

NFPA 301

Code for Safety to Life from Fire on Merchant Vessels

1998 Edition



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An International Codes and Standards Organization

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NFPA 301

Code for

Safety to Life from Fire on Merchant Vessels

1998 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 and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998.

This edition of NFPA 301 was approved as an American National Standard on August 6, 1998.

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 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 regulated community benefits through increased input into the rules the marine industry would subsequently be required to follow. Similar efforts have either 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.

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

Information on referenced publications can be found in Chapter 20 and Appendix C.

Chapter 1 Administration

1-1* Title. NFPA 301, *Code for Safety to Life from Fire on Merchant Vessels*, shall be known as the *Merchant Vessel Code* and is referred to herein as “this code” or “the code.”

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 might involve unreasonable hardships or unnecessary inconvenience or interference with the normal use of a vessel, but provides minimum requirements for fire safety consistent with the public interest.

1-3 Scope.

1-3.1 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.

1-3.2 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.

1-3.3 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 accordingly.

1-3.4* 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.

1-4 Application.

1-4.1* This code shall apply to new construction merchant vessels. This code shall also apply to all towing vessels 12 m (39.4 ft) or more in length; all vessels that carry cargo; and all vessels that carry more than 12 passengers.

Exception: Pleasure craft, which are covered by NFPA 302, Fire Protection Standard for Pleasure and Commercial Motor Craft, and war ships.

1-4.2 Existing vessels undergoing major modification or conversion shall comply with all requirements of this code within the areas being modified and ancillary support systems.

1-4.3 Any alteration or any installation of new equipment, joinery, or furnishings shall comply with the requirements for new construction.

1-4.4 Where specific requirements contained in Chapters 8 through 16 differ from general requirements contained in Chapters 1 through 7, the requirements of Chapters 8 through 16 shall govern. Where the requirements in Chapters 17 through 19 differ from the requirements in Chapters 1 through 16, the requirements in Chapters 17 through 19 shall govern.

1-4.5 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.

1-4.6* This code is not intended for application to vessels in international trade.

1-5 Equivalency Concepts.

1-5.1 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. (*See Appendix B.*)

1-5.2 The specific requirements of this code shall be permitted to be modified by the authority having jurisdiction 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 authority having jurisdiction, would be provided by compliance with the corresponding provisions contained in this code.

1-5.3 Vessels with alternative fire protection features accepted by the authority having jurisdiction shall be considered as conforming with the code.

1-6 Units.

1-6.1 Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

1-6.2 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.

1-7 Vessel Construction, Repair, and Alteration.

1-7.1* Vessels built or converted to meet this code shall comply with all of the provisions of the code.

1-7.2 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.

1-7.3 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.

Exception: The use of temporarily installed fire protection features shall be permitted while the ship's systems are out of service during ship's repairs. Temporary systems shall comply with Section 1-5 of this code.

1-8 Maintenance.

1-8.1 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.

1-8.2 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.

Chapter 2 Fundamental Requirements

2-1* Fundamentals. These requirements shall be used in applying this code.

- (a) Limit fire to the space and deck of origin
- (b) Provide for 100 percent self-sufficiency in extinguishing or controlling fires, protecting lives, and protecting property
- (c) Provide protected escape routes for egress
- (d) Provide areas of refuge
- (e) Provide for rapid improvement of requirements as marine and fire protection technology advances
- (f) Recognize the role of fire-fighting training of crew
- (g) Provide adequate inspection, maintenance, and house-keeping requirements

2-2 Fundamentals of Means of Egress.

2-2.1 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.

2-2.2 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.

2-2.3 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.

Exception: Security areas.

2-2.4 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 readily 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 acceptable exits. Every effort shall be taken to avoid occupants mistakenly traveling into dead-end spaces in a fire emergency.

2-2.5 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.

2-2.6 Every designated vertical egress opening between decks of a vessel shall be suitably enclosed or protected to afford reasonable 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.

2-3 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 reasonably necessary to defend in place or for that period of time needed to abandon ship.

2-4 Fundamentals of Illumination. Where artificial illumination is required, egress facilities shall be included in the lighting design in an adequate and reliable manner.

2-5 Fundamentals of Alarms. In every vessel of such size, arrangement, or service such that a fire itself might not provide adequate occupant warning, alarm facilities shall be provided where necessary to warn of the existence of fire and smoke.

Chapter 3 Definitions

3-1 General.

3-1.1 The following terms, for the purposes of this code, shall have the meanings given in this chapter, if not otherwise modified for a specific occupancy.

3-1.2 Words used in the present tense include the future; words used in the masculine gender include the feminine; the singular number includes the plural and the plural the singular.

3-1.3 Terms not defined in this chapter shall have their ordinarily accepted meanings or such as the context implies.

3-2 Definitions.

A-Class Division. See 6-2.4.2.1.

A-Class Door. See 6-2.4.3.1.

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

Accommodation Spaces. See 4-1.2 or Chapter 8.

Approved.* Acceptable to the authority having jurisdiction.

Area of Refuge. See 5-1.2.

Atrium. A continuous series of deck opening 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.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Balcony. Deck area that projects from a bulkhead.

B-Class Division. See 6-2.4.2.2.

B-Class Door. See 6-2.4.3.2.

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

Bulkhead Panel. A component of a division or bulkhead. Bulkhead panels are fitted together with joiner components to form a bulkhead.

C-Class Division. See 6-2.4.2.3.

C'-Class Division. See 6-2.4.2.3 (b).

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

Cargo. A product that is transported for trade and not used for the vessel's operation.

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

Cargo Space. See 4-1.8.

Ceiling.* A ceiling is a horizontal division within a space for the purpose of decoration, acoustics, or fire protection.

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

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.

Combustible Material. Material made of or surfaced with wood, compressed paper, plant fibers, plastics, or other material that will ignite and burn, whether flame-proofed or not, or whether plastered or unplastered.

Common Path of Travel. See 5-1.2.

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

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

Deck. A horizontal division in a vessel's structure.

Deck Covering.* A material applied to a deck for purposes of increasing the fire or thermal endurance of the deck.

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

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

Draft Stop.* A division installed vertically between the ceiling or lining and the vessel's structure or horizontally between a bulkhead and the vessel's structure.

Electrical and Control Spaces. Electrical and control spaces are those used for the control and management of routine and emergency vessel operations. (See 4-1.5 or Chapter 11.)

Embarkation Area. See 5-1.2.

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. (See 4-1.6 or Chapter 12.)

Exit. See 5-1.2.

Exit Access. See 5-1.2.

Exit Discharge. See 5-1.2.

Exit Enclosure. See 5-1.2.

Fire Damper.* A duct-closure device that is operated automatically or manually, including manual remote.

Fire Hydrant. A connection to the fire main for the purpose of supplying water to fire hose or other fire protection apparatus.

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

Fire Pump Controller. For the purpose of this code, a group of devices that serve 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.

Fire-Rated Glazing.* Glazing systems installed in fire-rated bulkhead or overhead assemblies that have been tested to achieve specified fire-resistance ratings.

Fire Resistant. A term applied to materials such as finishes, furnishings, fabrics, padding, draperies, and other combustible materials. It denotes a higher degree of resistance to ignition than ordinary combustible materials.

Flame Spread. The propagation of flame over a surface.

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

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

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

High-Risk Fuel. Class-IA, -IB, -IC, or -II liquids as defined by NFPA 30, *Flammable and Combustible Liquids Code*, 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.

Horizontal Exit. See 5-1.2.

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

Hospital. See 9-1.2.

Interior Finish. Any coating or veneer applied as a finish to a bulkhead, structural insulation, or overhead, including

the visible finish, all intermediate materials, and all application materials and adhesives.

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

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

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 identified standards or has been tested and found suitable for a specified purpose.

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

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

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.

Manned Space. See 12-1.2.

Means of Egress. See 5-1.2.

Medical, Health Care, and Child Care Spaces. See 4-1.3 or Chapter 9.

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

Mixed Occupancies. See 4-1.12.

Noncombustible Material. See 6-2.2.

Open Deck. See 4-1.9 or Chapter 15.

Overlays. Decorative materials applied to decks for finishing purposes.

Overnight Accommodations. See 19-1.2.

Passageway. A corridor.

Passenger. See 19-1.2.

Penetration. See 6-2.4.8.

Photoluminescent. Having the ability to store incident electromagnetic radiation typically from ambient light sources, and release it in the form of visible light. The released light is normally visible for a limited time if the ambient light sources are removed or partially obscured.

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

Restricted Access. See 14-1.2.

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.

Service Space. See 4-1.4 or Chapter 10.

Shall. Indicates a mandatory requirement.

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

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.

Smoke Damper. A duct-closure device that is operated automatically or manually, including manual remote, and that is designed to restrict the spread of smoke through the ductwork.

Stairway. A vertical means of egress between decks.

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.

Storage Space. See 4-1.7 or Chapter 13.

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 endurance capabilities of structural elements.

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

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

Unmanned Space. See 12-1.2.

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

Chapter 4 Classification of Occupancy and Hazard of Contents

4-1 Classification of Occupancy.

4-1.1 General. All vessel occupancies shall be classified according to this chapter. Occupancies shall conform to the requirements of the specific occupancy Chapters 8 through 16.

4-1.2 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 8.)

Accommodation spaces shall include the following:

- (a) Passenger or crew cabins
- (b) Lounge areas
- (c) Athletic facilities
- (d) Gaming areas
- (e) Office spaces
- (f) Spaces for religious worship
- (g) Theaters
- (h) Restaurants/messing areas
- (i) Public toilets/washrooms
- (j) Public sales/shops

4-1.3* 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; and for the care of infants. *(For requirements, see Chapter 9.)*

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

- (a) Hospital/intensive care facilities
- (b) Limited care facilities
- (c) Child care facilities

4-1.4 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 10.)*

Service spaces shall include the following:

- (a) Galleys
- (b) Film development/processing facilities
- (c) Sculleries
- (d) Food preparation areas [no cooking facilities; i.e., equipment capable of generating temperatures in excess of 120°C (248°F).]
- (e) Laboratory facilities
- (f) Laundries

4-1.5 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 11.)*

Electrical and control spaces shall include the following:

- (a) Radio/communications
- (b) Engineering Enclosed Operating Station (not in the machinery space)
- (c) Electrical power/control/ switchboard spaces
- (d) Navigation/bridge
- (e) Central damage control or fire-protection systems control, or both

4-1.6* 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 12.)*

Engineering and machinery spaces shall include the following:

- (a) Main and auxiliary propulsion plants
- (b) Power generating plants including emergency generator rooms
- (c) Steering gear rooms Anchor windlass rooms
- (d) Machine shops
- (e) Marine sanitation devices
- (f) Pump rooms/bunkering stations
- (g) Stabilizer rooms
- (h) Heating, ventilation, and air-conditioning plants (including fan rooms)
- (i) Refrigeration machinery plants
- (j) Anchor windlass rooms
- (k) Miscellaneous industrial facilities

- (l) Sewage treatment spaces
- (m) Incinerator rooms

4-1.7 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 in supporting 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 13.)*

Storage spaces shall include the following:

- (a) General storage spaces
- (b) Pyrotechnics lockers
- (c) General storage lockers (no flammable materials)
- (d) Cleaning gear lockers
- (e) Flammable materials storage
- (f) Flammable materials lockers
- (g) Walk-in refrigeration spaces
- (h) Bosun's lockers
- (i) Garbage/trash holding and processing other than incineration

4-1.8 Cargo Spaces and Fuel Tanks. Cargo spaces shall include those spaces utilized for the carriage or storage of items/products that are being transported by the vessel. *(For requirements, see Chapter 14.)*

Cargo spaces shall include the following:

- (a) Enclosed dry cargo storage
- (b) Liquid fuel tanks
- (c) Open vehicle decks
- (d) Chemical tanks
- (e) Open cargo storage
- (f) Liquefied/compressed gas storage
- (g) Enclosed vehicle decks

4-1.9 Open Deck.

4-1.9.1 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.

4-1.9.2 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.

4-1.10 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 4-1 if the helicopter is to be routinely embarked on the vessel during voyages. *(For requirements, see Chapter 16.)*

4-1.11 Voids. Spaces that do not contain any equipment or room dedicated for storage shall be considered to be voids.

4-1.12 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.

4-1.13* Multiple-Purpose Vessels. For vessels that serve multiple purposes, the requirements of Chapters 17 through 19 shall apply to their corresponding portions of the vessel. Where conflicts arise, the most stringent requirement shall apply.

Chapter 5 Means of Egress

5-1 General.

5-1.1 Application. Means of egress for vessels shall comply with this chapter. (*Also see Chapter 1.*)

5-1.2 Definitions.

Area of Refuge.* Those areas designated as personnel emergency spaces.

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

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

Exit.* That portion of a means of egress that is separated from all other spaces of the vessel by construction or equipment as required in 5-1.3.1 to provide a protected way of travel to the exit discharge.

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

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

Exit Enclosure. The bulkheads and decks around an exit.

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.

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: (a) the exit access, (b) the exit, and (c) the exit discharge.

