cords*, 2013.

ANSI/UL 1666, *Standard for Test for Flame Propagation Height of Electrical and Optical Fiber Cable Installed Vertically in Shafts*, 2012.

ANSI/UL 1685, *Standard for Vertical-Tray Fire Propagation and Smoke-Release Tests for Electrical and Optical Fiber Cables*, 2010.

• **2.3.11 U.S. Coast Guard Publications.** U.S. Coast Guard Headquarters, 2703 Martin Luther King Jr. Avenue, SE, Washington, DC 20593-7000.

Navigation and Vessel Inspection Circular (NVIC) 9-97, Change 1, *Guide to Structural Fire Protection Aboard Merchant Vessels*, 2010.

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

Title 16, Code of Federal Regulations, “Commercial Practices,” Parts 1630 and 1632, 2010.

Title 46, Code of Federal Regulations, “Shipping,” Parts 1–199, 2009.

Title 49, Code of Federal Regulations, “Transportation,” Part 173, 2009.

2.3.13 Other Publications.

Merriam-Webster’s Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2008.

2.4 References for Extracts in Mandatory Sections.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*, 2016 edition.

NFPA 556, *Guide on Methods for Evaluating Fire Hazard to Occupants of Passenger Road Vehicles*, 2016 edition.

NFPA 914, *Code for Fire Protection of Historic Structures*, 2015 edition.

NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 2016 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster’s Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

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.

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

3.3 General Definitions.

3.3.1 Accommodation Area. A group of accommodation spaces and interconnecting corridors or spaces.

3.3.2* Area of Refuge. In merchant vessels, an area that is separated from the effects of fire and flooding where passengers and crew can gather to await disembarking in the event of fire or flooding.

3.3.3 Atrium. A continuous series of deck openings connecting three or more deck levels within an accommodation space that is covered at the top of the series of openings and is used for purposes other than an enclosed stairway, elevator hoistway, escalator opening, or a utility trunk for pipe, cable, or ductwork.

3.3.4 Balcony. Deck area that projects from a bulkhead.

3.3.5 Bulkhead. A vertical structure constructed between the deck and overhead that divides the vessel interior into spaces.

3.3.6* Bulkhead Panel. A component of a division or bulkhead.

3.3.7 Cargo. Commodities in transit. [307, 2016]

3.3.8 Cargo Hold. Cargo spaces containing other than bulk liquid cargo.

3.3.9* Ceiling. In merchant vessels, a horizontal division within a space for the purpose of decoration, acoustics, or fire protection.

3.3.9.1 Continuous B-Class Ceiling. A B-Class ceiling that terminates only in an A- or B-Class bulkhead.

3.3.10 Central Control Station. A control station in which fire and safety control and indicator functions are centralized.

3.3.11* Common Path of Travel. The portion of exit access that must be traversed before two separate and distinct paths of travel to two exits are available.

N 3.3.12 Contents and Furnishings. Any objects in a ship that normally are secured or otherwise put in place for functional or decorative reasons, excluding parts of the structure of the ship but including contents of spaces such as furniture, carpet and padding, rugs, draperies, curtains, decorations, and cushions.

3.3.13 Damper.

3.3.13.1* Fire Damper. In merchant vessels, a duct-closure device intended to restrict the passage of flame that is operated automatically or manually, including manual remote.

3.3.13.2 Smoke Damper. A device within an air distribution system to control the movement of smoke. [5000, 2018]

3.3.14 Dead-End Corridor. A passageway, or portion thereof, from which there is only one means of egress.

3.3.15 Deck. In merchant vessels, a horizontal division in a vessel's structure.

3.3.16* Deck Covering. A material applied to a deck for purposes of increasing the fire resistance of the deck.

3.3.17* Deck Finish. The final exposed surface of the deck.

3.3.18 Deck Overlay. A material used for leveling purposes or for creating a suitable surface for application of deck finish.

3.3.19 Division.

3.3.19.1 A-Class Division. A fire barrier system consisting of bulkheads or decks and including all penetrations for piping and cables, doors, windows, and ductwork, providing 60 minutes of fire resistance when tested in accordance with established test methods.

3.3.19.2 B-Class Division. A fire barrier system consisting of bulkheads or decks and including all penetrations for piping and cables, doors, windows, and ductwork, providing 30 minutes of fire resistance when tested in accordance with established test methods.

3.3.20 Door.

3.3.20.1 C-Class Door. A door constructed of noncombustible material that does not have A- or B-class fire resistance.

3.3.20.2 Horizontal Sliding Door. A door installed in the vertical plane that slides in a direction that is perpendicular to the direction of egress travel.

3.3.20.3 Weathertight Door. A door that prevents the penetration of rain, snow, wind-driven spray, and water on deck into the interior spaces.

3.3.21* Draft Stop. A continuous membrane used to subdivide a concealed space to resist the passage of smoke and heat. [5000, 2018]

3.3.22 Embarkation Area. The area from which a person exits the vessel in an emergency.

3.3.23* Exit. That portion of a means of egress that is separated from all other spaces of the vessel by construction or equipment to provide a protected way of travel to the exit discharge.

3.3.23.1* Horizontal Exit. An exit between adjacent areas on the same deck that passes through an A-60 Class boundary that is contiguous from side shell to side shell or to other A-60 Class boundaries.

3.3.24 Exit Access. That portion of a means of egress that leads to an exit.

3.3.25 Exit Discharge. That portion of a means of egress between the termination of an exit and an embarkation area or area of refuge.

3.3.26 Exit Enclosure. The bulkheads and decks around an exit.

3.3.27 Fire Hydrant. In merchant vessels, a connection to the fire main for the purpose of supplying water to fire hose or other fire protection apparatus.

3.3.28 Fire Performance. Reaction to fire exposure of materials, such as finishes, furnishings, fabrics, padding, draperies, and other combustible materials.

N 3.3.29 Fire Protection Rating. The designation indicating the duration of the fire test exposure to which an opening protective assembly was exposed. [101, 2018]

3.3.30 Fire Protection Suppression System. A fixed system designed to extinguish a fire or substantially reduce the heat release rate of the fire.

3.3.31 Fire Pump Controller. A group of devices that serves to govern, in some predetermined manner, the starting and stopping of the fire pump driver as well as monitoring and signaling the status and condition of the fire pump unit.

3.3.32* Fire-Rated Glazing. Glazing with either a fire protection rating or a fire resistance rating.

N 3.3.33 Fire Resistance. The ability of a material, product, or assembly to withstand fire or give protection from it for a period of time. [556, 2016]

3.3.34 Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as determined by the tests, or methods based on tests, prescribed by this Code. [101, 2018]

3.3.35 Flame Spread. The propagation of flame over a surface.

3.3.36 Food Preparation Area. An area that has no cooking equipment with surface temperatures greater than 120°C (248°F).

3.3.37 Fuel.

3.3.37.1 High-Risk Fuel. Class-IA, -IB, -IC, or -II liquids or Class-IIIA or -IIIB liquids heated to within 10°C (50°F) of their flash point, or pressurized to 174.4 kPa (25.3 psi) or more.

3.3.37.2 Low-Risk Fuel. All other fuels that are not high risk.

3.3.38 Furnishings. The contents of spaces such as desks, chairs, tables, sofas, draperies, and rugs.

3.3.39 Gallery. An intermediate level between deck and overhead of any area or space that exceeds 25 percent of the space below.

3.3.40 High-Speed Vessels. A craft capable of a maximum speed [in meters per second (m/s)] equal to or exceeding $3.7 \times \text{displacement}^{(0.1667)}$, where displacement corresponds to the design waterline [in cubic meters (m³)].

3.3.41 Hospital. A vessel or part of a vessel used on a 24-hour basis for the medical, obstetrical, or surgical care of four or more inpatients.

3.3.42 Joiner Construction. Nonstructural partitions used to subdivide compartments, such as bulkhead panels, doors, windows, insulation, ceilings, connectors, and interior finishes.

3.3.43 Lining. Structural components, such as suspended ceilings or curtain bulkheads, which are non-load bearing or used for aesthetic purposes.

3.3.44 Low-Location Lighting. Electrically powered lighting or photoluminescent indicators placed at points of the escape route to readily identify all routes of escape.

3.3.45* Major Modification. A conversion of a vessel that substantially changes the dimensions or carrying capability of the vessel, changes the type of the vessel, substantially prolongs the life of the vessel, or otherwise changes the vessel such that it is essentially a new vessel.

3.3.46 Material.

3.3.46.1 Combustible Material. Any material that will burn regardless of its autoignition temperature.

3.3.46.2 Noncombustible Material. See 8.2.2.

3.3.46.3 Steel or Other Equivalent Material. Any noncombustible construction that has structural and thermal integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test.

3.3.47* Means of Egress. A continuous and unobstructed way of exit travel from any point in the vessel to an area of refuge or embarkation area consisting of three separate and distinct

parts: (1) the exit access, (2) the exit, and (3) the exit discharge.

3.3.48 Mezzanine. An intermediate level between deck and overhead of any area or space that does not exceed 25 percent of the space below.

3.3.49 Ocean-Going Towing Vessel. A towing vessel intended to operate at a distance greater than 20 miles offshore.

3.3.50 Overlays. Decorative materials applied to decks for finishing purposes.

3.3.51 Overnight Accommodations. Accommodation space that has one or more berths, including beds or bunks, for use by passengers.

3.3.52 Passageway. A corridor or hallway. [1405, 2016]

3.3.53 Passenger. An individual carried on a vessel who is not one of the following: (1) an owner, a representative of the owner, a charterer, or a representative of a charterer; (2) the vessel's master; or (3) a member of the vessel's crew who is paid for onboard services.

3.3.54* Photoluminescent. Having the ability to store incident electromagnetic radiation typically from ambient light sources, and release it in the form of visible light.

3.3.55 Signaling Line Circuit. A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input signals or output signals, or both, are carried.

3.3.56 Stairtower. A stairway enclosed in a continuous vertical shaft.

3.3.57 Stairway. A vertical means of egress between decks.

3.3.58* Structural Fire Protection. Fire protection that is intended to limit the spread of fire and smoke to as small an area as reasonable, by specifying fire **resistance** capabilities of structural elements.

3.3.59* Survival Craft. Craft capable of sustaining the lives of persons in distress after abandoning the vessel on which they were originally carried.

3.3.60 Tank Ship. A vessel that carries flammable or combustible liquids in bulk.

3.3.61* Trunk. A vertical shaft or duct used for the passage of pipes, wires, ladders, and other devices.

3.3.62 Underlayment. A layer of materials installed between a deck finish and the deck below.

3.3.63 Voids. Cofferdams and spaces not normally accessible or used for storage.

3.4 Space Definitions.

3.4.1* Electrical and Control Space. Electrical and control spaces are those used for the control and management of routine and emergency vessel operations.

3.4.2* Engineering and Machinery Space. Engineering and machinery spaces, including trunks and ducts, are those containing machinery used to support propulsion, power generation, heating and ventilation, and other auxiliary systems.

3.4.3* Manned Space. A space that is normally occupied.

3.4.4 Public Space. Any space that is dedicated for use by and accessible to the public.

3.4.5* Restricted Access Space. Spaces that are not normally occupied by the crew during the course of normal working or watchstanding but that can be periodically checked during the course of their rounds.

3.4.6 Security Space. A space dedicated to an activity that requires the limitation or control of access by persons to certain given times, such as counting rooms, vaults, monitor stations, or areas of physical restraint.

3.4.7* Unmanned Space. A space that is occasionally occupied.

3.4.8* Vehicle Space. Those spaces used for the carriage of vehicles with fuel in their tanks.

3.5 Special Definitions for Terms Used in Chapter 5.

3.5.1 Alternative Calculation Procedure. A calculation procedure that differs from the procedure originally employed by the design team but that provides predictions for the same variables of interest.