5-1.3 Separation of Means of Egress. See also Section 6-2.

5-1.3.1 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 following requirements:

(a) The separation shall be a minimum of A-0 Class rating 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 A-60 class rating.

(b) Any opening therein shall be protected by an A-Class door equipped with a door-closer complying with 5-2.1.7.

(c) 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.

(d) Penetrations and openings through an exit enclosure bulkhead and decks shall be prohibited, including penetrations or communicating openings between adjacent exit enclosures.

Exception: Electrical conduit, doors, ductwork, and piping serving the enclosure, provided penetrations are constructed in accordance with 6-2.4.8.

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

Exception to d: Ducting, piping, and electrical cabling that shall be permitted to penetrate exit enclosures as long as they pass completely through the enclosure and the penetration is constructed in accordance with 6-2.4.8.

5-1.3.2 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 6-2.5.1 for deck construction.

5-1.3.3 Exit enclosures shall be designed to provide a continuous protected path of travel, including landings and passageways, to an exit discharge.

5-1.3.4 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 5-2.2.6.4.*)

5-1.3.5 Exit Access Passageways. Passageways used as exit access shall be a minimum B-15 Class rating in accordance with 6-2.3. Where exit access bounds a high-risk service space, or high-risk machinery space, the space shall be minimum A-60. Where exit access bounds a cargo space or open deck, the separation shall be minimum A-0.

Exception: As otherwise permitted in Chapters 8 through 19.

5-1.4 Interior Finish and Furnishings in Exits and Exit Accesses.

5-1.4.1 Interior finish in exits and exit accesses shall meet the requirements of Section 6-3.

5-1.4.2 Furnishings in exits shall meet the requirements for fire-restricting furnishings in Chapter 6.

5-1.5* Headroom. Means of egress shall be designed and maintained to provide adequate headroom as provided in other sections of this code (*see 5-2.2.2.1*), but in no case shall the ceiling height be less than 2.15 m (7 ft), nor shall any projection from the overhead be less than 2.0 m (6 ft 8 in.) nominal height from the deck.

5-1.6 Changes in Level in Means of Egress.

5-1.6.1 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.).

5-1.6.2 Changes in level in means of egress not more than 50 cm (19.7 in.) shall be either by a ramp or by a stair complying with the requirements of 5-2.2 and 19-2.6. The minimum tread depth of such stair shall be 30 cm (11.8 in.), and the location of each step shall be readily apparent by a change in color pattern, texture, or lighting.

5-1.7 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.

Exception: As provided by Chapters 8 through 19.

5-2 Means of Egress Components.

5-2.1 Doors.

5-2.1.1 General.

5-2.1.1.1 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 5-1 and to the special requirements of this subsection. Such an assembly shall be designated as a door.

5-2.1.1.2 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.

5-2.1.2* 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.

5-2.1.3 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.

Exception: As permitted by Chapters 8 through 19.

5-2.1.4 Swing and Force to Open.

5-2.1.4.1 Any door in a means of egress shall be of the side-hinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging to the full use of the opening in which it is installed. Doors shall swing in the direction of egress travel.

Exception No. 1: Horizontal sliding doors complying with 5-2.1.10.

Exception No. 2: Revolving doors complying with 19-2.2.1.

Exception No. 3: Stateroom doors shall be permitted to open into the stateroom.

5-2.1.4.2* During its swing, any door into a means of egress shall leave unobstructed at least one-half of the required width of an aisle, passageway, or landing. When fully open, the door shall not project more than 15 cm (5.9 in.) into the required width of an aisle, passageway, or landing. Doors shall not open immediately onto a stair without a landing. The landing shall have a width at least equal to the width of the door. (See 5-2.2.3.)

5-2.1.4.3 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.

Exception: Power-operated doors as provided in 5-2.1.8.

5-2.1.5 Locks, Latches, and Alarm Devices.

5-2.1.5.1 Doors shall be arranged to be opened readily 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.

Exception No. 1: Doors shall be permitted to have key-operated locks from the egress side, provided the following requirements are met:

- (a) This exception shall be specifically permitted by Chapters 8 through 19
- (b) On the egress side, on or adjacent to the door, there shall be a readily visible, durable sign that reads **THIS DOOR TO REMAIN UNLOCKED WHEN THE SPACE IS OCCUPIED**. The sign shall be in letters not less than 2.5 cm (1 in.) high on a contrasting background
- (c) The locking device shall be of a type that is readily distinguishable as locked
- (d) A key shall be immediately available to any occupant inside the space

Exception No. 2: 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.

5-2.1.5.2 Every stair enclosure door shall allow re-entry from the stair enclosure to the interior of the vessel.

5-2.1.5.3 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.

Exception: 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.

5-2.1.5.4 Where pairs of doors are required in a means of egress, each leaf of the pair shall be provided with its own releasing device. Devices that depend upon the release of one door before the other shall not be used.

Exception: Where double doors are used, it shall be permitted for only one door to have releasing hardware provided operation of the door hardware allows both doors to open.

5-2.1.5.5 No lock, padlock, hasp, bar, chain, or other device, or combination thereof, shall be installed or maintained on or in connection with any door on which panic hardware or fire exit hardware is required by this code if such device prevents or is intended to prevent the free use of the door for purposes of egress.

5-2.1.6 Exit Door Hardware.

5-2.1.6.1 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.

5-2.1.6.2 A door in the means of egress shall be equipped with exit door hardware that meets the following requirements:

- (a) 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
- (b) Causes the door latch to release when a force that shall not be required to exceed 65 N (14.8 lbf) is applied

5-2.1.6.3 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.

5-2.1.7 Self-Closing Devices. A door designed normally to be kept closed in a means of egress shall be a self-closing door and shall not be secured in the open position at any time.

Exception: Doors shall be permitted to be held open where the following requirements are met:

- (a) Upon release of the hold-open mechanism, the door becomes self-closing
- (b) The release device is 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
 - (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, or
 - (3) operation of an automatic sprinkler system. The above systems shall be permitted to be zoned as approved by the authority having jurisdiction
- (c) Any fire detection system or smoke detector is provided with such supervision and safeguards as are necessary to ensure reliability of operation in case of fire (see also Section 7-1)
- (d) Upon loss of power to the hold-open device, the hold-open mechanism is released and the door becomes self-closing
- (e) The automatic release of one door in a stair enclosure results in the closing of all doors serving that stair

5-2.1.8 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 5-2.1.4.3 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 5-2.1.4.)

Exception No. 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 5-2.1.4.3, shall not be required to have a swing-out feature.

Exception No. 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 5-2.1.3, if a minimum of 75 cm (29.5 in.) clear width is provided by the single leaf.

Exception No. 3: Doors complying with 5-2.1.9.

Exception No. 4: Doors fitted with an independent, local power source, capable of operation a minimum of 10 times subsequent to loss of primary power.

Exception No. 5: Power-operated watertight doors.

5-2.1.9 Balanced Doors. Where panic hardware is installed on balanced doors, the panic hardware shall be of the push-pad type, and the pad shall not extend more than approximately one-half the width of the door measured from the latch side.

5-2.1.10 Horizontal Sliding Doors. Horizontal sliding doors complying with the following shall be permitted in a means of egress:

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

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

(c) 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.

(d) 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.

(e) 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 5-2.1.7, and shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows*.

5-2.1.11 Watertight Doors. Watertight doors in a means of egress shall be the quick-acting or power-operated type.

5-2.2 Stairs.

5-2.2.1 General. Stairs, either interior or exterior, used as a component in the means of egress shall conform to the general requirements of Section 5-1 and to the special requirements of 5-2.2.

Exception: Aisle steps in accommodation occupancies as provided in 19-2.9.7.2.

5-2.2.2 Types of Stairs.

5-2.2.2.1* Dimensional Criteria. Stairs shall be in accordance with Table 5-2.2.2.1:

Table 5-2.2.2.1 Stairs

Stair Requirements	Dimensions
Minimum width clear of all obstructions, except projections not exceeding 10 cm (3.9 in) at or below handrail height on each side	90 cm (35.4 in.)
Maximum height of risers	20 cm (7.9 in.)
Minimum height of risers	10 cm (3.9 in.)
Minimum net tread depth	24 cm (9.4 in.)
Minimum headroom	205 cm (80.7 in.)
Maximum height between landings	350 cm (137.8 in.)
Landing	(see 5-2.2.3 and 5-2.1.4.2)

5-2.2.2.2 Tread Slope. Tread slope shall not exceed 2.0 cm/m (0.24 in./ft) (a slope of 1 in 50).

5-2.2.2.3* Riser Height and Net Tread Depth. Riser height shall be measured as the vertical distance between tread nos-

ings. 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). At tread nosings, such beveling or rounding shall not exceed 1.5 cm (0.6 in.) in horizontal dimension. The total tread shall not be less than 25 cm (9.8 in.).

5-2.2.2.4 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.

5-2.2.3 Stair Details.

5-2.2.3.1 All stairs serving as required means of egress shall be of permanent, fixed construction.

5-2.2.3.2 Stairs, platforms, and landings used to connect more than three decks shall be of noncombustible material throughout.

Exception: Handrails.

5-2.2.3.3 Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel. Every landing shall have a dimension measured in direction of travel equal to the width of the stair. Such dimension shall not be required to exceed 120 cm (47.2 in.) where the stair has a straight run.

5-2.2.3.4 Stair treads shall be uniformly slip-resistant and shall be free of projections or lips that could trip stair users.

5-2.2.3.5 Treads of stairs and landing floors shall be solid.

Exception: Noncombustible, grated stair treads and landings as provided in Chapters 8 through 19.

5-2.2.3.6 Stairs shall be arranged so as to make clear the direction of egress to an area of refuge or embarkation area. Stairs that continue beyond the level of exit discharge shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.

Exception: Stairs that continue beyond the level of exit discharge, where the exit discharge is obvious, shall not be interrupted.

5-2.2.3.7 Spiral Stairs. Where specifically permitted for individual occupancies by Chapters 8 through 19, spiral stairs shall be permitted as a component in a means of egress, provided the following requirements are met:

- (a) The occupant load served shall not exceed five.
- (b) The clear width of the stairs shall be not less than 65 cm (25.6 in.).
- (c) The height of risers shall not exceed 24 cm (9.4 in.).
- (d) Headroom shall be not less than 200 cm (78.7 in.).
- (e) Treads shall have a minimum depth of 20 cm (7.9 in.) at a point 30 cm (11.8 in.) from the narrower edge.
- (f) All treads shall be identical.

5-2.2.3.8 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.

5-2.2.4 Guards and Handrails.

5-2.2.4.1 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.

5-2.2.4.2 Handrails. Each stair or ramp with a slope exceeding 1 in 12 shall have handrails on both sides. In addition, handrails shall be provided within 75 cm (29.5 in.) of all portions of the required egress width of stairs. The required egress width shall be along the natural path of travel. (*See also 5-2.2.4.5.*)

5-2.2.4.3 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.

5-2.2.4.4 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 might engage loose clothing.

5-2.2.4.5* Handrail Details. The following requirements pertain to handrails:

(a) 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.

Exception No. 1 to (a): Required handrails that form part of a guard 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.

Exception No. 2 to (a): Additional handrails that are lower or higher than the main handrail shall be permitted.

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

(c) 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.

(d) Handrail ends shall be returned to the bulkhead or deck or shall terminate at newel posts.

(e) 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.

(f) 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.

Exception to (f): 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 a size that a sphere 15 cm (5.9 in.) in diameter cannot pass through the triangular opening.

(g) 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.

5-2.2.4.6 Guard Details. The following requirements pertain to guards:

(a) The height of guards required by 5-2.2.4.1 shall be measured vertically to the top of the guard from the top of the surface below.

(b) Guards shall be not less than 100 cm (39.4 in.) high.

Exception to (b): In accommodation occupancies as provided in Chapter 8.

(c) Open guards shall have intermediate rails or an ornamental pattern such that a sphere 10 cm (3.9 in.) in diameter cannot pass through any opening.

Exception No. 1 to (c): 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 (5.8 in) in diameter cannot pass through the triangular opening.

Exception No. 2 to (c): In engineering and machinery space occupancies, and in storage occupancies.

5-2.2.5 Special Provisions for Exterior Stairs.

5-2.2.5.1 Landings. Landings to which egress doors lead shall be approximately level with the adjoining deck.

5-2.2.5.2 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.

5-2.2.5.3 Exterior stairs shall be constructed of noncombustible material.

5-2.2.5.4 Exterior stairs shall not be permitted to constitute more than 50 percent of the required egress capacity.

Exception: Exterior stairs serving spaces with fewer than 10 persons.

5-2.2.5.5 Exterior stairs shall comply with the requirements of Table 5-2.2.5.5 and subsequent sections.

5-2.2.6 Enclosure and Protection of Stairs.

5-2.2.6.1 Enclosures. All interior stairs serving as an exit or exit component shall be enclosed in accordance with 5-1.3.1. All other interior stairs shall be protected in accordance with 6-2.5.

5-2.2.6.2* Separation and Protection of Outside Stairs. 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. This construction 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. All openings below an outside stair shall be pro-

tected with an assembly having a minimum A-0 Class fire-resistance rating.

5-2.2.6.3 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. (See also 5-1.3.4.)

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

5-2.2.6.4 Signs. Stairs shall be provided with signage within the enclosure at each deck landing. The signage shall indicate the deck level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair. The signage also shall state the deck level of, and the direction to, the exit discharge. The signage shall be inside the enclosure located approximately 1.5 m (5 ft) above the floor landing in a position that is readily visible when the door is in either the open or closed position.

5-2.3 Smokeproof Enclosures.

5-2.3.1 Where smokeproof enclosures are required by other sections of this code, they shall comply with 5-2.3.

5-2.3.2 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.

5-2.3.3 The appropriate design method shall be any system that meets the performance level stipulated in 5-2.3.2. 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.

5-2.3.4 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 the direction of travel.

5-2.3.5 Discharge. Every smokeproof enclosure shall open to an adjacent smokeproof enclosure, to an open deck having

Table 5-2.2.5.5 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 cm clear between rails	29.5 in. clear between rails	70 cm clear between rails	27.5 in. clear between rails
Minimum horizontal dimension of any landing or platform	75 cm clear	29.5 in. clear	70 cm clear	27.5 in. clear
Maximum riser height	22 cm	8.7 in.	30 cm	11.8 in.
Minimum tread, exclusive of nosing	22 cm	8.7 in.	15 cm	5.9 in.
Minimum nosing or projection	2.5 cm	1 in.	No requirement	
Spiral stairs	As permitted by 5-2.2.3.7		Same	
Minimum headroom	200 cm	6.7 ft	Same	
Handrail height	85 cm to 95 cm	2.8 ft to 3.1 ft	Same	
Capacity, number of persons	width cm × 1.66	width in. × 0.66	10	

direct access to a embarkation area, or into an exit access or exit. Such exit passageways shall be without openings other than the entrance from the smokeproof enclosure and the door to the open deck, or embarkation area. The exit passageway shall be separated from the remainder of the vessel by fire barriers having A-0 Class fire-resistance ratings.

5-2.3.6 Access. Access shall be by way of a vestibule, an exit, an exit access, a stair enclosure, or by way of an open deck.

Exception: Smokeproof enclosures consisting of a pressurized stair enclosure.

5-2.3.7 Natural Ventilation. Doors to smokeproof enclosures using natural ventilation shall 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.

5-2.3.8 Mechanical Ventilation. Smokeproof enclosures by mechanical ventilation shall comply with all of the following:

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

(b) In the smoke control mode, the vestibule shall be provided with not less than 1 air change per minute, and the exhaust shall be 150 percent of the supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for those purposes. Supply air shall enter the vestibule within 15 cm (5.9 in.) of the deck level. 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. Doors, when in the open position, shall not obstruct duct openings. Controlling dampers shall be permitted in duct openings if needed to meet the design requirements, but are not otherwise required.

(c) 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.

(d) 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.

5-2.3.9 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; or by remote manual operation from the bridge, a central control station, or other location that is continuously manned.

5-2.3.10 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.

5-2.3.11 Standby Power. Standby power for mechanical ventilation equipment shall be provided by an emergency source of power.

5-2.3.12 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.

5-2.3.13 Emergency Lighting. All smokeproof enclosures and vestibules shall be provided with emergency lighting powered by the standby power system (*see 5-2.3.11*).

5-2.4 Horizontal Exits.

5-2.4.1 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.

5-2.4.2 Horizontal Exit Division.

5-2.4.2.1 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.

5-2.4.2.2 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.

5-2.4.3 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.

5-2.4.4 Doors in Horizontal Exits.

5-2.4.4.1 Doors in horizontal exits shall comply with 5-2.1.4.

5-2.4.4.2 Where swinging fire doors are used in horizontal exits, they shall comply with the following requirements:

(a) They shall swing in the direction of egress travel.

(b) 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.

(c) They shall be of any other approved arrangement provided that doors always swing with any possible egress travel.

5-2.4.4.3 Doors in horizontal exits shall be designed and installed to minimize air leakage.

5-2.4.4.4 All fire doors in horizontal exits shall be self-closing or automatic-closing in accordance with 5-2.1.7. Horizontal exit doors located across a corridor shall be automatic-closing in accordance with 5-2.1.7.

5-2.4.5 Boundaries for Horizontal Exits. Boundaries separating areas between which there are horizontal exits shall be A-60 Class. They shall provide a separation continuous from sideshell to sideshell and deck to deck. (*See also 6-2.4.*)

Exception No. 1: Where an A-60 Class boundary 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 deck.

Exception No. 2: As otherwise provided in Chapters 17 through 19.

5-2.5 Ramps.

5-2.5.1 General. Every ramp used as a component in a means of egress shall conform to the general requirements of Section 5-1 and to the special requirements of 5-2.5.

5-2.5.2 Dimensional Criteria. Ramps shall be in accordance with Table 5-2.5.2:

Table 5-2.5.2 Ramps

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

Exception: Aisle ramps as permitted for accommodation occupancies in Chapter 19.

5-2.5.3 Ramp Details.

5-2.5.3.1 Landings. Ramps shall have landings at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 50. Every landing shall have a dimension measured in the direction of travel not less than the width of the ramp. Such dimension shall not be required to exceed 120 cm (47.2 in.) where the ramp has a straight run.

5-2.5.3.2 Slip Resistance. A ramp shall have a slip-resistant surface.

5-2.5.3.3 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.

5-2.5.3.4 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.

5-2.5.3.5 Ramps Serving as Required Means of Egress.

5-2.5.3.5.1 All ramps serving as required means of egress shall be of permanent, fixed construction.

5-2.5.3.5.2 A ramp used as a means of egress shall be constructed of an assembly of noncombustible material. The ramp floor and landings shall be solid and without perforations.

Exception: Deck coverings complying with 6-3.4.

5-2.5.4 Guards and Handrails. Guards complying with 5-2.2.4 shall be provided for ramps. Handrails complying with 5-2.2.4 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.

Exception: Guards and handrails provided for ramped aisles in accommodation occupancies in accordance with Chapter 19.

5-2.5.5 Special Provisions for Outside Ramps. Balconies or landings to which doors lead shall be approximately level with the deck of the vessel.

5-2.5.6 Water Accumulation. Outside ramps and landings shall be designed to prevent water from accumulating on their surfaces.

5-2.5.7 Enclosure and Protection of Ramps. Ramps in a required means of egress shall be enclosed or protected as a stair in accordance with 5-2.2.6.

5-2.6* Exit Passageways.

5-2.6.1 General. Exit passageways shall conform to the general requirements of Section 5-1 and to the special requirements of 5-2.6.

5-2.6.2 Enclosure. An exit passageway shall be separated from other parts of the vessel as specified in 5-1.3.1.

5-2.6.3 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.

5-2.6.4 Width. The width of an exit passageway shall be adequate to accommodate the aggregate required capacity of all exits discharging through it.

Exception: Where an exit passageway serves occupants of the level of exit discharge as well as other decks, capacity shall not be required to be aggregated. (See 5-3.1.4.)

5-2.6.5 Deck. The deck shall be solid and without perforations.

5-2.7 Service Stairs and Ladders.

5-2.7.1 General. Service stairs and ladders shall be designed to be used for egress from areas accessible only to able-bodied crew.

5-2.7.2 Dimensional Criteria. Service stairs and ladders shall comply with the requirements of Table 5-2.7.2.

Table 5-2.7.2 Service Stairs and Ladders

Stair Requirements	Dimensions
Minimum width	70 cm (27.5 in.)
Minimum horizontal dimension of landing or platform	70 cm (27.5 in.)
Maximum riser height	30 cm (11.8 in.)
Minimum net tread depth	17 cm (6.7 in.)
Minimum total tread depth	25 cm (9.8 in.)
Hand rail height	85 cm to 95 cm (33.5 in. to 37.5 in.)
Minimum headroom	2.0 m (6.6 ft)
Spiral stairs	As permitted by 5-2.2.3.7

5-2.7.3 Construction Materials. Service stairs and ladders shall be constructed of steel or equivalent materials.

Exception: Where otherwise permitted in Chapters 8 through 19.

5-2.7.4 Construction and Installation. Service ladders shall comply with the requirements of ASTM F 840, *Standard Specification for Ladders, Fixed, Vertical, Steel, Ship's*.

Exception No. 1: Ladders installed with a pitch less than 75 degrees shall not be permitted.

Exception No. 2: Combustible ladders shall not be permitted.

5-2.8 Vertical Ladders.

5-2.8.1 General. Vertical ladders shall be permitted to be used for egress from areas accessible only to able-bodied crew.

5-2.8.2 Construction and Installation. Vertical ladders shall be constructed of steel.

Exception: Where specifically permitted by Chapters 17 through 19.

5-2.8.2.1 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.

5-2.8.2.2 Rungs shall be constructed as follows:

- (a) At least 40.5 cm (16 in.) in width
- (b) 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

5-2.8.2.3 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.

5-2.8.3 The lowest rung of any ladder shall be not more than 30 cm (11.8 in.) above the level of the surface beneath it.

5-2.9* Alternating Tread Devices.

5-2.9.1 Alternating tread devices complying with 5-2.9.2 shall be permitted to be used only as follows:

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

5-2.9.2 Alternating tread devices shall comply with the following requirements:

- (a) Handrails shall be provided on both sides of alternating tread devices in accordance with 5-2.2.4.5.
- (b) The clear width between handrails shall be a minimum of 45 cm (17.7 in.) and shall not exceed 60 cm (23.6 in.).
- (c) Headroom shall not be less than 2 m (6.6 ft).
- (d) The angle of the device shall be between 50 and 68 degrees to horizontal.
- (e) The height of the riser shall not exceed 25 cm (9.8 in.).
- (f) Treads shall have a minimum projected tread depth of 15 cm (5.9 in.) measured in accordance with 5-2.2.2.3 with each tread providing 25 cm (9.8 in.) of depth including tread overlap.
- (g) A minimum distance of 15 cm (5.9 in.) shall be provided between the stair handrail and any other object.
- (h) The initial tread of the stair shall begin at the same elevation as the platform, landing, or deck surface.
- (i) The alternating treads shall not be laterally separated by more than 5 cm (2 in.).
- (j) The occupant load served shall not be more than three.

5-2.10 Areas of Refuge.

5-2.10.1 Area of Refuge Details.

5-2.10.1.1 Areas of refuge shall comply with the following requirements:

- (a) Be bounded by A-60 bulkheads and decks

Exception: As otherwise provided in Chapters 17 through 19.

- (b) Be located above the waterline

- (c) Be a smokeproof enclosure in accordance with 5-2.3

Exception No. 1 to (c): The smokeproof enclosure shall not be required in a vessel that is protected throughout by an approved, supervised automatic sprinkler system.

Exception No. 2 to (c): Weather deck areas of refuge.

5-2.10.1.2 Ducts shall be permitted to penetrate A-60 bulkheads and decks, 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 UL 555S, *Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems*, or other approved means to resist the transfer of smoke into the area of refuge.

5-2.10.2 Areas of refuge shall have access to an embarkation area, by means protected as required for an exit.

5-2.10.3 Where the exit used to provide egress from an area of refuge to an embarkation area (as required by 5-2.10.2) includes stairs, the stairs shall comply with 5-2.2.

5-2.10.4* The area of refuge shall be provided with a reliable two-way communication system for communication between the area of refuge and a central control point.

5-2.10.5 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.

5-2.10.6 Windows Facing Exterior Areas of Refuge. Windows facing exterior areas of refuge shall not be openable and shall be protected in accordance with one of the following means.

Exception: As otherwise permitted by Chapters 17 through 19.

5-2.10.6.1 Windows facing exterior areas of refuge shall not be required to meet any integrity and shall be fitted with a steel shutter which meets A-60 integrity.

5-2.10.6.2 Windows facing exterior areas of refuge shall be required to meet A-60 integrity.

5-2.10.6.3 Windows facing exterior areas of refuge shall be required to meet A-0 integrity and be protected with sprinklers along the windows inside the space.

5-2.10.6.4* Windows facing exterior areas of refuge shall not be required to meet any integrity and shall be protected with window sprinklers in accordance with 7-2.7.

5-2.10.7 The door to the area of refuge shall be identified by signage.

5-2.10.8 Protection of Exterior Boundaries Below Exterior Areas of Refuge. Exterior boundaries below areas of refuge, including windows, shall be protected to minimum A-0 integrity.

Exception: Spaces fully below the waterline.

5-2.10.9 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 5-2.10.6.

5-3 Capacity of Means of Egress.

5-3.1 Occupant Load.

5-3.1.1 The total capacity of the means of egress for any deck, balcony, or other occupied space shall be sufficient for the occupant load thereof.

5-3.1.2 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 8 through 16 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.

5-3.1.3 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 5-3.1.2, 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.

5-3.1.4 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.

5-3.1.5 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.

5-3.1.6 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.