3.5.2 Data Conversion. The process of developing the input data set for the assessment method of choice.

3.5.3 Design Fire Scenario. A fire scenario selected for evaluation of a proposed design. [914, 2014]

3.5.4* Design Specification. A building characteristic and other conditions that are under the control of the design team. [5000, 2018]

3.5.5 Design Team. A group of stakeholders including, but not limited to, representatives of the architect, client, and any pertinent engineers and other designers.

3.5.6* Exposure Fire. A fire that starts at a location that is remote from the area being protected and grows to expose that which is being protected.

3.5.7* Fire Model. A structured approach to predicting one or more effects of a fire.

3.5.8* Fire Scenario. A set of conditions that defines the development of fire, the spread of combustion products throughout a building or portion of a building, the reactions of people to fire, and the effects of combustion products.

3.5.9* Fuel Load. The total quantity of combustible contents of a building, space, or fire area. [5000, 2018]

3.5.10 Incapacitation. A condition under which humans do not function adequately and become unable to escape untenable conditions.

3.5.11 Input Data Specification. Information required by the verification method.

3.5.12 Occupant Characteristics. The abilities or behaviors of people before and during a fire.

3.5.13* Performance Criteria. Threshold values on measurement scales that are based on quantified performance objectives.

3.5.14* Proposed Design. A design developed by a design team and submitted to the authority having jurisdiction for approval.

3.5.15 Safe Location. A location remote or separated from the effects of a fire so that such effects no longer pose a threat.

3.5.16 Safety Factor. A factor applied to a predicted value to ensure that a sufficient safety margin is maintained.

3.5.17 Safety Margin. The difference between a predicted value and the actual value where a fault condition is expected.

3.5.18 Sensitivity Analysis. An analysis performed to determine the degree to which a predicted output will vary given a specified change in an input parameter, usually in relation to models. [5000, 2018]

3.5.19 Stakeholder. An individual, or representative of same, having an interest in the successful completion of a project.

3.5.20 Uncertainty Analysis. An analysis performed to determine the degree to which a predicted value will vary. [5000, 2018]

3.5.21 Verification Method. A procedure or process used to demonstrate or confirm that the proposed design meets the specified criteria.

Chapter 4 Fundamental Requirements

4.1* Fundamentals. The following requirements shall be used in applying this code:

- (1) Limit fire to the space and deck of origin.
- (2) Provide for 100 percent self-sufficiency in extinguishing or controlling fires, protecting lives, and protecting property.
- (3) Provide protected escape routes for egress.
- (4) Provide areas of refuge.
- (5) Provide for rapid improvement of requirements as marine and fire protection technology advances.
- (6) Recognize the role of fire-fighting training of crew.
- (7) Provide adequate inspection, maintenance, and house-keeping requirements.

4.2 Fundamentals of Means of Egress.

4.2.1 Every vessel shall be provided with means of egress and other safeguards sufficient to provide a reasonable degree of safety for passengers and crew. The design of means of egress and other safeguards shall be such that reliance for safety to life will not depend solely on any single safeguard. Additional safeguards shall be provided for life safety in case any single safeguard is ineffective due to human or mechanical failure.

4.2.2 Every vessel shall be provided with means of egress and other safeguards of kinds, numbers, locations, and capacities appropriate to the individual vessel with due regard to the vessel service, the capabilities of the passengers and crew, the number of persons exposed, the fire protection available, the type of construction of the vessel, and other factors necessary to provide all passengers and crew with a reasonable degree of safety.

4.2.3 In every vessel, means of egress shall be arranged and maintained to provide free and unobstructed egress from all parts of the vessel at all times when it is occupied. No lock or fastening shall be installed to prevent free escape from any space on the vessel, other than from security spaces intended for physical restraint.

4.2.4 Every exit shall be clearly visible, or the route to reach every exit shall be conspicuously indicated in such a manner that every occupant of each vessel will know the direction of escape from any point. Each means of egress, in its entirety, shall be arranged or marked so that the way to a place of safety is indicated in a clear manner. Any doorway or passageway that is not an exit or a way to reach an exit, but is capable of being confused with an exit, shall be arranged or marked to prevent confusion with exits. Every effort shall be taken to avoid occupants mistakenly traveling into dead-end spaces in a fire emergency.

4.2.5 A minimum of two means of egress shall be provided in every area where size, occupancy, and arrangement endanger passengers and crew attempting to use a single means of egress that is blocked by fire or smoke. The two means of egress shall be arranged to minimize the possibility that both might be rendered impassable by the same emergency condition.

4.2.6 Every designated vertical egress opening between decks of a vessel shall be enclosed or protected to afford safety to passengers and crew while using that means of egress and to prevent spread of fire, smoke, or fumes through vertical openings from deck to deck before occupants have entered exits.

4.3 Fundamentals of Construction. Every vessel shall be constructed, arranged, equipped, maintained, and operated to avoid undue danger to the lives and safety of its passengers and crew from fire, smoke, fumes, or resulting panic during the period of time necessary to defend in place or for that period of time needed to abandon ship.

4.4 Fundamentals of Illumination. Where artificial illumination is required, egress facilities shall be included in the lighting design to ensure that the egress paths are illuminated.

4.5 Fundamentals of Alarms. In every vessel of such size, arrangement, or service such that a fire itself does not provide adequate occupant warning, alarm facilities shall be provided where necessary to warn of the existence of fire and smoke.

4.6 Life Safety Compliance Options.

4.6.1 Options. Life safety meeting the fundamental requirements of Sections 4.1 and 4.2 shall be provided in accordance with either of the following:

- (1) Prescriptive-based provisions per 4.6.2
- (2) Performance-based provisions per 4.6.3

4.6.2 Prescriptive-Based Option.

4.6.2.1 A prescriptive-based life safety design shall be in accordance with Chapters 1 through 4, Chapters 6 through 8, and the applicable occupancy chapter, Chapters 9 through 21.

4.6.2.2 Prescriptive-based designs meeting the requirements of Chapters 1 through 3, Sections 4.3 through 4.5, and Chapters 6 through 21 of this code shall be deemed to satisfy the provisions of Sections 4.1 and 4.2.

4.6.2.3 Where specific requirements contained in Chapters 9 through 21 differ from the general requirements contained in Chapters 1 through 4, and Chapters 6 through 8, the requirements of Chapters 9 through 21 shall govern.

4.6.3 Performance-Based Option. A performance-based life safety design shall be in accordance with Chapters 1 through 5.

Chapter 5 Performance-Based Option

5.1 General Requirements.

5.1.1* Application. The requirements of this chapter shall apply to life safety systems designed to the performance-based option permitted by 4.6.1 and 4.6.3.

5.1.2 Goals and Objectives. The performance-based design shall meet the fundamental requirements of this code in accordance with Sections 4.1 and 4.2.

5.1.3 Qualifications. The performance-based design shall be prepared by a registered design professional.

5.1.4* Independent Review. The authority having jurisdiction shall be permitted to require an approved, independent third party to review the proposed design and provide an evaluation of the design to the authority having jurisdiction.

5.1.5 Sources of Data. Data sources shall be identified and documented for each input data requirement that must be met using a source other than a design fire scenario, an assumption, or a design specification. The degree of conservatism reflected in such data shall be specified, and a justification for the source shall be provided.

5.1.6* Final Determination. The authority having jurisdiction shall make the final determination as to whether the performance objectives have been met.

5.1.7* Maintenance of Design Features. The design features necessary for the vessel to continue to meet the fundamental requirement of this code shall be maintained for the life of the vessel. Such fundamental requirements shall include complying with all documented assumptions and design specifications. Any variations shall require the approval of the authority having jurisdiction prior to the actual change.

Δ 5.1.8 Special Definitions. A list of special terms used in this chapter follows:

- (1) Alternative calculation procedure. See 3.5.1.
- (2) Data conversion. See 3.5.2.
- (3) Design fire scenario. See 3.5.3.
- (4) Design specification. See 3.5.4.
- (5) Design team. See 3.5.5.
- (6) Exposure fire. See 3.5.6.
- (7) Fire model. See 3.5.7.
- (8) Fire scenario. See 3.5.8.
- (9) Fuel load. See 3.5.9.
- (10) Incapacitation. See 3.5.10.
- (11) Input data specification. See 3.5.11.
- (12) Occupant characteristics. See 3.5.12.
- (13) Performance criteria. See 3.5.13.
- (14) Proposed design. See 3.5.14.
- (15) Safe location. See 3.5.15.
- (16) Safety factor. See 3.5.16.
- (17) Safety margin. See 3.5.17.
- (18) Sensitivity analysis. See 3.5.18.
- (19) Stakeholder. See 3.5.19.
- (20) Uncertainty analysis. See 3.5.20.
- (21) Verification method. See 3.5.21.

5.2 Performance Criteria.

5.2.1 General. A design shall meet the objectives specified in Sections 4.1 and 4.2 if, for each design fire scenario, assumption, and design specification, the performance criterion in 5.2.2 is met.

5.2.2* Performance Criterion. Any occupant who is not knowledgeable about ignition shall not be exposed to instantaneous or cumulative untenable conditions.

5.3 Retained Prescriptive Requirements.

5.3.1* Systems and Features. All fire protection systems and features of the vessel shall comply with applicable NFPA standards for those systems and features.

▲ 5.3.2 Means of Egress. In addition to the performance criteria of Section 5.2 and the methods of Section 5.4 through Section 5.8, the design shall comply with the following requirements:

- (1) Changes in level in means of egress — 7.1.6
- (2) Guards — 7.2.2.4.1
- (3) Doors — 7.2.1
- (4) Stairs — 7.2.2, excluding the provisions of 7.2.2.6.1 and 7.2.2.6.2
- (5) Ramps — 7.2.5
- (6) Alternating tread devices — 7.2.9
- (7) Capacity of means of egress — Section 7.3, excluding the provisions of 7.3.3 and 7.3.4
- (8) Impediments to egress — 7.5.2
- (9) Illumination of means of egress — Section 7.8
- (10) Emergency lighting — Section 7.9
- (11) Marking of means of egress — Section 7.10

5.3.3 Equivalency. Equivalent designs for the features covered in the retained prescriptive requirements mandated by 5.3.2 shall be addressed in accordance with the equivalency provisions of Section 1.4.

5.4 Design Specifications and Other Conditions.

5.4.1* Clear Statement. Design specifications and other conditions used in the performance-based design shall be clearly stated and shown to be realistic and sustainable.

5.4.2 Assumptions and Design Specifications Data.

5.4.2.1 Each assumption and design specification used in the design shall be accurately translated into input data specifications, as appropriate for the calculation method or model.

5.4.2.2 Any assumption and design specifications that the design analyses do not explicitly address or incorporate and that are, therefore, omitted from input data specifications shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

5.4.2.3 Any assumption and design specifications modified in the input data specifications, because of limitations in test methods or other data-generation procedures, shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

5.4.3 Vessel Characteristics. Characteristics of the vessel or its contents, equipment, or operations that are not inherent in the design specifications, but that affect occupant behavior or the rate of hazard development, shall be explicitly identified.

5.4.4* Operational Status and Effectiveness of Vessel Features and Systems. The performance of fire protection systems and vessel features shall reflect the documented performance and reliability of the components of those systems or features, unless design specifications are incorporated to modify the expected performance.

5.4.5 Occupant Characteristics.

5.4.5.1* General. The selection of occupant characteristics to be used in the design calculations shall be approved by the authority having jurisdiction and shall provide an accurate reflection of the expected population of vessel users. Occupant characteristics shall represent the normal occupant profile, unless design specifications are used to modify the expected occupant features. Occupant characteristics shall not vary across fire scenarios except as authorized by the authority having jurisdiction.