5-3.2 Measurement of Means of Egress. Width of means of egress shall be measured in the clear at the narrowest point of the exit component under consideration.

Exception: Projections not to exceed 8 cm (3.1 in.) on each side are permitted at and below handrail height.

5-3.3 Egress Capacity.

5-3.3.1 Egress capacity for components of means of egress shall be based on the following:

- (a) Stairway width of 0.8 cm per person (0.3 in. per person)
- (b) Level components and ramps width of 0.5 cm per person (0.2 in. per person)

Exception: Stairway widths shall be permitted to be sized in accordance with IMO Assembly Resolution A757, Standard for the Calculation of the Width of Stairways Forming Means of Escape on Passenger Ships.

5-3.3.2 The required capacity of a corridor is the occupant load utilizing the corridor for exit access divided by the re-

quired 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.

5-3.4 Minimum Width.

5-3.4.1 The minimum width of any means of egress shall be as specified for a given egress component by Chapter 5 or for individual occupancies by Chapters 8 through 19.

Exception No. 1: The minimum width of 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.

Exception No. 2: Doors as provided for in 5-2.1.3.

Exception No. 3: Aisles and aisle accessways in accommodation occupancies as provided in Chapter 19.

5-3.4.2 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.

5-4 Number of Separate Means of Egress.

5-4.1 General.

5-4.1.1 The minimum number of separate means of egress from any deck, occupancy, or portion thereof, shall be two.

Exception No. 1: Where a single means of egress is permitted by Chapters 8 through 19.

Exception No. 2: A mezzanine shall be permitted to have a single means of egress provided the common path of travel limitations of Chapters 8 through 19 are not exceeded.

5-4.1.2 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.

5-5 Arrangement of Means of Egress.

5-5.1 General.

5-5.1.1 Exits shall be located and exit access shall be arranged so that exits are readily accessible at all times.

5-5.1.2 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.

Exception No. 1: Where a single exit is permitted by Chapters 8 through 19.

Exception No. 2: Where common paths of travel are permitted for an occupancy by Chapters 8 through 19, such common paths of travel shall be permitted but shall not exceed the limit specified.

5-5.1.3 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.

5-5.1.4* 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. Where exit enclosures are provided as the required exits and are interconnected by a passageway conforming to the requirements of 5-1.3.5, 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 arranged to comply with 5-5.1.3. The other exits or exit access doors shall be located so that if one becomes blocked, the others will be available.

Exception: In vessels protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 7-2.2, the minimum separation distance between two exits or exit access doors measured in accordance with 5-5.1.4 shall be not less than one-third the length of the maximum overall diagonal dimension of the area to be served.

5-5.1.5* Interlocking or scissor stairs shall be permitted to be considered separate exits if enclosed in accordance with 5-1.3.1 and separated from each other by A-Class rated construction. There shall be no penetrations or communicating openings, whether protected or not, between the stair enclosures.

5-5.1.6 Exit access shall be arranged so that there are no dead ends in corridors.

Exception: Where dead ends are permitted by Chapters 8 through 19, such dead ends shall not exceed the limit specified.

5-5.1.7 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.

5-5.2 Impediments to Egress. See also 5-1.7 and 5-2.1.5.

5-5.2.1 In no case shall access to an exit be through galleys, storerooms, restrooms, engineering and machinery spaces, closets, staterooms or similar spaces, or any spaces with doors that can be locked.

Exception: Exit access in specific occupancies shall be permitted to pass through rooms or spaces subject to locking as provided in Chapter 9.

5-5.2.2 Exit access and exit doors shall be designed and arranged to be clearly recognizable. Hangings or draperies shall not be placed over exit doors or otherwise located to conceal or obscure any exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.

5-5.3 Exterior Ways of Exit Access.

5-5.3.1 Exit access shall be permitted to be by means of any exterior landing or open deck that conforms to the requirements of Chapter 5.

5-5.3.2 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.

5-5.3.3 Exterior exit-access landings shall be separated from the interior of the vessels by bulkheads and opening protectives as required for corridors.

Exception: Where the exterior exit-access landing 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.

5-5.3.4 There shall be no obstruction by railings, barriers, or gates that divide the open space into sections appurtenant to individual rooms or other subdivisions.

5-5.3.5 An exterior exit access shall be arranged so that there are no dead ends in excess of 6 m (19.7 ft).

5-5.3.6 Any landing or other exterior exit access that projects beyond the outside bulkhead of the vessel shall comply with the requirements of Chapter 5 as to width and arrangement.

5-5.3.7 An exterior exit access shall have solid, substantially level decks and shall have guards that are at least equivalent to those specified in 5-2.2.4 on unenclosed sides more than 75 cm (29.5 in.) above the deck or level below.

5-6 Measurement of Travel Distance to Exits.

5-6.1 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 8 through 19.

5-6.2 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.

5-6.3 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.

5-6.4* Where any part of an exterior exit is within 3 m (9.8 ft) horizontal distance of any unprotected vessel opening, as permitted by 5-2.2.6.2 for outside stairs, the travel distance to the exit shall include the length of travel to the embarkation area or area of refuge.

5-7 Discharge from Exits.

5-7.1 All exits shall terminate directly at an exit discharge, an area of refuge, or an embarkation area. Open decks, or other portions of the exit discharge, shall be of required width and size to provide all occupants with a safe access to an embarkation area.

Exception No. 1: Interior exit discharge as permitted by 5-7.2.

Exception No. 2: Open deck exit discharge as permitted by 5-7.5.

5-7.2 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 not discharging to an area of refuge or an embarkation area shall meet the following requirements:

- (a) Lead to a free and unobstructed way to an area of refuge or embarkation area that is readily visible and identifiable from the point of discharge from the exit
- (b) Provide protection throughout by an approved, automatic sprinkler system or have the portion of the level of discharge used for this purpose protected by an approved, automatic sprinkler system and separated from the nonsprinklered portion of the deck by fire resistance-rated construction that meets the requirements for the enclosure of exits (see 5-1.3.1)

Exception: As provided otherwise by Chapters 17 through 19.

- (c) Provide separation from areas below by construction having a fire-resistance rating not less than that required for the exit enclosure

Exception to (c): Levels below the level of discharge shall be permitted to be open to the level of discharge in an atrium in accordance with 19-3.1.2.

5-7.3 The exit discharge shall be arranged and marked to make clear the direction of egress to an area of refuge or an embarkation area. (See 5-2.2.3.6.)

5-7.4 Doors, stairs, ramps, passageways, landings, and other components of an exit discharge shall comply with the detailed requirements of Chapter 5 for such components.

5-7.5 Weather deck exit discharge shall be permitted where the following requirements are met:

- (a) Discharge is to open decks.
- (b) The open deck has a fire-resistance rating at least the equivalent of that required for the exit enclosure.
- (c) There is a continuous and safe means of egress from the open deck to an area of refuge or an embarkation area.

5-8 Illumination of Means of Egress.

5-8.1 General.

5-8.1.1 Illumination of means of egress shall be provided in accordance with Section 5-8 for every vessel where required in Chapters 8 through 19. For the purposes of this requirement, exit access shall include only designated stairs, aisles, ramps, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, ramps, walkways, and passageways leading to an area of refuge or an embarkation area.

5-8.1.2 Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time as required to maintain the illumination to the minimum criteria values herein specified.

5-8.1.3* The decks and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated by 5-8.1.1 shall be illuminated to values of not less than 10 lux (1 foot-candle) measured at the deck.

5-8.1.4 Any required illumination shall be arranged so that the failure of any single lighting unit, such as the burning out of an electric bulb, will not leave any area in darkness.

5-8.1.5 The equipment or units installed to meet the requirements of Section 5-10 shall be permitted also to serve the function of illumination of means of egress, provided that all applicable requirements of Section 5-8 for such illumination are met.

5-8.2 Sources of Illumination.

5-8.2.1 Illumination of means of egress shall be from the main power source.

5-8.2.2 No battery-operated electric light nor any type of portable lamp or lantern shall be used for primary illumination of means of egress. Battery-operated electric lights shall be permitted to be used as an emergency source to the extent permitted under Section 5-9.

5-9 Emergency Lighting.

5-9.1 General.

5-9.1.1 Emergency lighting facilities for means of egress shall be provided in accordance with Section 5-9 for all occupancies where required in Chapters 8 through 19. For the purposes of this requirement, exit access shall include only designated stairs, aisles, ramps, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, ramps, aisles, and walkways leading to an area of refuge or an embarkation area.

5-9.1.2 Where maintenance of illumination depends upon changing from one energy source to another, there shall be no appreciable interruption of illumination during the changeover. Where emergency lighting is provided by a prime mover-operated electric generator, a delay of not more than 45 seconds shall be permitted.

If the emergency generator cannot meet the 45-second requirement, then a transitional power source shall be required.

5-9.2 Performance of System.

5-9.2.1 In the event of failure of normal lighting, emergency lighting shall be in accordance with IEEE Standard 45, *Recommended Practice for Electric Installations on Shipboard*.

Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 10 lux (1 foot-candle) and a minimum at any point of 1 lux (0.1 foot-candle) measured along the path of egress at deck level. Illumination levels shall be permitted to decline to 6 lux (0.6 foot-candle) average and a minimum at any point of 0.6 lux (0.06 foot-candle) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

5-9.2.2 The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting.

5-9.2.3 Emergency generators used to provide power to emergency lighting systems shall be installed, tested, and maintained in accordance with 46 CFR, Part 112, Subchapter J.

5-9.2.4 Battery-operated emergency lights shall use only reliable types of rechargeable batteries provided with suitable facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with 46 CFR, Parts 110-113, Subchapter J.

5-9.2.5 The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

5-9.3 Testing and Maintenance. Emergency lighting shall be tested at least quarterly.

5-10 Marking of Means of Egress.

5-10.1 General.

5-10.1.1 Means of egress shall be marked in accordance with Section 5-10 where required by Chapters 8 through 19.

Exception: Marking of means of egress complying with IMO Resolution A760 shall be permitted.

5-10.1.2 Exits shall be marked by an approved sign, readily visible from any direction of exit access.

5-10.1.3 Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach it is

not readily apparent to the occupants. Sign placement shall be such that no point in the exit access is more than 30 m (98 ft) from the nearest visible sign.

5-10.1.4 Every sign required by Section 5-10 shall be located and of such size, distinctive color, and design as to be readily visible and shall provide contrast with decorations, interior finish, or other signs. No decorations, furnishings, or equipment that impairs visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision of the required exit sign of such a character as to detract attention from the exit sign.

5-10.2 Size of Signs. Every sign required by Section 5-10 shall have the word EXIT or other appropriate wording in plainly legible letters not less than 15 cm (5.9 in.) high with the principal strokes of letters not less than 2 cm (0.8 in.) wide. The word EXIT shall have letters of a width not less than 5 cm (2 in.), except the letter I, and the minimum spacing between letters shall be not less than 1 cm (0.4 in.). Signs larger than the minimum established in this paragraph shall have letter widths, strokes, and spacing in proportion to their height.

Exception: Listed exit signs, illuminated in accordance with 5-10.3, shall be permitted to have letters not less than 15 cm (5.9 in.) in height with the principal strokes of letters not less than 0.5 cm (0.2 in.) in width with a letter width not less than 4 cm (1.6 in.), except the letter I.

5-10.3 Illumination of Signs.

5-10.3.1 Every sign required by 5-10.1.2 or 5-10.1.3 shall be suitably illuminated by a reliable light source. Signs shall be visible in both the normal and emergency lighting mode.

Exception: Signs that provide evenly illuminated letters shall have a minimum luminance of 0.21 cd/m² (0.06 foot-lamberts) as measured by a color-corrected photometer.

5-10.3.2 Every sign required by 5-10.1.4 shall provide evenly illuminated letters having a minimum luminance of 0.2 cd/m² (0.06 foot-lamberts).

Exception: Signs complying with the requirements of 5-10.3.3 shall be acceptable.

5-10.3.3 Every sign required to be illuminated by 5-10.3 shall be continuously illuminated as required under the provisions of Section 5-8.

Exception: Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.

5-10.3.4 The level of illuminance shall be in accordance with 5-10.3.2.

5-10.4 Specific Requirements.

5-10.4.1 Directional Signs.

5-10.4.1.1 A sign complying with 5-10.2 reading EXIT or a similar designation with a directional indicator showing the direction of travel shall be placed in every location where the direction of travel to reach the nearest exit is not apparent.

5-10.4.1.2 The directional indicator shall be located outside of the EXIT legend, not less than 1 cm (0.4 in.) from any letter, and shall be permitted to be integral to or separate from the sign body. The directional indicator shall be of a chevron type as shown in Figure 5-10.4.1.2 and shall be identifiable as a directional indicator at a minimum distance of 30 m (98.4 ft) under all space illumination conditions. The direc-

tional indicators shall not be located at the end of the sign opposite the direction indicated.



Figure 5-10.4.1.2 Chevron-type indicator.

5-10.4.2 Special Signs. Any door, passageway, or stairway that is neither an exit nor a way of exit access, and that is located or arranged so that it is likely to be mistaken for an exit, shall be identified by a sign reading NO EXIT. Such sign shall have the word NO in letters 5 cm (2 in.) high with stroke width of 1 cm (0.4 in.) and the word EXIT in letters 2.5 cm (1 in.) high, with the word EXIT below the word NO.

5-11 Low-Location Lighting.

5-11.1 General.

5-11.1.1 Low-location lighting shall be provided in accordance with Section 5-11 for all occupancies where required in Chapters 8 through 19.

5-11.1.2 If an emergency generator is used to power the low-location lighting system, a transitional power source shall be required if the emergency generator cannot meet the 45-second requirement. The emergency generator shall be installed, tested, and maintained in accordance with 46 CFR, Part 112, Subchapter J.

5-11.2 Performance of Systems.

5-11.2.1 The means of egress shall be marked with low-location lighting in the event that the normal emergency lighting is less effective because of smoke or loss of power.

5-11.2.2 Low-location lighting systems shall function for at least 60 minutes after activation.

5-11.2.3 Low-location lighting systems shall meet the requirements of IMO Resolution A752(18), *Guidelines for the Evaluation, Testing, and Application of Low-Location Lighting on Passenger Ships*.

5-11.2.4 If batteries are used to power the low-location lighting system, they shall be reliable types of rechargeable batteries provided with suitable facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with 46 CFR, Parts 110–113, Subchapter J.

5-11.2.5 The low-location lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

5-11.2.6 If low-location lighting is fitted in a machinery, service, or other similar place where the egress path is not normally bounded by bulkheads, it shall be installed on the deck.

5-11.3 Testing and Maintenance. The low-location lighting system shall be tested at least weekly.

Chapter 6 Features of Fire Protection

6-1 General.

6-1.1 Application.

6-1.1.1 The features associated with a vessel's fire protection construction shall comply with this chapter.

6-1.1.2 Vessels classified in accordance with Chapters 17 through 19 and having individual occupancies as classified in Chapters 8 through 16, shall meet the minimum construction requirements of those chapters.

6-2 Construction and Compartmentation.

6-2.1 Construction. The hull, structural bulkheads, columns and stanchions, superstructures, deckhouses, and divisional bulkheads shall be constructed of noncombustible material.

Exception: Where permitted by Chapters 8 through 19.

6-2.2 A material shall be considered noncombustible if the criteria in 6-2.2.1 or 6-2.2.2 are satisfied.

Exception: The following materials are considered as inherently noncombustible and shall not be required to be tested or listed for noncombustibility:

- (a) Sheet or block glass, clay, ceramics or uncoated glass fiber
- (b) All metals except magnesium or magnesium alloys
- (c) Portland cement, gypsum, concrete with aggregates of only sand, gravel, vermiculite, silica, perlite or pumice
- (d) Woven or knitted glass fabric containing no treatments other than 2.5 percent lubricant by mass

6-2.2.1 A material shall be considered noncombustible when tested in accordance with Part 1 of the IMO *Fire Test Procedures Code*.

6-2.2.2 A material shall be considered noncombustible if it meets the criteria of 46 CFR, Part 164.009.

6-2.2.3 Noncombustible materials shall be listed.

6-2.3 Steel or Equivalent Material. A material shall be considered as having equivalent load-carrying capability compared to steel when tested in accordance with 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*.

6-2.4 Fire Barriers.

6-2.4.1 Fire-rated deck and bulkhead assemblies used as fire barriers to form fire compartments, as well as any exposed stanchions, frames, stiffeners, beams, girders, or trusses supporting such assemblies, shall be of a design that has been tested to meet the conditions of acceptance as stipulated herein.

Exception: Where permitted by Chapters 8 through 16, a combustible, decorative finish, or veneer, shall be permitted to be used on ceilings and bulkheads designated as fire barriers, provided the finish meets the requirements of Section 6-3.

6-2.4.2 Fire barriers, as well as any assemblies used to provide enclosure of openings in the fire barriers, shall be rated as follows.

6-2.4.2.1 A-Class fire barriers shall be constructed of steel or equivalent material and shall be stiffened and made intact with the main structure of the vessel. A Class includes A-60 rating and A-0 rating.

A-60 rating shall meet one of the following criteria:

(a) Constructed such that when the barrier assembly is subjected to the standard fire test—ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, ISO 834, *Fire Resistance Tests—Elements of Building Construction*, or equivalent, the assembly shall prevent the passage of smoke and flame for 1 hour. Additionally, the assembly shall provide thermal protection such that the average temperature on the unexposed side does not rise more than 140°C (284°F) above the original (ambient) temperature, nor shall the temperature at any single point, including any joint, rise more than 180°C (356°F) above the original temperature within the 1-hour time period.

(b) The assembly shall satisfy the performance requirements for A-60 when tested in accordance with Part 3 of the IMO *Fire Test Procedures Code*.

A-0 rating shall meet the requirements of 6-2.4.2.1(a), except that there are no thermal protection requirements.

(c) B-15 Class divisions that, when tested according to 6-2.4.2.2(a), prevented the passage of flame and hot gases for 60 minutes shall be permitted to be used as components of A-Class construction.

6-2.4.2.2 B Class includes B-15 rating and B-0 rating.

B-15 rating shall meet one of the following criteria, when tested without a surface finish:

(a) Constructed of noncombustible materials such that when the barrier assembly is subjected to the standard fire test—ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, ISO 834, *Fire Resistance Tests—Elements of Building Construction*, or equivalent, the assembly shall prevent the passage of flame for 30 minutes. Additionally, the assembly shall provide thermal protection such that the average temperature on the unexposed side does not rise more than 140°C (284°F) above the original (ambient) temperature, nor shall the temperature at any single point, including any joint, rise more than 225°C (437°F) above the original temperature within the initial 15 minutes of the test.

(b) The assembly shall satisfy the performance requirements for B-15 when tested in accordance with Part 3 of the IMO *Fire Test Procedures Code*.

B-0 rating shall meet the requirements of 6-2.4.2.2(a), excluding the thermal protection requirements.

Any bulkhead panels used as B-Class construction shall be listed.

6-2.4.2.3 C Class includes the following:

(a) C-Class rating shall be constructed of noncombustible materials and shall not be required to meet any requirements relative to the passage of smoke and flame nor the limiting of temperature rise.

(b)* C'-Class rating shall be constructed of noncombustible material(s) and shall be constructed to prevent the passage of smoke between adjacent areas.

(c) Where C or C' Class is required, B or A Class shall be permitted.

6-2.4.3 Door assemblies in fire-rated bulkheads shall be of an appropriate rating for the location in which they are installed and shall comply with the following.

6-2.4.3.1 Fire doors shall be self-closing or automatic-closing in accordance with 5-2.1.7 and, where used within the means

of egress, shall comply with the provisions of 5-2.1. A-Class doors shall meet one of the following criteria:

- (a) Tested in accordance with ASTM F 1384, *Standard Test Method for Fire Test of Marine Joiner Doors*, as follows:
 1. The door and frame assembly shall remain closed in the opening for 60 minutes.
 2. The door and frame assembly shall stop the penetration of flame for 60 minutes.
 3. The door shall not separate from the frame more than one and one-half times the thickness of the door.
 4. The average, unexposed face temperature rise of the door, as determined by the five thermocouples located as stated in 7.2.1 and 7.2.2 of ASTM F 1384, shall not be more than 140°C (284°F), and the temperature rise, recorded by any of the individual unexposed face thermocouples, shall not be more than 180°C (356°F) during the period of 60 minutes for A-60 Class and 0 minutes for A-0 Class.
- (b) NVIC 6-80, *Guide to Structural Fire Protection Aboard Merchant Vessels*

6-2.4.3.2 A B-Class door shall meet one of the following criteria.

- (a) Tested in accordance with ASTM F 1384, *Standard Test Method for Fire Test of Marine Joiner Doors*, as follows:
 1. The door and frame assembly shall remain closed in the opening for 30 minutes.
 2. The door and frame assembly shall stop the penetration of flame for 30 minutes.
 3. The door shall not separate from the frame more than one and one-half times the thickness of the door.
 4. The average, unexposed face temperature rise of the door, as determined by the five thermocouples located as stated in 7.2.1 and 7.2.2 of ASTM F 1384, *Standard Test Method for Fire Test of Marine Joiner Doors*, shall not be more than 140°C (284°F), and the temperature rise, recorded by any of the individual unexposed face thermocouples, shall not be more than 225°C (437°F) during the period of 15 minutes for B-15 Class and 0 minutes for B-0 Class.
- (b) NVIC 6-80, *Guide to Structural Fire Protection Aboard Merchant Vessels*

6-2.4.4 Structural Insulations. Any insulation used to achieve an A- or B-Class rating shall be listed as meeting 46 CFR, Part 164.007.

6-2.4.5 Deck Coverings. Any deck coverings used to achieve an A- or B-Class rating shall be listed as meeting 46 CFR, Part 164.006.

6-2.4.6* Fire window assemblies shall be permitted in fire-rated bulkheads provided they meet the criteria of Part 3 of the IMO *Fire Test Procedures Code*, including the radiation criteria of Appendix 1.

Exception: Where otherwise permitted by Chapters 5 or 8 through 19.

6-2.4.7 Every opening in a fire barrier shall be protected to limit the spread of fire and restrict the movement of smoke from one side of the fire barrier to the other. The fire-protection rating for opening protectives shall be identical to that of the barrier in which it is installed.

6-2.4.8 Penetrations and Miscellaneous Openings in Fire Barriers.

6-2.4.8.1 Openings in fire barriers for air-handling ductwork or air movement shall be protected in accordance with Section 7-4.

6-2.4.8.2 Pipes, conduits, bus ducts, cables, wires, air ducts, pneumatic tubes and ducts, drive shafts, and similar service equipment that pass through fire barriers shall be protected as follows:

(a) The space between the penetrating item and the fire barrier shall be filled with a listed material capable of maintaining the fire resistance of the barrier, or shall be protected by a listed device designed for that specific purpose and that maintains the fire resistance of the barrier.

(b) Where the penetrating item uses a sleeve to penetrate the fire barrier, the sleeve shall be continuously welded on at least one side of the fire barrier, and the space between the item and the sleeve shall be filled with a material capable of maintaining the fire resistance of the barrier, or shall be protected by a device designed for that specific purpose and that maintains the fire resistance of the barrier.

(c) Insulation and coverings for pipes and ducts shall not pass through the fire barrier unless the material is capable of maintaining the fire resistance of the barrier, or is protected by a device designed for that specific purpose and maintains the fire resistance of the barrier.

(d) Where designs take transmission of vibration into consideration, any vibration isolation shall be made on either side of the fire barrier or shall be made by a device designed for that specific purpose and does not degrade the fire resistance of the barrier.

6-2.5 Vertical Openings.

6-2.5.1 All decks shall be constructed as a fire barrier of minimum A-0 integrity to provide compartmentation.

Exception No. 1: As permitted by 19-3.1.1.

Exception No. 2: As permitted by 19-3.1.2.

Exception No. 3: Where C' Class is permitted by Chapters 8 through 19, decks shall be permitted to be reduced to C' Class.

Exception No. 4: Where A-60 integrity is required by Chapters 8 through 19, decks shall be A-60 integrity.

6-2.5.2 Openings through decks, such as stairways, hoistways for elevators, dumbwaiters, inclined and vertical conveyors; shaftways used for light, ventilation, or services; or joints used to allow structural movements or vibration isolation, shall be enclosed with fire barriers (vertical) meeting the requirements for decks in 6-2.5.1, such as bulkhead or partition assemblies. Such enclosures shall be continuous from deck to deck. Openings shall be protected as appropriate for the fire-resistance rating of the barrier.

Exception No. 1: As permitted by 19-3.1.1.

Exception No. 2: As permitted by 19-3.1.2.

Exception No. 3: As permitted by 6-2.4.5.

Exception No. 4: Escalators and moving walks protected in accordance with Exception No. 1 to 6-2.4.7.

Exception No. 5: Where A-60 integrity is required by Chapters 5 or 8 through 19, fire barriers separating the opening shall be A-60 integrity.

Exception No. 6: As permitted by Chapters 8 through 19.

6-2.5.3 Vertical openings (shafts) that penetrate one or more decks shall be enclosed at the lowest and/or highest level of the shaft, respectively, with construction in accordance with 6-2.5.4.

Exception: Shafts shall be permitted to terminate in a room or space having a use related to the purpose of the shaft, provided that the room or space is separated from the remainder of the vessel by construction having a fire-resistance rating and opening protectives in accordance with 6-2.5.4 and 6-2.4.7.

6-2.5.4* All deck openings shall be protected to the same fire-resistance rating as the deck in which they are installed.

6-2.5.5 A vertical opening, connecting only two adjacent decks, shall be permitted to be open to one of the two decks.

6-2.5.6 Service openings for conveyors, elevators, and dumbwaiters, where required to be open on more than one deck at the same time for purposes of operation, shall be provided with closing devices in accordance with 5-2.1.7.