5.4.5.2* Response Characteristics. The basic response characteristics of sensibility, reactivity, mobility, and susceptibility shall be evaluated. Such evaluation shall include the expected distribution of characteristics of a population appropriate to the use of the vessel. The source of data for these characteristics shall be documented.

5.4.5.3 Location. It shall be assumed that, in every normally occupied room or area, at least one person shall be located at the most remote point from the exits.

5.4.5.4* Number of Occupants. The design shall be based on the maximum number of people that every occupied room or area is expected to contain. Where the success or failure of the design is contingent on the number of occupants not exceeding a specified maximum, operational controls shall be used to ensure that the maximum number of occupants is not **exceeded**.

5.4.5.5* Crew Assistance. The inclusion of trained crew members as part of the fire safety system shall be identified and documented.

5.4.6 Outside Assistance. Design characteristics or other conditions related to the availability, speed of response, effectiveness, roles, and other characteristics of shoreside emergency response personnel shall be specified, estimated, or characterized sufficiently for evaluation of the design. Alternative safety assessments complying with 46 CFR 199.630(f), "Life-saving for Certain Inspected Vessels, Alternatives for Passenger Vessels in a Specified Space," if applicable, shall be considered in this evaluation.

5.4.7* Post-Construction Conditions. Design characteristics or other conditions related to activities during the life of a vessel that affect the ability of the vessel to meet the stated goals and objectives shall be specified, estimated, or characterized sufficiently for evaluation of the design.

5.4.8 Vessel Route. Design characteristics or other conditions related to resources or conditions along the vessel's normal area of operation that affect the ability of the vessel to meet the stated goals and objectives shall be specified, estimated, or characterized sufficiently for evaluation of the design.

5.4.9* Consistency of Assumptions. The design shall not include mutually inconsistent assumptions, specifications, or statements of conditions.

5.4.10* Special Provisions. Additional provisions that are not covered by the design specifications, conditions, estimations, and assumptions provided in Section 5.4, but that are required for the design to comply with the performance objectives, shall be documented.

5.5* Design Fire Scenarios.

5.5.1 Approval of Parameters. The authority having jurisdiction shall approve the parameters involved in design fire scenarios. The proposed design shall be considered to meet the goals and objectives if it achieves the performance criteria for each required design fire scenario. (See 5.5.3.)

▲ 5.5.2* Evaluation. Design fire scenarios shall be evaluated using a method acceptable to the authority having jurisdiction and appropriate for the conditions. Each design fire scenario shall be as challenging as any that could occur in the vessel, but shall be realistic, with respect to at least one of the following scenario specifications:

- (1) Initial fire location
- (2) Early rate of growth in fire severity
- (3) Smoke generation

▲ 5.5.3* Required Design Fire Scenarios. Design fire scenarios shall comply with the following requirements:

- (1) Scenarios selected as design fire scenarios shall include, but shall not be limited to, those specified in 5.5.3.1 through 5.5.3.8.
- (2) Design fire scenarios demonstrated by the design team to the satisfaction of the authority having jurisdiction as inappropriate for the vessel use and conditions shall not be required to be evaluated fully.

▲ 5.5.3.1* Design Fire Scenario 1. Design fire scenario 1 shall be as follows:

- (1) It is an occupancy-specific fire representative of a typical fire for the occupancy.
- (2) It explicitly accounts for the following:
 - (a) Occupant activities
 - (b) Number and location
 - (c) Room size
 - (d) Furnishings and contents
 - (e) Fuel properties and ignition sources
 - (f) Ventilation conditions
 - (g) Identification of the first item ignited and its location

▲ 5.5.3.2* Design Fire Scenario 2. Design fire scenario 2 shall be as follows:

- (1) It is an ultrafast-developing fire (i.e., flammable liquid fire) in the primary means of egress, with interior doors open at the start of the fire.
- (2) It addresses the concern regarding a reduction in the number of available means of egress.

▲ 5.5.3.3* Design Fire Scenario 3. Design fire scenario 3 shall be as follows:

- (1) It is a fire that starts in a normally unoccupied room, potentially endangering a large number of occupants in a large room or other area.
- (2) It addresses the concern regarding a fire starting in a normally unoccupied room and migrating into a space that can, potentially, hold the greatest number of occupants.

▲ 5.5.3.4* Design Fire Scenario 4. Design fire scenario 4 shall be as follows:

- (1) It is a fire that originates in a concealed bulkhead or ceiling space adjacent to a large occupied room.
- (2) It addresses the concern regarding a fire originating in a concealed space that does not have either a detection system or a suppression system and then spreading into the room within the vessel that can, potentially, hold the greatest number of occupants.

▲ 5.5.3.5* Design Fire Scenario 5. Design fire scenario 5 shall be as follows:

- (1) It is a slowly developing fire, shielded from fire protection systems, in close proximity to a high-occupancy area.
- (2) It addresses the concern regarding a relatively small ignition source causing a significant fire.

▲ 5.5.3.6* Design Fire Scenario 6. Design fire scenario 6 shall be as follows:

- (1) It is an ultrafast-developing fire resulting from the largest possible fuel load characteristic of the normal operation of the vessel.
- (2) It addresses the concern regarding a rapidly developing fire with occupants present.

▲ 5.5.3.7* Design Fire Scenario 7. Design fire scenario 7 shall be as follows:

- (1) It is an outside exposure fire.
- (2) It addresses the concern regarding a fire starting at a location remote from the area of concern and either spreading into the area, blocking escape from the area, or developing untenable conditions within the area.

▲ 5.5.3.8* Design Fire Scenario 8. Design fire scenario 8 shall be as follows:

- (1) It is a fire originating in ordinary combustibles in a room or area with each passive or active fire protection system independently rendered ineffective.
- (2) It addresses concerns regarding the unreliability or unavailability of each fire protection system or fire protection feature, considered individually.
- (3)* It is not required to be applied to fire protection systems for which the level of reliability in conjunction with the design performance in the absence of the system are acceptable to the authority having jurisdiction.

5.5.4 Design Fire Scenarios Data.

5.5.4.1 Each design fire scenario used in the performance-based design proposal shall be translated into input data specifications, as appropriate for the calculation method or model.

5.5.4.2 Any design fire scenario specifications that the design analyses do not explicitly address or incorporate and that are, therefore, omitted from input data specifications shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

5.5.4.3 Any design fire scenario specifications modified in input data specifications, because of limitations in test methods or other data-generation procedures, shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

5.6* Evaluation of Proposed Designs.

5.6.1 General. A proposed design's performance shall be assessed relative to each fundamental requirement in Section 4.1 and Section 4.2 and each applicable scenario in 5.5.3, with the assessment conducted through the use of appropriate calculation methods. The authority having jurisdiction shall approve the choice of assessment methods.

5.6.2 Use. The design professional shall use the assessment methods to demonstrate that the proposed design will achieve the goals and objectives, as measured by the performance criteria in light of the safety margins and uncertainty analysis, for each scenario, given the assumptions.

5.6.3 Input Data.

5.6.3.1 Data. Input data for computer fire models shall be obtained in accordance with ASTM E1591, *Standard Guide for Obtaining Data for Deterministic Fire Models*. Data for use in analytical models that are not computer-based fire models shall be obtained using appropriate measurement, recording, and storage techniques to ensure the applicability of the data to the analytical method being used.

5.6.3.2 Data Requirements. A complete listing of input data requirements for all models, engineering methods, and other calculation or verification methods required or proposed as part of the performance-based design shall be provided.

5.6.3.3* Uncertainty and Conservatism of Data. Uncertainty in input data shall be analyzed and, as determined appropriate by the authority having jurisdiction, addressed through the use of conservative values.

5.6.4* Output Data. The assessment methods used shall accurately and appropriately produce the required output data from input data based on the design specifications, assumptions, and scenarios.

5.6.5 Validity. Evidence shall be provided to confirm that the assessment methods are valid and appropriate for the proposed vessel, use, and conditions.

5.7* Safety Factors. Approved safety factors shall be included in the design methods and calculations to reflect uncertainty in the assumptions, data, and other factors associated with the performance-based design.

5.8 Documentation Requirements.

5.8.1* General. All aspects of the design, including those described in 5.8.2 through 5.8.14, shall be documented. The format and content of the documentation shall be acceptable to the authority having jurisdiction.

5.8.2* Technical References and Resources. The authority having jurisdiction shall be provided with sufficient documentation to support the validity, accuracy, relevance, and precision of the proposed methods. The engineering standards, calculation methods, and other forms of scientific information provided shall be appropriate for the particular application and methodologies used.

5.8.3 Vessel Design Specifications. All details of the proposed design that affect the ability of the vessel to meet the stated goals and objectives shall be documented.

5.8.4 Performance Criteria. Performance criteria, with sources, shall be documented.

5.8.5 Occupant Characteristics. Assumptions about occupant characteristics shall be documented.

5.8.6 Design Fire Scenarios. Descriptions of design fire scenarios shall be documented.

5.8.7 Input Data. Input data to models and assessment methods, including sensitivity analyses, shall be documented.

5.8.8 Output Data. Output data from models and assessment methods, including sensitivity analyses, shall be documented.

5.8.9 Safety Factors. The safety factors utilized shall be documented.

5.8.10 Prescriptive Requirements. Retained prescriptive requirements shall be documented.

5.8.11* Modeling Features.

5.8.11.1 Assumptions made by the model user and descriptions of models and methods used, including known limitations, shall be documented.

5.8.11.2 Documentation shall be provided to verify that the assessment methods have been used validly and appropriately to address the design specifications, assumptions, and scenarios.

5.8.12 Evidence of Modeler Capability. The design team's relevant experience with the models, test methods, databases, and other assessment methods used in the performance-based design proposal shall be documented.

5.8.13 Performance Evaluation. The performance evaluation summary shall be documented.

Δ 5.8.14 Use of Performance-Based Design Option. Design proposals shall include documentation that provides anyone involved in the ownership or management of the vessel with notification of the following:

- (1) Approval of the vessel as a performance-based design with certain specified design criteria and assumptions
- (2) Need for required re-evaluation and re-approval in cases of remodeling, modification, renovation, change in use, or change in established assumptions

Chapter 6 Classification of Occupancy and Hazard of Contents

6.1 Classification of Occupancy.

6.1.1 General. All vessel occupancies shall be classified according to this chapter. Occupancies shall conform to the requirements of the specific occupancy Chapters 10 through 18.