6-2.5.7 Escalators or moving walks not constituting an exit shall have their floor openings enclosed or protected as required for other vertical openings. Escalators or moving walks, or groups of escalators or moving walks, shall not span more than two decks.

Exception No. 1: In occupancies protected throughout by an approved, automatic sprinkler system in accordance with 7-2.2, escalators or moving walk openings shall be permitted to be protected in accordance with the method detailed in NFPA 13, *Standard for the Installation of Sprinkler Systems*, or in accordance with a method approved by the authority having jurisdiction.

Exception No. 2: Escalators in large open areas, such as atriums.

6-2.6 Mezzanines.

6-2.6.1 Area Limitations.

6-2.6.1.1 The aggregate area of mezzanines within a space shall not exceed one-fourth the open area of the space in which the mezzanines are located. Enclosed space shall not be included in a determination of the size of the space in which the mezzanine is located.

Exception: Engineering and machinery space occupancies.

6-2.6.1.2 There shall be no limit on the number of mezzanines in a space.

6-2.6.1.3 For purposes of determining the allowable mezzanine area, the area of mezzanines shall not be included in the area of the space.

6-2.6.2 Openness. All portions of a mezzanine shall be open to and unobstructed from the space in which the mezzanine is located.

Exception No. 1: Bulkheads or railings not more than 110 cm (43 in.) high.

Exception No. 2: A mezzanine having two or more means of egress need not open into the space in which it is located if at least one of the means of egress provides direct access to an exit at the mezzanine level.

6-2.7 Concealed Spaces.

6-2.7.1 Draft Stops. Draft stops shall be fitted in concealed spaces as follows:

(a) Vertical concealed spaces shall have draft stops installed that are constructed with minimum B-0 fire resistance at each deck level.

(b)* All interstitial spaces (between ceiling and deck above) shall have draft stops installed for the full depth of the interstitial space by partitions meeting B-0 fire-resistance rating not greater than 14 m (45 ft) apart.

Exception No. 1: If the concealed space is protected throughout by an approved, automatic sprinkler system in accordance with Section 7-2.2.

Exception No. 2: Concealed spaces serving as plenums. (See NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*.)

Exception No. 3: Draft stops shall not be required in a concealed interstitial space above a public space when the vessel has no overnight accommodations, and the public space is completely bounded by A-Class divisions or the outer shell of the vessel.

6-2.7.2 Combustible Materials in Concealed Spaces. Combustible materials shall not be permitted in concealed spaces.

Exception: As permitted in Section 6-2.

6-2.7.2.1 Cabling. Electrical cabling in concealed spaces shall be fire resistant in accordance with 46 CFR, Part 110, Subchapter J.

6-2.7.2.2 Coverings for Pipe or Ventilation Duct. Insulation for pipe or ventilation ducts shall be noncombustible. Any facing, lagging, or protective covering shall be noncombustible or meet the requirements for interior finish of 6-3.3.

6-2.7.2.3 Combustible Veneers. Any combustible veneers shall meet the requirements of 6-3.3.

6-2.7.2.4 Fire Suppression Piping. Listed nonmetallic fire suppression piping installed behind a B-15 or higher barrier shall be permitted in concealed spaces.

6-2.7.2.5 Ventilation Ducting. Ventilation ducting meeting the exception in 7-4.2.1 shall be permitted.

6-2.7.2.6 Plastic Pipe. Plastic pipe meeting the criteria for 6-3.3 shall be accepted.

6-3 Interior Finish.

6-3.1 General.

6-3.1.1 Interior finish shall include interior wall and ceiling finish and interior deck finish.

6-3.1.2 Interior finish shall be considered to mean the exposed interior surfaces of vessels including, but not limited to, fixed or movable partitions and overheads.

6-3.1.3 Interior deck finish shall be considered to mean the exposed deck surfaces of vessels including coverings that might be applied over a normal finished deck or stair, including risers.

6-3.2 Use of Interior Finishes.

6-3.2.1 Requirements for interior finish shall apply as specified elsewhere in this code for specific occupancies. (See Chapter 5 and Chapters 8 through 19.)

6-3.2.2 Requirements for interior deck finish shall apply except where indicated otherwise by Chapters 8 through 19.

6-3.3* Interior Finish Classification. Where required by Chapters 8 through 19, interior finish shall be listed and shall meet the requirements of 6-3.3.1 or 6-3.3.2.

6-3.3.1 Interior finish materials shall have a flame-spread rating not exceeding 20 and a smoke-developed rating not

exceeding 10 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

Exception: Paint not exceeding 0.9 mm ($\frac{1}{8}$ in.) in thickness shall be permitted or greater thickness shall be permitted in sprinklered spaces.

6-3.3.2 Interior finishes shall meet the requirements of (a) through (c) of this paragraph.

(a) Part 5 of the IMO *Fire Test Procedures Code* or ASTM E-1317, *Standard Test Method for Flammability of Marine Surface Finishes*.

(b) Part 2 of the IMO *Fire Test Procedures Code*.

Exception: Toxicity test criteria shall not apply.

(c) ISO 1716: *Building Materials—Determination of Calorific Potential*, the net heat of combustion shall be less than 45 MJ/m²

6-3.4* Interior Deck Finishes and Deck Overlays.

6-3.4.1 Where required, interior deck finishes shall meet 16 CFR, Part 1630 and one of the following:

(a) Consist of 100 percent wool.

(b) Meet NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source* (ASTM E 648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*) with a critical radiant flux not less than 0.45 W/cm² and meet ASTM E 662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*, with a specific optical density not exceeding 450 in both flaming and nonflaming modes.

(c) Meet Part 5 of the IMO *Fire Test Procedures Code*, and meet ASTM E 662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*, with a specific optical density not exceeding 450 in both flaming and nonflaming modes.

(d) Meet Parts 2 and 6 of the IMO *Fire Test Procedures Code*.

Exception: Toxicity test criteria shall not apply.

6-3.4.2 If an underlayment is used, it shall meet the requirements of 6-3.4.1.

Exception: Deck finish materials that meet the requirements of 6-3.4.1 when tested with the underlayment.

6-3.4.3 Deck Overlays. Deck overlays shall not exceed 10 mm (0.4 in.) in thickness.

6-3.5 Trim and Incidental Finish. The total volume of combustible face trim, moldings, and decorations, including veneers, in any space shall not exceed a volume equivalent of 2.5 mm (0.1 in.) veneer on the combined area of the bulkheads and overhead. Such trim, molding, or decorations shall not perform any structural function.

6-4 Fire-Resistant Furnishings. Where required, furnishings shall comply with this section.

6-4.1 Seating Furniture. Seating furniture shall comply with UL 1056, *Fire Test of Upholstered Furniture*.

6-4.2 Case furniture constructed entirely of noncombustible materials, with a maximum 3 mm (0.12 in.) thickness of combustible veneer, shall be permitted to be used if the veneer meets the requirements of 6-3.3.

6-4.3* Draperies. Draperies or other vertically hung textiles shall be constructed with materials that pass NFPA 701, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*.

6-4.4 Furniture Test Criteria. Furniture installed in medium- and low-risk accommodation spaces shall meet NFPA 266, *Standard Method of Test for Fire Characteristics of Upholstered Furniture Exposed to Flaming Ignition Source*, or ASTM E 1537, *Standard Method for Fire Testing of Upholstered Furniture Items*, with a maximum rate of heat release of 80 kW and a maximum total heat released, within the first 10 minutes of test, of 25 MJ (23,697 Btu).

Chapter 7 Vessel Fire Detection and Protection Equipment

7-1* Fire Detection, Alarm, and Communications Systems.

7-1.1 General Requirements. Fire detection, alarm, and communications systems shall be listed and comply with SOLAS II-2, Regulation 13 and the requirements of Section 7-1. Nothing in this system shall be construed as a restriction on new technologies or alternatives to those requirements, provided that the level of protection is maintained.

7-1.2 Addressable Fire Alarm Systems. Addressable fire alarm systems, whereby specific space and zone identification, or both, is provided by individually identifiable initiating devices, shall be arranged to meet the following criteria:

- (a) Means are provided to ensure that any one fault (e.g., open circuit, short circuit, or ground) occurring in the signaling line circuit will not render any initiating devices in any fire zone inactive.
- (b) All arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g., electrical, electronic, information).
- (c) Signaling line circuits shall be capable of supporting 100 percent of the initiating devices connected to them if all are activated simultaneously, without any loss of signal.
- (d) A signaling line circuit shall be arranged.

7-1.3 Installation Requirements. Fire detection, alarm, and communication systems shall be installed in accordance with SOLAS Chapter II-2, Regulation 13.2.

7-1.4 Design Requirements.

7-1.4.1 Fire detection, alarm, and communication systems shall meet design requirements of SOLAS Chapter II-2, Regulation 13.3.

7-1.4.2 Fire detection, alarm, and communication equipment and devices shall be listed for marine use.

7-1.4.3 The installation of all wiring, cable, and power equipment shall be in accordance with Section 7-6.

7-1.5 Sample-Extraction Smoke Detection Systems. Where required, sample-extraction smoke detection systems shall be designed and installed in accordance with SOLAS II-2, Regulation 13.1.

7-1.6 Inspection, Testing, and Maintenance of Fire Alarm and Detection Systems. To ensure operational integrity, the fire detection and alarm system shall be maintained and tested in accordance with the requirements of Chapter 7 of NFPA 72, *National Fire Alarm Code*®.

7-2 Fire-Protection Systems and Equipment.

7-2.1 General. Component and machinery installed in fire-protection systems are to be designed so as to ensure proper operations in a marine environment aboard a vessel under inclination conditions cited in American Bureau of Shipping, *Rules for Building and Classing Steel Vessels*, Part 4, Section 1, Table 4/1.1.

7-2.2* Foam-Water Sprinkler and Spray Systems. Foam deluge systems shall be listed and shall be designed and installed in accordance with 46 *CFR*, Part 76.17.

7-2.3 Pressure Tanks. Pressure tank(s) that support sprinkler systems shall be designed and installed in accordance with NFPA 22, *Standard for Water Tanks for Private Fire Protection*, and NFPA 13, *Standard for the Installation of Sprinkler Systems*. Foam systems shall be installed in accordance with 7-2.8.

7-2.4 Drainage and Dewatering. Vessels protected by water-based extinguishing systems shall be designed to remove water from those vessels at a rate no less than the maximum possible rate of water admittance from the extinguishing system.

7-2.5 Automatic Engine Shutdown. Where fixed gaseous extinguishing systems are installed in spaces that contain internal combustion engines that draw intake air from within the protected space, automatic engine shutdowns shall be provided upon actuation of the extinguishing system.

7-2.6 Inspection, Testing, and Maintenance. All water-based systems required by this code shall be inspected, tested, and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire-Protection Systems*.

7-2.7 Automatic Sprinklers. Where required, automatic sprinkler systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

7-2.8 Water-Mist Systems. Water-mist systems shall be listed and designed in accordance with NFPA 750, *Standard on Water Mist Fire-Protection Systems*.

7-2.9 Low-Expansion Foam Systems. Low-expansion foam systems shall be listed and shall be designed and installed in accordance with NFPA 11, *Standard for Low Expansion Foam*.

7-2.10 Carbon Dioxide Extinguishing Systems. Carbon dioxide extinguishing systems shall be listed and shall be designed and installed in accordance with 46 *CFR*, Parts 76.15, 34.15, and 95.15.

7-2.11 Clean Agent Systems. Clean agent systems shall be listed and designed and installed in accordance with NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*.

7-2.12 Halon Systems. No new halon extinguishing systems shall be installed.

7-2.13 Inert Gas Systems. On vessels that have cargo tanks where an inert gas system is required, the inert gas system shall be installed in accordance with SOLAS II-2, Regulation 62.

7-2.14 Dry and Wet Chemical Extinguishing Systems. Dry and wet chemical systems shall be in accordance with NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, and NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, respectively.

7-2.15 Portable Fire Extinguishers.

7-2.15.1 Portable fire extinguishers (including mounting) shall be listed for marine use and maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

7-2.15.2 Extinguishers shall be classed in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

7-2.16 Fire Main, Fire Pumps, Hydrants, and Hose.

7-2.16.1 General. Each vessel shall have an installed fire main, pumps, hydrants, hose, hose accessories, and nozzles and shall be capable of delivering an adequate supply of water to all portions of the vessel for the purpose of fighting fires in accordance with SOLAS II-2 Regulation 4 as modified by 7-2.16.2 through 7-2.16.10.

Exception No. 1: As provided by Chapters 8 through 19.

Exception No. 2: Fog applicators shall not be required at fire stations when fire hose located at such fire stations are outfitted with variable pattern nozzles meeting NFPA 1964, Standard for Spray Nozzles (Shutoff and Tip).

Exception No. 3: Reference to American Bureau of Shipping, Rules for Building and Classing Steel Vessels, Part 4, Section 9.5 through 9.9 in lieu of SOLAS II-2, Regulation 4 shall be acceptable when determining a vessel's fire main, fire pump, hydrant, and hose requirement.