6.1.2 Accommodation Spaces. Accommodation spaces shall include, but are not limited to, all portions of a vessel used for such purposes as overnight residence, deliberation, worship, entertainment, dining, or amusement. (*For requirements, see Chapter 10.*)

6.1.2.1 Accommodation spaces shall include the following:

- (1) Passenger or crew cabins
- (2) Lounge areas
- (3) Athletic facilities
- (4) Gaming areas
- (5) Office spaces

- (6) Spaces for religious worship
- (7) Theaters
- (8) Restaurants and messing areas
- (9) Public toilets and washrooms
- (10) Public sales and shops

6.1.3 Medical, Health Care, and Child Care Spaces. Medical and health care spaces shall include those spaces used for purposes such as medical or other treatment or care of persons suffering from physical illness, disease, or infirmity; child care spaces shall include those spaces used for the care of infants and children. *(For requirements, see Chapter 11.)*

6.1.3.1* Medical, health care, and child care spaces shall include the following:

- (1) Hospital and intensive care facilities
- (2) Limited-care facilities
- (3) Child care facilities

6.1.4 Service Spaces. Service spaces shall include galleys, laundries, or other spaces used for the purposes of providing support services to passengers and crew. *(For requirements, see Chapter 12.)*

6.1.4.1 Service spaces shall include the following:

- (1) Galleys
- (2) Film development and processing facilities
- (3) Sculleries
- (4) Food preparation areas [no cooking facilities, i.e., no equipment capable of generating temperatures in excess of 120°C (248°F)]
- (5) Laboratory facilities
- (6) Laundries

6.1.5 Electrical and Control Spaces. Electrical and control spaces shall include those spaces used for the control and management of routine and emergency operations. *(For requirements, see Chapter 13.)*

6.1.5.1 Electrical and control spaces shall include the following:

- (1) Radio and communications areas
- (2) Engineering enclosed operating station (not in the machinery space)
- (3) Electrical power, control, and switchboard spaces
- (4) Navigation and bridge area
- (5) Central damage control, fire-protection systems control, or both

6.1.6 Engineering and Machinery Spaces. Engineering and machinery spaces shall include those spaces containing machinery used to support propulsion, power generation, heating and ventilation, and other auxiliary systems. *(For requirements, see Chapter 14.)*

6.1.6.1* Engineering and machinery spaces shall include the following:

- (1) Main and auxiliary propulsion plants
- (2) Power-generating plants, including emergency generator rooms
- (3) Steering gear rooms
- (4) Machine shops
- (5) Marine sanitation devices
- (6) Pump rooms and bunkering stations
- (7) Stabilizer rooms

- (8) Heating, ventilation, and air-conditioning plants, including fan rooms
- (9) Refrigeration machinery plants
- (10) Anchor windlass rooms
- (11) Miscellaneous industrial facilities
- (12) Sewage treatment spaces
- (13) Incinerator rooms

6.1.7 Storage Spaces. Storage spaces shall include all spaces of the vessel utilized primarily for the storage of goods, merchandise, food products, and other items necessary to support the daily routine operation of the vessel. Minor storage incidental to another occupancy shall be treated as part of the predominant occupancy. *(For requirements, see Chapter 15.)*

6.1.7.1 Storage spaces shall include the following:

- (1) General storage spaces
- (2) Pyrotechnics lockers
- (3) General storage lockers (no flammable materials)
- (4) Cleaning gear lockers
- (5) Flammable materials storage
- (6) Flammable materials lockers
- (7) Walk-in refrigeration spaces
- (8) Bosun's lockers
- (9) Garbage and trash holding and processing other than incineration

6.1.8 Cargo Spaces and Fuel Tanks. Cargo spaces shall include those spaces utilized for the carriage or storage of items or products that are being transported by the vessel. *(For requirements, see Chapter 16.)*

6.1.8.1 Cargo spaces shall include the following:

- (1) Enclosed dry cargo storage
- (2) Liquid fuel tanks
- (3) Open vehicle decks
- (4) Chemical tanks
- (5) Open cargo storage
- (6) Liquefied and compressed gas storage
- (7) Enclosed vehicle decks

6.1.9 Open Deck.

6.1.9.1 Spaces permanently open to weather on one or more sides shall be considered open decks. For covered open deck spaces, all portions of the overhead shall be less than 5 m (16.4 ft) from the nearest opening to the weather.

6.1.9.2 Open-ended or open-sided covered spaces, regardless of size, shall be considered to be equivalent to open deck spaces, provided that such structures are not permanently enclosed on more than one side.

6.1.10 Helicopter Deck. Areas on a weather deck of a vessel dedicated to accommodating the landing of helicopters for routine or emergency uses shall be considered to be helicopter decks. The helicopter deck is an area on a weather deck of the vessel dedicated to accommodating the landing of helicopters for routine or emergency uses. Hangar spaces shall also be covered by Section 6.1 if the helicopter is to be routinely embarked on the vessel during voyages. *(For requirements, see Chapter 18.)*

6.1.11 Voids. Spaces that do not contain any equipment or room dedicated for storage shall be considered to be voids.

6.1.12 Mixed Occupancies. Where two or more classes of occupancy are contained in the same space on a vessel, and are intermingled so that separate safeguards are impracticable, means of egress facilities, construction, protection, and other safeguards shall comply with the life safety requirements of the highest hazard occupancy involved. Minor equipment that is incidental to the space, such as HVAC or bar equipment, shall be considered as part of that space.

6.1.13* Multiple-Purpose Vessels. For vessels that serve multiple purposes, the requirements of Chapters 19 through 21 shall apply to their corresponding portions of the vessel. Where conflicts arise, the most stringent requirement shall apply.

Chapter 7 Means of Egress

7.1 General.

7.1.1 Application. Means of egress for vessels shall comply with this chapter. (Also see Chapter 1.)

7.1.2 Special Terms.

7.1.2.1 Area of Refuge. An area qualifies as an area of refuge when the area provides separation from the effect of fire and flooding for the maximum amount of time required to complete disembarking of the vessel or 1 hour, whichever is less. Areas of refuge need to be properly sized and protectively bounded from fire and smoke and need to provide protected access to the embarkation area. See 3.3.2.

7.1.2.2 Common Path of Travel. See 3.3.11.

7.1.2.3 Embarkation Area. See 3.3.22.

7.1.2.4 Exit. See 3.3.23.

7.1.2.5 Exit Access. See 3.3.24.

7.1.2.6 Exit Discharge. See 3.3.25.

7.1.2.7 Exit Enclosure. See 3.3.26.

7.1.2.8 Horizontal Exit. See 3.3.23.1.

7.1.2.9 Means of Egress. See 3.3.47.

7.1.3 Separation of Means of Egress. See also Section 8.2.

7.1.3.1 Where an exit is required by this code to be protected by separation from other parts of the vessel, the separating construction shall meet the requirements in 7.1.3.1.1 through 7.1.3.1.4.

7.1.3.1.1 The separation shall be a minimum of A-0 Class divisions where the exit connects two or more decks. This shall apply whether the decks counted are above or below the deck where exit discharge begins. Where an exit bounds a high-risk accommodation space, high-risk service space, high-risk machinery space, or a cargo space, the separation shall be an A-60 class division.

7.1.3.1.2 Openings in exit enclosures shall be limited to those necessary for access to the enclosure from normally occupied spaces and corridors and for egress from the enclosure, and shall be protected by an A-Class door in accordance with 8.2.4.3.1.

7.1.3.1.3 Penetrations through an exit enclosure for electrical systems, ducts, and pipes serving the enclosure shall be permitted only if constructed in accordance with 8.2.4.9.

7.1.3.1.4 Penetrations between adjacent exit enclosures for electrical systems, ducts, and pipes shall be permitted only if constructed in accordance with 8.2.4.9, and the penetrating item passes completely through the enclosure.

7.1.3.1.5 There shall be no penetrations or communicating openings between adjacent exit enclosures.

7.1.3.2 An exit enclosure that only connects two decks shall be required to be enclosed only at one deck, provided the enclosure meets the requirements of 8.2.5.1 for deck construction.

7.1.3.3 Exit enclosures shall be designed to provide a continuous protected path of travel, including landings and passageways, to an exit discharge.

7.1.3.4 No exit enclosure shall be used for any purpose that could interfere with its use as an exit and, if so designated, as an area of refuge. (See also 7.2.2.6.4.)

7.1.3.5 Exit Access Passageways. Passageways used as exit access shall be constructed as a minimum B-15 Class division in accordance with 8.2.4.3.2. Where exit access bounds a high-risk service space, or high-risk machinery space, the separating division shall be minimum A-60 Class. Where exit access bounds a cargo space or open deck, the separating division shall be minimum A-0 Class. Alternative fire protection provisions for exit access passageways contained in Chapters 10 through 21 shall be permitted.

7.1.4 Interior Finish and Furnishings in Exits and Exit Accesses.

7.1.4.1 Interior finish in exits and exit accesses shall meet the requirements of Section 8.3.

7.1.4.2 Furnishings in exits shall meet the requirements of Section 8.4.

7.1.5* Headroom. Means of egress shall be designed and maintained to provide the required headroom as required in 7.2.2.2.1.

7.1.5.1 Means of egress shall have a ceiling height at least 2.15 m (7 ft).

7.1.5.2 Any projection from the overhead in a means of egress shall not be less than 2.0 m (6 ft 8 in.) nominal height from the deck.

7.1.6 Changes in Level in Means of Egress.

7.1.6.1 Changes in level in means of egress shall be by a ramp or a stair where the elevation difference is more than 50 cm (19.7 in.).

7.1.6.2 Changes in level in means of egress not more than 50 cm (19.7 in.) shall be either by a ramp or a stair complying with the requirements of 7.2.2 and 21.2.3.

7.1.6.2.1 The minimum tread depth of such stair in a means of egress shall be 30 cm (11.8 in.).

7.1.6.2.2 The location of each step in a means of egress shall be apparent by a change in color pattern, texture, or lighting.

7.1.7 Impediments to Egress. Any device or alarm installed to restrict the improper use of a means of egress shall be designed and installed so that it cannot, even in case of failure, impede or prevent emergency use of such means of egress. Alternative

provisions contained in Chapters 10 through 21 shall be permitted.

7.2 Means of Egress Components.

7.2.1 Doors.

7.2.1.1 General.

7.2.1.1.1 A door assembly (i.e., the door opening, frame, door, and necessary hardware) used as a component in a means of egress shall conform to the general requirements of Section 7.1 and to the special requirements of this subsection. Such an assembly shall be designated as a door.

7.2.1.1.2 Every door that is required to serve as an exit shall be designed and constructed so that the way of exit travel is obvious and direct. Windows that could be mistaken for doors, because of their physical configuration or design and the materials used in their construction, shall be made inaccessible to the occupants by barriers or railings.

7.2.1.2* When determining the width for a door opening for purposes of calculating egress capacity, only the clear width of the door opening when the door is in the fully open position shall be measured. Clear width shall be the net, unobstructed width of the door opening without projections into such width.

7.2.1.3 No door opening in the means of egress shall be less than 80 cm (31.5 in.) in clear width. Where a pair of doors is provided, at least one of the doors shall provide a minimum 80 cm (31.5 in.) clear width opening. Alternative provisions contained in Chapters 10 through 21 shall be permitted.

7.2.1.4 Swing and Force to Open.

7.2.1.4.1 Any door in a means of egress shall be of the side-hinged or pivoted-swinging type, except for the following:

- (1) Horizontal doors complying with 7.2.1.10
- (2) Revolving doors complying with 21.2.2.1

7.2.1.4.2 Each door within the path of egress shall be designed and installed so that it is capable of swinging to the full use of the opening in which it is installed.

7.2.1.4.2.1 Doors shall swing in the direction of egress travel.

7.2.1.4.2.2 Stateroom doors shall be permitted to swing into those spaces.

7.2.1.4.2.3 Doors for spaces not designated for passenger occupancy, such as office or service spaces, shall be permitted to swing into those spaces.

7.2.1.4.3* During its swing, any door that opens into a means of egress shall leave unobstructed at least one-half of the required width of an aisle, passageway, or landing.

7.2.1.4.3.1 When fully open, a door shall not project more than 15 cm (5.9 in.) into the required width of an aisle, passageway, or landing.

7.2.1.4.3.2 Doors shall not open immediately onto a stair without a landing.

7.2.1.4.3.3 The landing shall have a width at least equal to the width of the door. (See 7.2.2.3.)

7.2.1.4.4 The forces required to fully open any door manually in a means of egress shall not exceed 65 N (14.8 lbf) to release the latch, 130 N (29.6 lbf) to set the door in motion, and 65 N

(14.8 lbf) to open the door to the minimum required width. Opening forces for interior side-hinged or pivoted-swinging doors without closers shall not exceed 20 N (4.9 lbf). These forces shall be applied at the latch stile when the vessel is on an even keel. These provisions shall not apply to power-operated doors, which shall comply with 7.2.1.8.