Exception No. 4: Fire main piping and pumps shall be permitted to be combined and sized to simultaneously supply water-based fire suppression systems in accordance with Section 7-2.

7-2.16.2* Fire-Main Pressure. The fire-main pressure shall be sufficient to support all provided fire-fighting equipment as recommended by the manufacturer of the equipment.

7-2.16.3 Diesel Engine Starting Arrangements. Engines shall be provided with a starting arrangement that utilizes stored energy and supervises the adequacy of the stored energy. These means shall enable the diesel-driven power source to be started at least six times within a period of 30 minutes and at least twice within the first 3 minutes. Any diesel-driven power source for the pump shall be capable of being readily started in its cold condition down to a temperature of 0°C (32°F) by manual cranking. If lower temperatures are likely to be encountered, heating arrangements shall be provided so that ready starting will be assured. The pump controller shall be listed or approved.

7-2.16.4 Required Fuel Reserves for Fire Pumps. Any service fuel tank shall contain sufficient fuel to enable the pump to run on full load for at least 3 hours and sufficient reserves of fuel shall be available outside the main machinery space to enable the pump to be run on full load for an additional 15 hours.

7-2.16.5 Location of Fire Pump. Where located in a space other than a machinery space, then the space containing the fire pump shall be insulated to a standard of structural fire protection equivalent to that required for a control station in Chapter 11. No direct access shall be permitted between the machinery space and the space containing the emergency fire pump and its source of power.

Exception: A remote-operated, watertight door shall be permitted. Remote operation shall be from the bridge, engineering control station, and fire control station, if any.

7-2.16.6 Ventilation Requirements. Ventilation arrangements to the space containing the independent source of

power for the emergency fire pump shall be such as to preclude, as far as practicable, the possibility of smoke from a machinery-space fire entering or being drawn into that space.

7-2.16.7* Fire Main Water Supply. In machinery spaces that are periodically unattended or when only one person is required on duty, water delivery from the fire main system shall be possible without entering the machinery space.

7-2.16.8 Operation of Fire Pumps. Fire pumps shall be capable of being started at the pump and from the central control station.

7-2.16.9 International Shore Connection. International shore connections shall be designed and installed in accordance with SOLAS II-2, Regulation 19.

7-2.16.10 Fire Hose. Fire hose shall be listed in accordance with UL 19, *Lined Fire Hose and Hose Assemblies*. At least one length of hose shall be provided for each hydrant. Hose shall be connected to hydrants at all times.

Exception: On open decks where no protection is afforded to the hose in heavy weather, or where the hose is susceptible to damage from the handling of cargo, the hose shall be permitted to be removed from the hydrant and stowed in an accessible nearby location.

7-3 Fire Fighter Protective Clothing, SCBA Equipment, and Fire Control Plans.

7-3.1 Fire Fighter Protective Clothing. Personal fire-fighting protection equipment shall include protective clothing and a flashlight and self-contained breathing apparatus. All fire-fighter protective clothing shall consist of turnout gear, helmet, gloves, boots, and hood and shall comply with NFPA 1971, *Standard on Protective Ensemble for Structural Fire Fighting*. Such equipment shall be located in vessel areas that allow for ready fire-fighter access and easy donning.

7-3.2 Self-Contained Breathing Apparatus (SCBA). SCBA units and spare cylinder shall comply with NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Service Fire Fighters*, be NIOSH-certified for an open circuit pressure demand type, have a full facepiece, and be rated for a minimum of 30 minutes.

7-3.2.1 A minimum of one spare SCBA cylinder shall be maintained for each required SCBA unit and all SCBA cylinders shall be interchangeable. All SCBA units outfitted aboard a vessel are to be of like kind (i.e., make, model, and manufacturer).

7-3.2.2 All SCBA units and cylinders shall be maintained operational in accordance with the manufacturer's recommendations, and maintenance records shall be maintained aboard the vessel.

7-3.2.3 The required number of SCBA units to be carried for fire-fighting purposes shall be in accordance with Chapters 17 through 19.

7-3.2.4 Storage of the SCBA units shall allow for ready donning by the fire fighter. All SCBA units shall be protected from the weather when not in use.

7-3.2.5 SCBA Recharging Systems. Where required by Chapters 8 through 19, an installed SCBA recharging system shall comply with the requirements in Section 7-3.

7-3.2.5.1* Type of SCBA Recharge or Refill Systems. SCBA air refill systems shall be permitted to consist of any combination of the following to achieve the required air refill capacity:

- (a) Air compressor with air purification and refill station system
- (b) Fixed air reservoirs (single or manifold storage bottles in cascade arrangement)
- (c) Additional filled spare SCBA cylinders fitted with integral pressure gauges/fill indicator

SCBA recharge systems shall be permitted to be used for other vessel requirements such as scuba cylinder recharging provided sufficient safeguards are in place, quality of air to fill the SCBA is not degraded, and the system continues to meet the minimum SCBA recharge requirements of Section 7-3 at all times.

7-3.2.5.2 SCBA Recharge Compressors. Oil or oil-less compressor systems shall be acceptable. Recharge compressors shall have air purification systems installed to meet the air quality standard cited in Section 7-3. SCBAs being charged shall be contained in air refill stations to protect the operator from SCBA explosion. Connecting air tubing shall comply with 46 *CFR*, Part 56. Compressors shall have over-pressurization safety valve(s) installed, and they shall not be capable of being isolated. Audible and visual alarms shall be installed to indicate unacceptable air output. Operating and safety instructions and systems schematic shall be permanently mounted on or near the compressor unit in plain view of the operator to address compressor, purification, and refill operations.

7-3.2.5.3 Fixed Air Reservoirs (Storage Bottles) Requirement. Storage cylinders shall comply with 49 *CFR*, Part 173.34. Connecting tubing shall comply with 46 *CFR*, Part 56. Cylinders shall be mounted vertically and shall be secured to the structure of the vessel. Cylinder bottoms shall not sit directly on steel decking. Cylinders shall be arranged to facilitate inspection, testing, and maintenance of the cylinders and tubing.

7-3.2.6 SCBA Recharge System Capacity/Spare Cylinder Quantity. A recharge rate/spare cylinder quantity shall meet the requirements needed to support the largest anticipated fire team considered necessary for the worst case, machinery space fire re-entry scenario.

7-3.2.6.1 One of the following, or any combination of the following shall be met:

- (a) A recharge system rate to support a minimum of three consecutive fire team entries
- (b) Charged spare cylinders to support a minimum of three consecutive fire team entries

7-3.2.7 Air Quality of SCBA Recharge System Air. All compressed air used to refill SCBA cylinders and contained in SCBA cylinders shall comply with the requirements of the Compressed Gas Association, *Commodity Specifications for Air*, G-7.1 for Grade E, 25 ppm water vapor air.

7-3.2.8 Location of Recharge Facilities. Recharge facilities shall be located where access will not be cut off in the event of a fire or heavy smoke. Recharge facilities shall be protected from the effects of weather and mechanical damage.

7-3.2.9 Emergency Power. Electrically driven air compressors shall have an automatic means for receiving power from the emergency bus.

7-3.2.10 Compression Air Supply Source. Air compressors shall be fitted with air inlets that take suction from weather and have minimal chance of ingesting smoke, exhaust air

from exhaust vents, diesel exhaust, foul air or other source of noxious substances.

7-3.2.11 Testing, Inspection, and Maintenance. Air recharge systems and equipment shall be inspected, tested, and maintained in accordance with manufacturer's recommendations.

7-3.2.12 Availability of SCBA Refill Systems. The SCBA refill systems shall be ready for immediate use at all times while the vessel is at sea and in port.

Exception: When the vessel is in a major overhaul or drydock status.

7-3.3 Fire Control Plans. All vessels shall be provided with fire control plans that comply with ASTM F 1626, *Standard Practice for Preparing Shipboard Fire Control Plans* and that shall be mounted in accordance with SOLAS II-2, Part A, Regulation 20.

7-4* Ventilation.

7-4.1* General. Depending on the space requirements, ventilation air shall be permitted to be supplied and exhausted by natural draft, mechanical means, or a combination of both. Because the ductwork for a ventilation system is common to many spaces, it can cause the spread of flame or smoke if not properly designed, and shall therefore be evaluated as a component of the vessel's structural fire-protection system.

7-4.2 Ducting Design.

7-4.2.1 Ventilation ducting shall be constructed of noncombustible materials and shall not degrade the integrity of the A-, B-, or C'-Class bulkheads and decks or smokeproof enclosures that the ducting might penetrate.

Exception: Duct sections shall be permitted to be constructed of combustible material only if the following criteria are met:

- (a) The duct is less than 2.0 m (6.56 ft) long.
- (b) The duct is less than or equal to 0.02 m² (0.215 ft²) in cross-sectional area.
- (c) The duct is constructed of material with a flame-spread rating not to exceed 20 and a smoke development not to exceed 10 when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.
- (d) The duct is used only at the end of a ventilation device.
- (e) The duct is located at least 600 mm (23.6 in.) from an opening in an A-, B-, or C'-Class division.

7-4.2.2 Penetrations of A-Class Divisions.

7-4.2.2.1 Penetrations of A-Class divisions shall be tight-fitting in accordance with one of the following methods:

- (a)* The duct shall be continuously welded to one side of the division.
- (b) The duct shall be flanged, with the flanges bolted to both sides of the division.
- (c) The duct shall be sealed using an approved fire stop in accordance with ASTM E 814, *Standard Test Method for Fire Tests of Through-Penetration Firestops*.

7-4.2.2.2 Where ducting penetrates an A-Class division, an automatic A-Class fire damper complying with 7-4.3 shall be installed.

7-4.2.3 Penetrations of B-Class Divisions. Penetrations of B-Class divisions shall comply with one of the following:

- (a) The duct shall be tight-fitting where the duct meets B-Class integrity.

- (b) The duct shall be fitted with an automatic fire damper complying with 7-4.3.
- (c) The duct shall meet the requirements of an A-Class penetration.

7-4.2.4 Vent ducting and fans serving stairway enclosures shall serve no other spaces.

7-4.2.5 In all ventilation systems, manually operated dampers shall be provided in accessible locations to shut off the passage of air in the event of fire. The means for manual damper control shall be located in an unlocked compartment, outside the spaces served by the ventilation system.

7-4.2.6 Insulation providing the same protection as the penetrated division shall be applied to the duct for a distance of 305 mm (12 in.) from the division. Any insulation installed for heat, comfort, refrigeration (including air conditioning), or for any other purpose, and all material incidental to the installation, shall be made of approved, noncombustible materials.

7-4.3 Damper Design. Where required, fire dampers shall comply with the requirements of Section 7-4.

Exception: Fire dampers listed for a one and one-half hour fire endurance that are capable of manual operation and fitted adjacent to the bulkhead shall be permitted.

7-4.3.1 The damper and the portion of the duct containing the damper shall be constructed of at least 3.0-mm steel (in A-Class bulkhead penetration) or 1.6-mm steel (in B-Class bulkhead penetration). A maximum 3.0-mm (0.125-in.) gap between the blade and casing shall be permitted. All springs, hinges, and other damper components shall be constructed of stainless or suitably protected steel to prevent corrosion. No insulation shall be necessary on the damper blade. The damper shall be made readily accessible for periodic inspection by means of a hinged or bolted plate in the duct. All dampers shall be capable of manual operation.

*Exception: Dampers that prevent the passage of smoke and flame for 1½ hours when tested according to UL 555 S, *Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems*, or meet Part 3 of the IMO Fire Test Procedures Code shall be acceptable.*

7-4.3.2 Where automatic fire dampers are required, they shall be provided with a fusible link assembly rated at approximately 74°C (165°F). In high ambient heat areas, such as the exhaust duct leading from the galley, automatic dampers shall be provided with a fusible link assembly rated at approximately 100°C (212°F). The dampers shall be designed to close against the anticipated draft in the duct. Other types of automatic dampers shall be permitted to be used, if approved.

7-4.3.3 Automatic fire dampers shall be fitted adjacent to the bulkhead. The damper shall be fitted on at least one side of the bulkhead with a visible indicator showing whether the damper is in the open or closed position. The local damper indicator shall be capable of always showing the actual position of the damper and shall be marked so as to readily indicate the damper position. Dampers shall be capable of being remotely closed from the central control station or of being manually closed from both sides of the bulkhead.

7-4.4 Duct Heating Units.

7-4.4.1 Where installed, duct heaters shall be provided with a thermal overheat-protection safety device and interlocked with the fan to prevent the heater from operating when the fan is not operating. The heater shall be designed to limit the

surface temperature of the heating element to a maximum of 232°C (450°F).

7-4.4.2 Space Heaters. Electric radiators and bulkhead mounted convection space heaters shall be listed and installed in accordance with SOLAS II-2, Regulation 18.3 and Section 7-6 herein.

7-4.5 Ventilation Control.

7-4.5.1 Spaces serviced by a power ventilation system shall be provided with remote means for stopping the ventilation system that services it in case of a fire. The remote means shall be permitted to be located immediately outside the space, at the fire control station, and/or on the bridge.