7.2.1.5 Locks, Latches, and Alarm Devices.

7.2.1.5.1 Doors shall be arranged to be opened from the normal egress side whenever the space is occupied. Locks, if provided, shall not require the use of a key, tool, special knowledge, or effort for operation from the inside of the space. These provisions shall not apply to the doors described in 7.2.1.5.2 or the barriers described in 7.2.1.5.3.

7.2.1.5.2 Doors shall be permitted to have key-operated locks from the egress side, provided the requirements in 7.2.1.5.2.1 through 7.2.1.5.2.4 are met.

7.2.1.5.2.1 Key-operated locks shall be specifically permitted by Chapters 10 through 21.

▲ 7.2.1.5.2.2 On the egress side, on or adjacent to the door, there shall be a readily visible, durable sign that reads in letters not less than 2.5 cm (1 in.) high on a contrasting background:

THIS DOOR TO REMAIN UNLOCKED
WHEN THE SPACE IS OCCUPIED.

7.2.1.5.2.3 The locking device shall be of a type that is readily distinguishable as locked.

7.2.1.5.2.4 A key shall be available to any occupant inside the space.

7.2.1.5.3 Access barriers that are intended to protect the space or activities therein shall have closure operable from inside the space. Barriers intended to restrain persons within the space shall be continuously monitored by persons capable of opening the barrier.

7.2.1.5.4 Every stair enclosure door shall allow re-entry from the stair enclosure to the interior of the vessel.

7.2.1.5.5 A latch or other fastening device on a door shall be provided with a lever, handle, panic bar, or other simple type of releasing device having an obvious method of operation (under all lighting conditions). The releasing mechanism for any latch shall be located not more than 120 cm (47.2 in.) above the finished floor. Doors shall be capable of being opened with no more than one releasing operation, except as provided in 7.2.1.5.6.

7.2.1.5.6 Egress doors from individual staterooms shall be permitted to be provided with devices that require not more than one additional releasing operation, such as a night latch, dead bolt, or security chain, provided such device is operable from the inside without the use of a key or tool and is mounted at a height not to exceed 120 cm (47.2 in.) above the finished floor.

7.2.1.6 Exit Door Hardware.

7.2.1.6.1 Exit door hardware shall consist of a door-latching assembly that incorporates a device that releases the latch upon the application of a force in the direction of egress travel.

7.2.1.6.2 A door in the means of egress shall be equipped with exit door hardware that meets the following requirements:

- (1) Consists of bars or panels, the actuating portion of which shall extend across not less than one-half of the width of the door leaf, not less than 75 cm (29.5 in.) nor more than 110 cm (43.3 in.) above the floor
- (2) Causes the door latch to release when a force that shall not be required to exceed 65 N (14.8 lbf) is applied

7.2.1.6.3 Required exit door hardware shall not be equipped with any locking device, set screw, or other arrangement that can be used to prevent the release of the latch when pressure is applied to the releasing device. Devices that hold the latch in the retracted position shall be prohibited on exit door hardware unless listed and approved for such use.

7.2.1.7 Self-Closing Devices. A door designed to be kept normally closed in a means of egress shall be a self-closing door and shall not be secured in the open position at any time.

7.2.1.7.1 Doors in a means of egress shall be permitted to be held open where the requirements of 7.2.1.7.2 through 7.2.1.7.6 are met.

7.2.1.7.2 The hold-open mechanism shall be so designed that the door will automatically close upon release of the hold-open mechanism.

7.2.1.7.3 The release device shall be designed so that the door can be released instantly and, upon release, become self-closing manually (locally) and remotely from a continuously manned control station, or the automatic releasing mechanism or medium is activated by one of the following:

- (1) The operation of a listed, automatic smoke detection system installed to protect the entire vessel and, further, designed and installed to provide for actuation of the system in time to preclude the generation of heat or smoke sufficient to interfere with egress
- (2) The operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening
- (3) Operation of an automatic sprinkler system

7.2.1.7.3.1 These systems shall be permitted to be zoned as approved by the authority having jurisdiction.

7.2.1.7.4 Any fire detection system or smoke detector shall be so designed that it is provided with supervision and safeguards as are necessary to ensure reliability of operation in case of fire (see also Section 9.1).

7.2.1.7.5 Upon loss of power to the hold-open device, the hold-open mechanism shall be released and the door shall become self-closing.

7.2.1.7.6 The automatic release of one door in a stair enclosure shall result in the closing of all doors serving that stair.

7.2.1.8 Power-Operated Doors. Where required doors are operated by power, such as doors actuated by sensing devices upon the approach of a person or doors with power-assisted manual operation, the design shall be such that, in the event of power failure, the door can be opened manually to permit egress travel or closed where necessary to safeguard the means of egress. The forces required to open these doors manually shall not exceed those specified in 7.2.1.4.4 except that the force required to set the door in motion shall not exceed 220 N (50.1 lbf). The door shall be designed and installed so that,

when a force is applied to the door on the side from which egress is made, it shall be capable of swinging from any position to the full use of the required width of the opening in which it is installed. (See 7.2.1.4.) These provisions shall not apply to the power-operated doors in 7.2.1.8.1 through 7.2.1.8.5.

7.2.1.8.1 Sliding, power-operated doors in exit access that can be manually opened in the direction of door travel with forces not exceeding those specified in 7.2.1.4.3 shall not be required to have a swing-out feature.

7.2.1.8.2 In the emergency break-out mode, a door leaf located within a two-leaf opening shall be exempted from the minimum 80 cm (31.5 in.) single-leaf requirement of 7.2.1.3, if a minimum of 75 cm (29.5 in.) clear width is provided by the single leaf.

7.2.1.8.3 Doors complying with 7.2.1.9 shall not be required to comply with 7.2.1.8.

7.2.1.8.4 Doors fitted with an independent, local power source capable of operation a minimum of 10 times subsequent to loss of primary power shall not be required to comply with 7.2.1.8.

7.2.1.8.5 Power-operated watertight doors shall not be required to comply with 7.2.1.8.

7.2.1.9 Balanced Doors.

7.2.1.9.1 Where panic hardware is installed on balanced doors, the panic hardware shall be of the push-pad type.

7.2.1.9.2 The pad shall not extend more than approximately one-half the width of the door measured from the latch side.

7.2.1.10 Horizontal Sliding Doors. Horizontal sliding doors used in a means of egress shall comply with 7.2.1.10.1 through 7.2.1.10.6.

7.2.1.10.1 The door shall be operable by a simple method from either side without special knowledge or effort.

7.2.1.10.2 The force applied to the device that is required to operate the door shall not exceed 65 N (14.8 lbf) when the vessel is on an even keel.

7.2.1.10.3 The force required to operate the door shall not exceed 130 N (29.6 lbf) to set the door in motion and 65 N (14.8 lbf) to close the door or open it to the minimum required width when the vessel is on an even keel.

7.2.1.10.4 The door shall be operable with a force not to exceed 220 N (50.1 lbf) when a force of 1110 N (252.9 lbf) is applied perpendicularly to the door adjacent to the operating device when the vessel is on an even keel.

7.2.1.10.5 The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic-closing by smoke detection in accordance with 7.2.1.7.

7.2.1.10.6 The door assembly shall be installed in accordance with NFPA 80.

7.2.1.11 Watertight Doors. Watertight doors in a means of egress shall be the quick-acting or power-operated type.

7.2.2 Stairs.

7.2.2.1 General. Stairs, either interior or exterior, used as a component in the means of egress shall conform to the general

requirements of Section 7.1 and to the special requirements of 7.2.2, unless they are aisle steps in accommodation occupancies as provided in 21.2.10.2.

7.2.2.2 Types of Stairs.

7.2.2.2.1* Dimensional Criteria. Stairs shall be in accordance with Table 7.2.2.2.1.

7.2.2.2.2 Tread Slope. Tread slope shall not exceed 2.0 cm/m (0.24 in./ft) (a slope of 1 in 50).

7.2.2.2.3* Riser Height and Net Tread Depth.

7.2.2.2.3.1 Riser height shall be measured as the vertical distance between tread nosings.

7.2.2.2.3.2 Tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge, but shall not include beveled or rounded tread surfaces that slope more than 20 degrees (a slope of 1 in 2.75).

7.2.2.2.3.3 At tread nosings, such beveling or rounding shall not exceed 1.5 cm (0.6 in.) in horizontal dimension.

7.2.2.2.3.4 The total tread shall not be less than 25 cm (9.8 in.).

7.2.2.2.4 There shall be no variation exceeding 0.5 cm (0.2 in.) in the depth of adjacent treads or in the height of adjacent risers, and the tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 1.0 cm (0.4 in.) in any flight.

7.2.2.3 Stair Details.

7.2.2.3.1 All stairs serving as required means of egress shall be of permanent, fixed construction.

7.2.2.3.2 Stairs, platforms, and landings used to connect more than three decks shall be of noncombustible material throughout. Handrails shall not be required to be of noncombustible material.

7.2.2.3.3 Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel.

7.2.2.3.3.1 Every landing shall have a dimension measured in the direction of travel equal to the width of the stair.

Table 7.2.2.2.1 Stairs

Stair Requirements	Dimensions	
	cm	in.
Minimum width clear of all obstructions, except projections not exceeding 10 cm (3.9 in.) at or below handrail height on each side	90	35.4
Maximum height of risers	20	7.9
Minimum height of risers	10	3.9
Minimum net tread depth	24	9.4
Minimum headroom	205	80.7
Maximum height between landings	350	137.8
Landing	(See 7.2.1.4.3 and 7.2.2.3.)	

7.2.2.3.3.2 The dimensions of a landing shall not be required to exceed 120 cm (47.2 in.) where the stair has a straight run.

7.2.2.3.4 Stair treads shall be uniformly slip resistant and shall be free of projections or lips that could trip stair users.

7.2.2.3.5 Treads of stairs and landing floors shall be solid, unless they are noncombustible or grated stair treads and landings, in which case they shall be permitted to follow the provisions in Chapters 10 through 21.

7.2.2.3.6 Stairs shall be arranged so as to make clear the direction of egress to an area of refuge or an embarkation area. Stairs that continue beyond a level of exit discharge that is not obvious shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.

7.2.2.3.7 Spiral Stairs. Where specifically permitted for individual occupancies by Chapters 10 through 21, spiral stairs used as a means of egress shall comply with 7.2.2.3.7.1 through 7.2.2.3.7.6.

7.2.2.3.7.1 The occupant load served shall not exceed five.

7.2.2.3.7.2 The clear width of the stairs shall be not less than 65 cm (25.6 in.).

7.2.2.3.7.3 The height of risers shall not exceed 24 cm (9.4 in.).

7.2.2.3.7.4 Headroom shall be not less than 200 cm (78.7 in.).

7.2.2.3.7.5 Treads shall have a minimum depth of 20 cm (7.9 in.) at a point 30 cm (11.8 in.) from the narrower edge.

7.2.2.3.7.6 All treads shall be identical.

7.2.2.3.8 Turnstiles. No turnstiles or other devices to restrict the movement of persons shall be installed in such a manner as to interfere in any way with required means of egress facilities.

7.2.2.4 Guards and Handrails.

7.2.2.4.1 Guards. Means of egress such as stairs, landings, passageways, deck openings, ramps, aisles, galleries, or mezzanines that are more than 75 cm (29.5 in.) above the deck below shall be provided with guards to prevent falls over the open side.

7.2.2.4.2 Handrails. Each stair or ramp with a slope exceeding 1 in 12 shall have handrails on both sides.

7.2.2.4.2.1 Handrails shall be provided within 75 cm (29.5 in.) of all portions of the required egress width of stairs.

7.2.2.4.2.2 The required egress width shall be along the natural path of travel. (See also 7.2.2.4.5.)

7.2.2.4.3 Required guards and handrails shall continue for the full length of each flight of stairs. At turns of stairs, inside handrails shall be continuous between flights at landings.

7.2.2.4.4 The design of guards and handrails and the hardware for attaching handrails to guards, balusters, or bulkheads shall be such that there are no projections that could engage loose clothing.

7.2.2.4.5* Handrail Details.

7.2.2.4.5.1 Handrails on stairs shall be not less than 85 cm (33.5 in.) nor more than 95 cm (37.4 in.) above the surface of the tread, measured vertically to the top of the rail from the leading edge of the tread, unless the required handrails form

part of a guard, in which case they shall be permitted to have a maximum height of 105 cm (41.5 in.) measured vertically to the top of the rail from the leading edge of the tread.

7.2.2.4.5.2 Additional rails that are lower or higher than the main handrail shall be permitted.

7.2.2.4.5.3 Handrails shall provide a clearance of at least 4 cm (1.6 in.) between the handrail and the bulkhead to which it is fastened.

7.2.2.4.5.4 Handrails shall be designed so they can be grasped firmly with a comfortable grip and so the hand can be slid along the rail without encountering obstructions.

7.2.2.4.5.5 Handrail ends shall be returned to the bulkhead or deck or shall terminate at newel posts.

7.2.2.4.5.6 Handrails that are not continuous between flights shall extend horizontally, at the required height, at least 30 cm (12 in.) beyond the top riser, and continue to slope for a depth of one tread beyond the bottom riser where a guard or bulkhead exists.

7.2.2.4.5.7 Handrails on open sides of stairs shall have intermediate rails or an ornamental pattern such that a sphere 10 cm (3.9 in.) in diameter cannot pass through any openings in such handrail, except that the triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 15 cm (5.9 in.) in diameter cannot pass through the triangular opening.

7.2.2.4.5.8 Handrails shall be capable of withstanding a distributed horizontal load of 750 N/m (170.8 lbf/ft) applied in the direction normal to the bulkhead and a distributed load of 750 N/m (170.8 lbf/ft) applied in the downward direction.

7.2.2.4.6 Guard Details.

7.2.2.4.6.1 The height of guards required by 7.2.2.4.1 shall be measured vertically to the top of the guard from the top of the surface below.

7.2.2.4.6.2 Guards shall be not less than 100 cm (39.4 in.) high, except that guards in accommodation occupancies shall comply with the provisions of Chapter 10.

7.2.2.4.6.3 Open guards, in spaces other than engineering and machinery space occupancies and in storage occupancies,

shall have intermediate rails or an ornamental pattern such that a sphere 10 cm (3.9 in.) in diameter cannot pass through any opening, except that the triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 15 cm (5.9 in.) in diameter cannot pass through the triangular opening.

7.2.2.5 Special Provisions for Exterior Stairs.

7.2.2.5.1 Landings. Landings to which egress doors lead shall be approximately level [within 1 cm ($\frac{3}{8}$ in.)] with the adjoining deck.

7.2.2.5.2 Exterior stairs shall be permitted to be used as a component of egress where there is an obvious route or egress direction signage leading to an area of safe refuge or an embarkation area.

7.2.2.5.3 Exterior stairs shall be constructed of noncombustible material.

7.2.2.5.4 Exterior stairs, serving spaces with 10 or more persons, shall not be permitted to constitute more than 50 percent of the required egress capacity.

7.2.2.5.5 Exterior stairs shall comply with the requirements of Table 7.2.2.5.5 and subsequent sections.

7.2.2.6 Enclosure and Protection of Stairs.

7.2.2.6.1 Enclosures. All interior stairs serving as an exit or exit component shall be enclosed in accordance with 7.1.3.1. All other interior stairs shall be protected in accordance with 7.2.5.

7.2.2.6.2* Separation and Protection of Outside Stairs. Outside stairs that are part of a required means of egress shall be protected in accordance with 7.2.2.6.2.1 through 7.2.2.6.2.3.

7.2.2.6.2.1 Outside stairs shall be separated from the interior of the vessel by bulkheads with the fire resistance rating required for enclosed stairs with fixed or self-closing opening protectives.

7.2.2.6.2.2 The separation shall extend vertically from the freeboard deck to a point 3 m (10 ft) above the topmost landing of the stairs or to the deck, whichever is lower, and at least 3 m (10 ft) horizontally.

Table 7.2.2.5.5 Exterior Stairs

Stair Requirements	Dimensions for Stairs Serving More than 10 Persons		Dimensions for Stairs Serving 10 or Fewer Persons	
	cm	in.	cm	in.
Minimum widths	75 clear	29.5 clear	70 clear	27.5 clear
Minimum horizontal dimension of any landing or platform	between rails 75 clear	between rails 29.5 clear	between rails 70 clear	between rails 27.5 clear
Maximum riser height	22	8.7	30	11.8
Minimum tread, exclusive of nosing	22	8.7	15	5.9
Minimum nosing or projection	2.5	1	No requirement	
Spiral stairs	As permitted by 7.2.2.3.7		As permitted by 7.2.2.3.7	
Minimum headroom	200	80.4	200	80.4
Handrail height	85 to 95	32 to 37	85 to 95	32 to 37

7.2.2.6.2.3 Outside stairs shall be protected from adjacent interior spaces as follows:

- (1) Low-risk spaces shall not require protection.
- (2) Medium- and high-risk spaces that are not protected by sprinklers require A-0 protection.
- (3) Medium- and high-risk spaces that are protected by sprinklers require either A-0 protection or window sprinkler protection.

7.2.2.6.3 There shall be no enclosed, usable space within an exit enclosure, including under stairs, nor shall any open space within the enclosure, including stairs and landings, be used for any purpose, such as storage or similar use, that could interfere with egress, unless the enclosed usable space meets the requirements of 7.2.2.6.4.

7.2.2.6.4 Enclosed usable space under stairs shall be permitted, provided the bulkheads and soffits of the enclosed space are protected in the same manner as the stair enclosure. Entrance to such enclosed usable space under stairs shall not be from within the stair enclosure.

7.2.2.7 Signs. Stairs shall be provided with **approved** signage within the enclosure at each deck landing.

7.2.2.7.1 The signage shall be inside the enclosure located approximately 1.5 m (5 ft) above the floor landing in a position that is visible when the door is in either the open or closed position.

7.2.2.7.2 The signage shall indicate the deck level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair.

7.2.2.7.3 The signage also shall state the deck level of, and the direction to, the exit discharge.

7.2.3 Smokeproof Enclosures.

7.2.3.1 Where smokeproof enclosures are required by other sections of this code, they shall comply with 7.2.3.

7.2.3.2 A smokeproof enclosure shall be an enclosure designed so that the movement of products of combustion produced by a fire occurring in any part of the vessel into the smokeproof enclosure shall be limited.

7.2.3.3 The appropriate design method shall be any system that meets the performance level stipulated in 7.2.3.2. The smokeproof enclosure shall be permitted to be created by using natural ventilation, by using mechanical ventilation incorporating a vestibule, or by pressurizing the enclosure.

7.2.3.4 Enclosure. Where a vestibule is used, it shall be within the enclosure and shall be considered part of the smokeproof enclosure. Vestibules shall have a minimum dimension of 110 cm (43.5 in.) in width and 185 cm (72.8 in.) in the direction of travel.

7.2.3.5 Discharge. Every smokeproof enclosure shall open to an adjacent smokeproof enclosure, to an open deck having direct access to an embarkation area, or into an exit access or exit.

7.2.3.5.1 The exit passageway shall be separated from the remainder of the vessel by A-0 Class divisions.

7.2.3.5.2 The exit passageways shall be without openings other than the entrance from the smokeproof enclosure and the door to the open deck or to the embarkation area.

7.2.3.6 Access. Access to spaces other than smokeproof enclosures consisting of a pressurized stair enclosure shall be by way of a vestibule, an exit, an exit access, a stair enclosure, or by way of an open deck.

7.2.3.7 Natural Ventilation. Doors to smokeproof enclosures using natural ventilation shall either be normally closed, self-closing, or shall be automatic-closing by actuation of a smoke detector within 3 m (9.8 ft) of the vestibule door.

7.2.3.8 Mechanical Ventilation. Smokeproof enclosures by mechanical ventilation shall comply with 7.2.3.8.1 through 7.2.3.8.4.

7.2.3.8.1 The door assembly from the vessel into the vestibule shall be normally closed, self-closing, or automatic-closing by actuation of a smoke detector located within 3 m (9.8 ft) of the vestibule door and remotely from the bridge or a central control station.

7.2.3.8.2 In the smoke control mode, the vestibule shall be provided with not less than one air change per minute, and the exhaust shall be 150 percent of the supply.

7.2.3.8.2.1 Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for those purposes.

7.2.3.8.2.2 Supply air shall enter the vestibule within 15 cm (5.9 in.) of the deck level.

7.2.3.8.2.3 The top of the exhaust register shall be located not more than 15 cm (5.9 in.) down from the top of the trap and shall be entirely within the smoke trap area.

7.2.3.8.2.4 Doors, when in the open position, shall not obstruct duct openings.

7.2.3.8.2.5 Controlling dampers shall be permitted in duct openings if needed to meet the design requirements, but are not otherwise required.

7.2.3.8.3 To serve as a smoke and heat trap and to provide an upward-moving air column, the vestibule ceiling shall be at least 50 cm (19.7 in.) higher than the door opening into the vestibule. The height shall be permitted to be decreased where justified by engineering design and field testing.

7.2.3.8.4 The smokeproof enclosure shall be provided with a dampered relief opening at the top and supplied mechanically with sufficient air to discharge a minimum of 1200 L/sec (2543 ft³/min) through the relief opening while maintaining a minimum positive pressure of 25 Pa (0.10 in. water column) in the enclosure relative to the vestibule with all doors closed.

7.2.3.9 Activation of Mechanical Ventilation Systems. The activation of the systems shall be initiated by a smoke detector installed in an approved location within 3 m (9.8 ft) of the entrance to the smokeproof enclosure; or by an automatic sprinkler system; by remote manual operation from the bridge, a central control station, or other location that is continuously manned.

7.2.3.10 Door Closers. The activation of an automatic-closing device on any door in the smokeproof enclosure shall activate all other automatic-closing devices on doors in the smokeproof enclosure.

7.2.3.11 Standby Power. Standby power for mechanical ventilation equipment shall be provided by an emergency source of power.

7.2.3.12 Testing. Before the mechanical equipment is accepted by the authority having jurisdiction, it shall be tested to confirm that the mechanical equipment is operating in compliance with these requirements.

7.2.3.13 Emergency Lighting. All smokeproof enclosures and vestibules shall be provided with emergency lighting powered by the standby power system (see 7.2.3.11).

7.2.4 Horizontal Exits.

7.2.4.1 Application. Horizontal exits shall be permitted to be substituted for other exits to the extent that the total egress capacity of the other exits (e.g., stairs, ramps, doors leading outside the vessel) will not be reduced below half that required for the entire deck area of the occupancy if no horizontal exit existed.

7.2.4.2 Horizontal Exit Division.

7.2.4.2.1 Every area for which credit is allowed in connection with a horizontal exit shall have at least one exit that is not a horizontal exit in addition to the horizontal exit or exits.

7.2.4.2.2 Every horizontal exit for which credit is given shall be arranged so that there is at least one exit leading from each side of the horizontal exit to stairways or other means of egress leading to an area of refuge or embarkation area.

7.2.4.3 Egress from Horizontal Exits. Where the horizontal exit is intended to be used for egress from both sides of a horizontal exit, the deck area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas, allowing not less than 0.30 m² (3.2 ft²) clear floor area per person.

7.2.4.4 Doors in Horizontal Exits.

7.2.4.4.1 Doors in horizontal exits shall comply with 7.2.1.4.

7.2.4.4.2 Swinging fire doors used in horizontal exits shall comply with 7.2.4.4.2.1 through 7.2.4.4.2.3.

7.2.4.4.2.1 These fire doors shall swing in the direction of egress travel.

7.2.4.4.2.2 Where a horizontal exit serves areas on both sides of a fire barrier, there shall be adjacent openings with swinging doors, opening in opposite directions, with signs on each side of the fire barrier indicating the door that swings with the travel from that side.

7.2.4.4.2.3 Horizontal exits shall be of any other approved arrangement, provided that doors always swing with any possible egress travel.

7.2.4.4.3 Doors in horizontal exits shall be designed and installed to minimize air leakage.

7.2.4.4.4 All fire doors in horizontal exits shall be self-closing or automatic-closing in accordance with 7.2.1.7.

7.2.4.4.5 Horizontal exit doors located across a corridor shall be automatic-closing in accordance with 7.2.1.7.

7.2.4.5 Boundaries for Horizontal Exits. Boundaries separating areas between which there are horizontal exits shall be A-60 Class divisions, unless they meet the requirements provided

in 7.2.4.6 or 7.2.4.7. They shall provide a separation continuous from sideshell to sideshell and from deck to deck.

7.2.4.6 Where an A-60 Class division is used to provide a horizontal exit in any deck of a vessel, it shall not be required on other decks if the decks on which the boundary is omitted are separated from the deck with the horizontal exit by an A-60 Class division.

7.2.4.7 Alternative provisions for boundaries in Chapters 19 through 21 shall supersede the requirements of 7.2.4.5.

7.2.5 Ramps.

7.2.5.1 General. Every ramp used as a component in a means of egress shall conform to the general requirements of Section 7.1 and to the special requirements of 7.2.5.

7.2.5.2 Dimensional Criteria. Ramps shall be in accordance with Table 7.2.5.2, except for aisle ramps as permitted for accommodation occupancies in Chapter 21.

7.2.5.3 Ramp Details.

7.2.5.3.1 Landings. Ramps shall have landings at the top, at the bottom, and at doors opening onto the ramp.

7.2.5.3.1.1 The slope of the landing shall not be steeper than 1 in 50.

7.2.5.3.1.2 Every landing shall have a dimension measured in the direction of travel not less than the width of the ramp.

7.2.5.3.1.3 Ramp dimensions shall not be required to exceed 120 cm (47.2 in.) where the ramp has a straight run.

7.2.5.3.2 Slip Resistance. A ramp shall have a slip-resistant surface.

7.2.5.3.3 Changes in Direction of Travel. Changes in direction of travel, if any, shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.

7.2.5.3.4 Drop-Offs. Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from traveling off the edge of the ramp. Curbs or barriers shall be a minimum of 10 cm (3.9 in.) in height.

Table 7.2.5.2 Ramps

Ramp Details	Requirements
Minimum width clear of all obstructions, except projections not exceeding 9 cm (3.5 in.) at or below handrail height on each side	115 cm (45 in.)
Maximum slope	For rise ≥ 15 cm (6 in.): 1 in 12 For rise >7.5 cm (3 in.) and <15 cm (6 in.): 1 in 10 For rise ≤ 7.5 cm (3 in.): 1 in 8
Maximum cross-slope	1 in 48
Maximum rise for single ramp run	75 cm (30 in.)

7.2.5.3.5 Ramps Serving as Required Means of Egress.

7.2.5.3.5.1 All ramps serving as required means of egress shall be of permanent, fixed construction.

7.2.5.3.5.2 A ramp used as a means of egress shall be constructed of noncombustible material. Deck coverings on ramps shall comply with 8.3.4. The ramp floor and landings shall be solid and without perforations.

7.2.5.4 Guards and Handrails. Guards complying with 7.2.2.4 shall be provided for ramps. Handrails complying with 7.2.2.4 shall be provided along both sides of a ramp segment steeper than 1 in 20. The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto, except for guards and handrails provided for ramped aisles in accommodation occupancies in accordance with Chapter 21.

7.2.5.5 Special Provisions for Outside Ramps. Balconies or landings to which doors lead shall be approximately level [within 1 cm ($\frac{3}{8}$ in.)] with the deck of the vessel.

7.2.5.6 Water Accumulation. Outside ramps and landings shall be designed to prevent water from accumulating on their surfaces.

7.2.5.7 Enclosure and Protection of Ramps. Ramps in a required means of egress shall be enclosed or protected as a stair in accordance with 7.2.2.6.

7.2.6* Exit Passageways.

7.2.6.1 General. Exit passageways shall conform to the general requirements of Section 7.1 and to the special requirements of 7.2.6.

7.2.6.2 Enclosure. An exit passageway shall be separated from other parts of the vessel as specified in 7.1.3.1.

7.2.6.3 Stair Discharge. An exit passageway that serves as a discharge from a stair enclosure shall have the same fire resistance rating and opening-protective fire protection rating as that required for the stair enclosure.

7.2.6.4 Width. The width of an exit passageway serving a single deck shall be adequate to accommodate the aggregate required capacity of all exits discharging through it. The width of an exit passageway serving more than one deck shall comply with 7.3.1.4.

7.2.6.5 Deck. The deck shall be solid and without perforations.

7.2.7 Service Stairs and Ladders.

7.2.7.1 General. Service stairs and ladders shall be designed to be used for egress from areas accessible only to able-bodied crew.

7.2.7.2 Dimensional Criteria. Service stairs and ladders shall comply with the requirements of Table 7.2.7.2.

7.2.7.3 Construction Materials. Service stairs and ladders shall be constructed of steel or equivalent materials, unless otherwise permitted in Chapters 10 through 21.

7.2.7.4 Construction and Installation.

7.2.7.4.1 Service ladders shall comply with the requirements of ASTM F840, *Standard Specification for Ladders, Fixed, Vertical, Steel, Ship's*.

Table 7.2.7.2 Service Stairs and Ladders

Stair Requirements	Dimensions	
	cm	in.
Minimum width	70	27.5
Minimum horizontal dimension of landing or platform	70	27.5
Maximum riser height	30	11.8
Minimum net tread depth	17	6.7
Minimum total tread depth	25	9.8
Hand rail height	85 to 95	33.5 to 37.5
Minimum headroom	200	79
Spiral stairs	As permitted by 7.2.2.3.7	

7.2.7.4.2 Ladders installed with a pitch less than 75 degrees shall not be permitted.

7.2.8 Vertical Ladders.

7.2.8.1 General. Vertical ladders shall be permitted to be used for egress from areas accessible only to able-bodied crew.

7.2.8.2 Construction and Installation. Vertical ladders shall be constructed of steel unless otherwise permitted in Chapters 19 through 21.

7.2.8.2.1 Each ladder used as a means of escape shall be mounted at least 18 cm (7 in.) from the nearest permanent object in back of the ladder measured to the closest portion of the ladder.

7.2.8.2.2 Rungs shall be constructed as follows:

- (1) At least 40.5 cm (16 in.) in width
- (2) Not more than 30.5 cm (12 in.) apart, and uniformly spaced for length of the ladder with at least 11 cm (4.5 in.) clearance above each rung

7.2.8.2.3 When a deck scuttle serves as a means of escape, it shall not be less than 45.5 cm (18 in.) in diameter and shall be fitted with a quick-acting release and a holdback device to hold the scuttle in an open position.

7.2.8.3 The lowest rung of any ladder shall be not more than 30 cm (11.8 in.) above the level of the surface beneath it.

7.2.9* Alternating Tread Devices.

7.2.9.1 Alternating tread devices that comply with 7.2.9.2 shall be permitted to be used only as follows:

- (1) To provide access to unoccupied upper deck areas
- (2) To provide a second means of egress from spaces subject to occupancy only by able-bodied crew

7.2.9.2 Alternating tread devices shall comply with 7.2.9.2.1 through 7.2.9.2.10.

7.2.9.2.1 Handrails shall be provided on both sides of alternating tread devices in accordance with 7.2.2.4.5.

7.2.9.2.2 The clear width between handrails shall be a minimum of 45 cm (17.7 in.) and shall not exceed 60 cm (23.6 in.).

7.2.9.2.3 Headroom shall not be less than 2 m (6.6 ft).

7.2.9.2.4 The angle of the device shall be between 50 and 68 degrees to horizontal.

7.2.9.2.5 The height of the riser shall not exceed 25 cm (9.8 in.).

7.2.9.2.6 Treads shall have a minimum projected tread depth of 15 cm (5.9 in.) measured in accordance with 7.2.2.2.3, with each tread providing 25 cm (9.8 in.) of depth, including tread overlap.

7.2.9.2.7 A minimum distance of 15 cm (5.9 in.) shall be provided between the stair handrail and any other object.

7.2.9.2.8 The initial tread of the stair shall begin at the same elevation as the platform, landing, or deck surface.

7.2.9.2.9 The alternating treads shall not be laterally separated by more than 5 cm (2 in.).

7.2.9.2.10 The occupant load served shall be three or fewer.

7.2.10 Areas of Refuge.

7.2.10.1 Area of Refuge Details.

7.2.10.1.1 An area of refuge, other than weather deck areas of refuge, shall comply with the requirements in 7.2.10.1.1.1 through 7.2.10.1.1.3.

7.2.10.1.1.1 An area of refuge shall be bounded by A-60 Class divisions, unless otherwise provided in Chapters 19 through 21.

7.2.10.1.1.2 An area of refuge shall be located above the waterline.

7.2.10.1.1.3 An area of refuge shall be a smokeproof enclosure in accordance with 7.2.3, unless the vessel is protected throughout by an approved, supervised automatic sprinkler system.

7.2.10.1.2 Ducts shall be permitted to penetrate A-60 Class divisions, unless prohibited by other provisions of this code, and shall be provided with smoke-actuated dampers meeting the requirements of Type I-250 or Type II-250 as defined in ANSI/UL 555S, *Smoke Dampers*, or other approved means to resist the transfer of smoke into the area of refuge.

7.2.10.2 An area of refuge shall have access to an embarkation area by means protected as required for an exit.

7.2.10.3 Where the exit used to provide egress from an area of refuge to an embarkation area (as required by 7.2.10.2) includes stairs, the stairs shall comply with 7.2.2.

7.2.10.4* The area of refuge shall be provided with a two-way communication system for communication between the area of refuge and a central control point.

7.2.10.5 Instructions for summoning assistance, via the two-way communication system, and written identification of the area of refuge location shall be posted adjacent to the two-way communication system.

7.2.10.6 Windows Facing Exterior Areas of Refuge. Windows facing exterior areas of refuge shall not be openable and shall be protected in accordance with any one of the requirements of 7.2.10.6.1 through 7.2.10.6.4, unless otherwise permitted by Chapters 19 through 21.

7.2.10.6.1 Windows facing exterior areas of refuge shall not be required to meet any integrity and shall be fitted with an A-60 Class steel shutter.

7.2.10.6.2 Windows facing exterior areas of refuge shall be required to be A-60 Class divisions.

7.2.10.6.3 Windows facing exterior areas of refuge shall be required to be A-0 Class divisions and be protected with sprinklers along the windows inside the space.

7.2.10.6.4* Windows facing exterior areas of refuge shall not be required to meet any integrity and shall be protected with window sprinklers in accordance with 9.2.7.

7.2.10.7 The door to the area of refuge shall be identified by signage.

7.2.10.8 Protection of Exterior Boundaries Below Exterior Areas of Refuge. Exterior boundaries below areas of refuge but above the waterline, including windows, shall be minimum A-0 Class divisions.

7.2.10.9 Embarkation Areas. Embarkation areas shall be protected as required for exterior areas of refuge. Windows in any spaces below embarkation spaces shall be protected in accordance with 7.2.10.6.

7.2.11* General Requirements for Aisles and Aisle Accessways.

7.2.11.1 The width of aisle accessways and aisles shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle accessway or aisle. Where aisle accessways or aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisle accessways and aisles.

7.2.11.2 Those portions of aisle accessways and aisles where egress is possible in either direction shall be uniform in required width.

7.2.11.3 Where nonfixed seating is located between a table and an aisle accessway or aisle, the measurement of required clear width of the aisle accessway or aisle shall be made to a line 50 cm (19.7 in.) away from the edge of the table. The 50 cm (19.7 in.) distance shall be measured perpendicular to the edge of the table.

7.2.11.4 The minimum required clear width of an aisle accessway within areas with fixed table locations shall be 30 cm (11.8 in.). The path of travel from any seat shall not exceed 10 m (32.8 ft) to the closest aisle or exit.

7.2.11.5 Aisle accessways between rows of theater-type seating shall have a clear width of not less than 30 cm (11.8 in.) and a maximum travel distance to an aisle or an exit of no more than 10 m (32.8 ft).

7.2.11.6 The minimum clear width of aisles shall be 50 cm (19.7 in.).

7.2.11.7 Aisle Stairs and Ramps.

7.2.11.7.1 Aisles that have a gradient steeper than 1 in 20, but not steeper than 1 in 8, shall consist of a ramp. Aisles that have a gradient steeper than 1 in 8 shall consist of an aisle stair.

7.2.11.7.2 Aisle stairs shall conform to the following:

- (1) There shall be no variation exceeding 0.5 cm (0.2 in.) in the depth of adjacent treads.
- (2) Treads shall be a minimum 28 cm (11 in.).

- (3) Riser heights shall be a minimum 10 cm (3.9 in.) and a maximum 22 cm (8.7 in.) and shall be uniform to within 0.5 cm (0.2 in.) between adjacent risers.

7.2.11.8 Aisle Handrails. Ramped aisles having a gradient exceeding 1 in 12 and aisle stairs shall be provided with handrails at one side or along the centerline.

7.3 Capacity of Means of Egress.

7.3.1 Occupant Load.

7.3.1.1 The total capacity of the means of egress for any deck, balcony, or other occupied space shall be sufficient for the occupant load thereof.

7.3.1.2 The occupant load in any vessel or portion thereof shall not be assumed to be less than the number determined by dividing the deck area by the occupant load factor that corresponds to the assigned use as specified in Chapters 10 through 18 for individual occupancies. Where both gross and net area figures are given for the same occupancy, calculations shall be made applying the gross area figure to the gross area of the portion of the vessel devoted to its specified use and applying the net area figure to the net area of the specified use.

7.3.1.3 The occupant load permitted in any vessel or portion thereof shall be permitted to be increased from that number established for the given use as specified in 7.3.1.2, where all other requirements of this code are also met, based on such increased number. The authority having jurisdiction shall be permitted to require an approved aisle, seating, or fixed equipment diagram to substantiate any increase in occupant load and shall be permitted to require that such diagram be posted in an approved location.

7.3.1.4 Where exits serve more than one deck, only the occupant load of each deck considered individually shall be required to be used in computing the capacity of the exits at that deck, provided that the required egress capacity of the exit shall not be decreased in the direction of egress travel.

7.3.1.5 Where means of egress from decks above and below converge at an intermediate deck, the capacity of the means of egress from the point of convergence shall be not less than the sum of the two.

7.3.1.6 Where any required egress capacity from a mezzanine passes through the space below, that required capacity shall be added to the required egress capacity of the space in which it is located.

7.3.2 Measurement of Means of Egress. Width of means of egress shall be measured in the clear (independent of permitted projections) at the narrowest point of the exit component under consideration. Projections not to exceed 8 cm (3.1 in.) on each side shall be permitted at and below handrail height.

7.3.3 Egress Capacity.

7.3.3.1 Egress capacity for components of means of egress shall be based on the requirements in 7.3.3.1.1 through 7.3.3.1.3.

7.3.3.1.1 Stairway width shall be 0.8 cm (0.3 in.) per person.

7.3.3.1.2 Level components and ramp widths shall be 0.5 cm (0.2 in.) per person.

7.3.3.1.3 Stairway widths shall be permitted to be sized in accordance with IMO Assembly Resolution A757(18), *Standard*

for the Calculation of the Width of Stairways Forming Means of Escape on Passenger Ships.

7.3.3.2 The required capacity of a corridor shall be the occupant load utilizing the corridor for exit access divided by the required number of exits to which the corridor connects, but shall not be less than the required capacity of the exit to which the corridor leads.

7.3.4 Minimum Width.

7.3.4.1 The minimum width of any means of egress shall be as specified for a given egress component by Section 7.2, for individual occupancies by Chapters 10 through 21, or as indicated in 7.3.4.2.

7.3.4.2 The minimum width exit access formed by furniture and movable partitions, serving not more than six people and less than 15 m (49.2 ft) in length, shall be not less than 50 cm (19.7 in.) at and below 100 cm (39.4 in.) height or 70 cm (27.6 in.) above 100 cm (39.4 in.) height, provided the minimum 90 cm (35.4 in.) can be provided without moving permanent bulkheads.

7.3.4.3 Where a single exit access leads to an exit, its capacity in terms of width shall be at least equal to the required capacity of the exit to which it leads. Where more than one exit access leads to an exit, each shall have a width adequate for the number of persons it shall accommodate.

7.4 Number of Separate Means of Egress.

7.4.1 General.

7.4.1.1 The minimum number of separate means of egress from any deck, occupancy, or portion thereof shall be two, unless a single means of egress is permitted by Chapters 10 through 21. A mezzanine shall be permitted to have a single means of egress, provided the common path of travel limitations of Chapters 10 through 21 are not exceeded.

7.4.1.2 Only the egress requirements of each level considered individually shall be required to be used in computing the number of means of egress at that level, provided that the required number of means of egress shall not be decreased in the direction of egress travel.

7.5 Arrangement of Means of Egress.

7.5.1 General.

7.5.1.1 Exits shall be located and exit access shall be arranged so that exits are unobstructed and accessible at all times.

7.5.1.2 Where exits are not immediately accessible from an open area, safe and continuous passageways, aisles, or corridors leading directly to every exit shall be maintained and shall be arranged to provide access for each occupant to at least two exits by separate ways of travel unless a single exit is permitted by Chapters 10 through 21.

7.5.1.3 Where common paths of travel are permitted for an occupancy by Chapters 10 through 21, such common paths of travel shall be permitted but shall not exceed the limit specified.

7.5.1.4 Where more than one exit is required from an occupancy, such exits shall be remotely located from each other and shall be arranged and constructed to minimize the possibility that more than one can be blocked by any one fire or other emergency condition.

7.5.1.5* If two exits or exit access doors are required, they shall be placed at a distance from one another equal to, but not less than, one-half the length of the maximum overall diagonal dimension of the occupancy or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors, unless otherwise provided in 7.5.1.6. Where exit enclosures are provided as the required exits and are interconnected by a passageway conforming to the requirements of 7.1.3.5, exit separation shall be permitted to be measured along the line of travel within the corridor. Where more than two exits or exit access doors are required, at least two of the required exits or exit access doors shall be located so that if one becomes blocked, the others will be available.

7.5.1.6 In vessels protected throughout by an approved, supervised automatic sprinkler system in accordance with 9.2.7, the minimum separation distance between two exits or exit access doors measured in accordance with 7.5.1.5 shall be not less than one-third the length of the maximum overall diagonal dimension of the area to be served.

7.5.1.7* Interlocking or scissor stairs shall be permitted to be considered separate exits if enclosed in accordance with 7.1.3.1 and separated from each other by A-Class divisions. There shall be no penetrations or communicating openings, whether protected or not, between the stair enclosures.

7.5.1.8 Exit access shall be arranged so that there are no dead ends in corridors, unless otherwise permitted by Chapters 10 through 21.

7.5.1.9 Exit access from spaces shall be permitted to be through adjoining or intervening spaces or areas, provided such adjoining spaces are accessory to the area served. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening spaces.

7.5.2 Impediments to Egress. See also 7.1.7 and 7.2.1.5.

7.5.2.1 Access to an exit shall not be permitted to be through galleys, storerooms, restrooms, engineering and machinery spaces, closets, staterooms or similar spaces, or any spaces with doors that can be locked, except that exit access in specific occupancies shall be permitted to pass through rooms or spaces subject to locking, as provided in Chapter 11.

7.5.2.2 Exit access and exit doors shall be designed and arranged to be clearly recognizable.

7.5.2.2.1 Hangings or draperies shall not be placed over exit doors or otherwise located to conceal or obscure any exit.

7.5.2.2.2 Mirrors shall not be placed on exit doors.

7.5.2.2.3 Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.

7.5.3 Exterior Ways of Exit Access.

7.5.3.1 Exit access shall be permitted to be by means of any exterior landing or open deck that conforms to the requirements of Chapter 7.

7.5.3.2 The long side of the landing or open deck shall be at least 50 percent open and shall be arranged to prevent the accumulation of smoke.

7.5.3.3 Exterior exit-access landings shall be separated from the interior of the vessel by bulkheads and opening protectives as required for corridors, unless the exterior exit-access land-

ing is served by at least two remote stairs that can be accessed without any occupant needing to travel past an unprotected opening to reach one of the stairs.

7.5.3.4 There shall be no obstruction by railings, barriers, or gates that divides the open space into sections appurtenant to individual rooms or other subdivisions.

7.5.3.5 An exterior exit access shall be arranged so that there are no dead ends in excess of 7 m (23 ft).

7.5.3.6 Any landing or other exterior exit access that projects beyond the outside bulkhead of the vessel shall comply with the requirements of Chapter 7 as to width and arrangement.

7.5.3.7 An exterior exit access shall have solid, approximately level decks and shall have guards that are at least equivalent to those specified in 7.2.2.4 on unenclosed sides more than 75 cm (29.5 in.) above the deck or level below.

7.6 Measurement of Travel Distance to Exits.

7.6.1 The maximum travel distance in any occupied space to at least one exit, measured in accordance with the following requirements, shall not exceed the limits specified by Chapters 10 through 21.

7.6.2 The travel distance to an exit shall be measured on the deck or other walking surface along the centerline of the natural path of travel starting from the most remote point subject to occupancy, curving around any corners or obstructions with a 0.3 m (1.0 ft) clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. Where measurement includes stairs, the measurement shall be taken in the plane of the tread nosing.

7.6.3 Where open stairways or ramps are permitted as a path of travel to required exits, such as between mezzanines or balconies and the deck below, the distance shall include the travel on the stairway or ramp and the travel from the end of the stairway or ramp to an outside door or other exit in addition to the distance traveled to reach the stairway or ramp.

7.6.4* Where any part of an exterior exit is within 3 m (9.8 ft) horizontal distance of any unprotected vessel opening, as permitted by 7.2.2.6.2 for outside stairs, the travel distance to the exit shall include the length of travel to the embarkation area or area of refuge.

7.7 Discharge from Exits.

7.7.1 All exits shall terminate directly at an exit discharge, an area of refuge, or an embarkation area, unless otherwise permitted in 7.7.2 and 7.7.5. Open decks, or other portions of the exit discharge, shall be of required width and size to provide all occupants with safe access to an embarkation area.

7.7.2 At least 50 percent of the required number of exits, comprising at least 50 percent of the required egress capacity, shall discharge directly to an area of refuge or an embarkation area. Exits that do not discharge to an area of refuge or an embarkation area shall meet the requirements in 7.7.2.1 through 7.7.2.3.

7.7.2.1 The exit shall lead to a free and unobstructed way to an area of refuge or embarkation area that is visible and identifiable from the point of discharge from the exit.

7.7.2.2 The exit shall provide protection throughout by an approved, automatic sprinkler system or have the portion of