7-4.5.2 Powered ventilation systems serving spaces protected by fixed-gas fire extinguishing systems shall be capable of being secured prior to the discharge of the extinguishing agent. The shutdown of the ventilation system and the means to close all vents shall be interlocked with and accomplished automatically by the operation of the fixed-gas fire extinguishing system release mechanism. Sufficient time for ventilation system rundown shall be allowed before actual release of the agent, or make-up extinguishing agent shall be designed into the system.

7-4.5.3 Provisions to secure ventilation to the protected space from outside that space shall be provided for spaces having natural ventilation and protected by a fixed-gas fire extinguishing system.

7-4.5.4 Requirements for activation of ventilation systems in smokeproof enclosures shall be in accordance with 5-2.3.9.

7-4.5.5 Electrical equipment subject to arcing shall be ventilated or placed in ventilated compartments where flammable gases, acidic fumes, or oil vapors cannot accumulate. Electrical requirements shall be in accordance with Section 7-6.

7-4.6 Ventilation Through Doors and Bulkheads. Vent grilles or louvers shall not be used in doors penetrating A-Class bulkheads, although such doors shall be permitted to be undercut not to exceed 13 mm (0.5 in.) above the door sill or top of approved deck covering. Doors in B- or lesser-Class bulkheads shall be permitted to contain vent grilles or louvers with a net area not to exceed 0.2 m² (2 ft²) in the lower half of the door and shall be permitted to be undercut not to exceed 25 mm (1 in.) above the door sill or top of deck covering.

7-4.7 Ventilation for Spaces Containing High-Risk Fuels. An independent exhaust system, employing a nonsparking, centrifugal fan, shall be provided to exhaust these spaces. The exhaust shall discharge directly to the weather. The nonsparking fan shall be located outside of the space serviced and at least 3 m (10 ft) from the discharge end of the exhaust duct. Where this distance requirement cannot be met, the nonsparking fan shall be equipped with an explosionproof motor.

Exception: Cargo spaces and fuel tanks.

7-4.8* Smoke-Control Ventilation. A smoke-control system shall confine smoke to the general area of fire origin, maintain use of the means of egress systems, and provide for the removal of smoke and heat by means of a fixed system or systems.

7-4.9 Plans, Marking, and Documentation. Ventilation equipment deemed necessary to operate in an emergency shall be shown on the fire-control plan per 7-3.3. All dampers shall be marked to indicate their open and closed positions. Remote damper shutdowns shall be clearly marked to identify the spaces served.

7-5 Elevators, Escalators, Dumbwaiters, and Other Transfer Devices. Vessel elevators and other vertical lift devices shall be designed in accordance with ASME A17.1, *Safety Code for Elevators and Escalators*. Testing and inspection procedures for shipboard elevators shall be in accordance with ASME A17.2, *Inspectors' Manual for Elevators and Escalators*.

7-6* General Requirements for Electrical Equipment. Design, installation, and maintenance of electrical equipment and wiring shall be in accordance with 46 CFR, Part 110, Subchapter J and IEEE Standard 45, *Recommended Practice for Electric Installations on Shipboard*.

7-7 Fixed Electric Heating Equipment for Pipelines, Vessels, Deicing, and Snow Melting. All fixed electric heating equipment installed on merchant vessels for heating pipelines and vessels, as well as electric heating equipment installed for prevention of ice formation on floors, decks, doors, or hatches, shall comply with Articles 426, 427, and 500 of NFPA 70, *National Electrical Code*.

Chapter 8 Accommodation Spaces

8-1 General Requirements.

8-1.1 Application. The requirements of Chapter 8 shall apply to all accommodation spaces.

8-1.2 Classification of Occupancy.

8-1.2.1* Subclassification of Accommodation Occupancies. Accommodation spaces shall be limited to combustible fire loads no greater than 37.5 kg/m² (7.5 lb/ft²) and shall be subclassified as follows:

- (a) High risk contains a fuel load greater than 15 kg/m² (3 lb/ft²) and less than or equal to 37.5 kg/m² (7.5 lb/ft²).
- (b) Medium risk contains a fuel load greater than 5 kg/m² (1 lb/ft²) and less than or equal to 15 kg/m² (3 lb/ft²).
- (c) Low risk contains a fuel load less than or equal to 5 kg/m² (1 lb/ft²).

8-1.2.2* Accommodation spaces, on vessels that are fully sprinklered in accordance with 7-2.7 or fully protected with a watermist system in accordance with 7-2.8, shall be considered low risk.

8-1.3 Minimum Construction/ Separation Requirements. Accommodation spaces shall be separated from adjoining spaces by bulkheads that are constructed in accordance with Table 8-1.3. (See 6-2.1.)

Exception: For medical, health care, and child care protected by automatic sprinklers.

8-1.4 Occupant Load.

8-1.4.1* Occupant Load Factors. The occupant load permitted in any accommodation space shall be determined on the basis of the following occupant load factors:

- (a) *Fixed seating criterion.* Design capacity.
- (b) *Public spaces without fixed seating.* One person for each 1 m² (10 ft²) of gross deck area and 0.65 m² (7 ft²) of net deck area. The occupant load of any open mezzanine or balcony shall be added to the deck below for the purpose of determining exit capacity.
- (c) *Staterooms and office areas.* Design capacity.

Table 8-1.3 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirements for High-Risk Accommodation Areas	Separation Requirements for Medium-Risk Accommodation Areas	Separation Requirements for Low-Risk and Sprinklered Accommodation Areas
High-risk accommodation	B-15	B-15	B-15
Medium-risk accommodation	B-15	B-0	B-0
Low-risk and sprinklered accommodation	B-15	B-0	C'
Medical, health care, and child care	B-15	B-15	B-0
High-risk service	A-60	A-0	A-0
Low-risk service	B-15	B-15	B-0
Electrical and control	A-60	A-0	B-0
Low-risk engineering and machinery	A-0	A-0	B-0
High-risk engineering and machinery	A-60	A-60	A-60
High-risk storage	A-60	A-60	A-0
Low-risk storage	B-15	B-0	C
Cargo	A-60	A-0	A-0
Open deck	A-0	A-0	C'
Helicopter platform	A-60	A-60	A-60
Voids	A-0	A-0	C'

(d) *Public sales (shops) areas.* One person per each 3 m² (32 ft²) of gross deck area.

(e) *Bleachers, pews, and other bench-type seating.* One person per 45 linear cm (18 in.).

For a space with mixed occupant load factors that contain flexible arrangements, the arrangement that would yield the highest occupancy load shall apply.

8-1.4.2 Occupant load shall be permitted to be increased above that permitted by 8-1.4.1 if the necessary aisles and exits are provided. To increase the occupant load, a diagram indicating placement of equipment, aisles, exits, and seating shall be provided to, and approved by, the authority having jurisdiction prior to any increase in occupant load. In areas not greater than 750 m² (8073 ft²) the occupant load shall not exceed 1 person in each 0.5 m² (5.5 ft²). In areas greater than 750 m² (8073 ft²) the occupant load shall not exceed 1 person in 0.65 m² (7 ft²).

8-2 Means of Egress Requirements.

8-2.1 General. All means of egress shall be in accordance with Chapter 5 and Section 8-2.

8-2.2 Means of Egress Components.

8-2.2.1 General. Components of means of egress shall be limited to the types described in 8-2.2.2 through 8-2.2.3.

8-2.2.2 Doors. Doors shall comply with 5-2.1.

8-2.2.3 Ramps. Ramps shall comply with 5-2.5.

Exception: Ramps serving only stages or nonpublic areas and ramped aisles shall be permitted to have a slope not steeper than 1 in 8.

8-2.3 Means of Egress Arrangement.

8-2.3.1 At least two separate exit accesses shall be provided. Each exit access shall be remotely located from the other as required by Section 5-5.

Exception: A single exit access shall be permitted for any of the following:

- (a) *Staterooms*
- (b) *Office areas with an occupant load less than 20, provided the exit access is directly into an exit access corridor*
- (c) *Public sales areas (shops) where the exit access opens directly to an exit access corridor.*

8-2.3.2 All accommodation spaces with an occupant load greater than 500 shall be provided with at least three separate means of egress. Public spaces with an occupancy greater than 1000 shall have at least four separate means of egress.

8-2.3.3 Mezzanines having an occupant load not greater than 30 shall be permitted to be served by a single means of egress and such means of egress shall be permitted to lead to the deck below.

8-2.3.4 Mezzanines having an occupant load greater than 30, but not more than 60, shall have at least two remote means of egress, but both such means of egress shall be permitted to lead to the deck below.

8-2.3.5 Mezzanines having an occupant load greater than 60 shall have means of egress provided as for a separate deck.

8-2.4 Travel Distance to Exits. Exits shall be arranged so that the total length of travel from any point to reach an exit shall not exceed 30 m (98.4 ft).

Exception: In fully sprinklered vessels, travel distance to an exit shall not exceed 45 m (147.6 ft).

8-2.5 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9.

8-2.6 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 5-10.

8-3 Protection.

8-3.1 Protection of Miscellaneous Openings in Fire Barriers. All penetrations shall be protected in accordance with 6-2.4.8.

Exception No. 1: Ducting installed in connection with air-handling systems that service accommodation occupancies and that utilize passageways as part of their "return air" system shall not be required to meet the fire-resistance rating of the connecting barrier if it meets the following requirements:

- (a) *The duct penetration of the barrier shall be installed low, such that no portion of the ductwork is higher than 50 cm (19.7 in.) above the deck.*
- (b) *The cross-sectional area of the penetration does not exceed 0.05 m² (0.54 ft²).*
- (c) *The duct does not provide a direct connection between the originating compartment and the passageway; that is, the duct terminates in a utility space adjoining both the passageway and originating compartment.*

Exception No. 2: Vertical ventilation ducts that service cargo or main machinery spaces that pass through accommodations or safety areas shall be insulated to the applicable division requirements for 1.8 m (6 ft) beyond the division.

8-3.2 Interior Finish. Interior finish shall comply with Section 6-3.

8-3.3 Furnishings.

8-3.3.1 Furnishings in low- and medium-risk accommodations areas shall meet 6-4.

8-3.3.2 The combustibility of furniture installed in high-risk accommodation spaces shall not be restricted as to the materials of construction.

8-3.3.3 Bedding. Mattress and bedding components shall comply with 16 CFR, Part 1632, *Standard for the Flammability of Mattresses and Mattress Pads*, and contains no polyurethane foam.

Exception: Bedding meeting UL 1895, Fire Test of Mattresses.

8-3.4 Detection, Alarm, and Communication Systems.

8-3.4.1 All accommodation spaces shall be provided with a manual alarm system in accordance with Section 7-1.

8-3.4.2 All overnight accommodation spaces shall be provided with a smoke detection system in accordance with Section 7-1 that additionally provides an audible alarm at the actuated device. Where suites of overnight accommodations are interconnected and intended for use by a single occupant or group of occupants, the smoke detectors shall be arranged such that activation of one smoke detector in the suite shall cause the audible alarm for all of the smoke detectors in the suite to activate.

8-3.4.3* Smoke detectors shall be installed in all stairways, corridors, and means of egress serving accommodation spaces. Where smoke detectors are installed within ducts they shall be listed for that purpose.

8-3.4.4 Occupant notification shall be by means of voice announcements, initiated by a person in a central control station.

The public address system shall provide at least 75 decibels and at least 10 decibels above the background noise in all areas occupied by passengers and crew. In addition, the public address system shall be supplied with a backup emergency source of power.

8-3.5 Extinguishment Requirements. All overnight accommodation spaces shall be protected throughout with an auto-

matic sprinkler system in accordance with 7-2.6 or an automatic water mist system in accordance with 7-2.7.

Exception: Except as provided in Chapters 17 through 19.

Chapter 9 Medical, Health Care, and Child Care Spaces

9-1 General Requirements.

9-1.1 Application. Medical, health care, and child care spaces shall comply with Chapter 9.

9-1.2 Definitions.

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.

9-1.3 Minimum Construction/ Separation Requirements. Medical, health care, and child care spaces shall be separated from adjoining spaces by bulkheads that are constructed in accordance with Table 9-1.3. (*See 6-2.1.*)

Table 9-1.3 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirement
High-risk accommodation	B-15
Medium-risk accommodation	B-15
Low-risk and sprinklered accommodation	B-0
Medical, health care, and child care	B-0
High-risk service	A-60
Low-risk service	A-0
Electrical and control	A-0
Low-risk engineering and machinery	A-0
High-risk engineering and machinery	A-60
Low-risk storage	B-0
High-risk storage	A-0
Cargo	A-60
Open deck	A-0
Helicopter platform	A-60
Voids	A-0

9-1.4 Occupant Load. The occupant load for which means of egress shall be provided for any deck shall be the maximum number of persons intended to occupy that deck but not less than one person for each 11 m² (118.4 ft²) of gross deck area in sleeping areas for health care and medical care, and 3 m² (32.3 ft²) for child care. Gross deck areas shall be measured within the exterior vessel bulkheads with no deductions. (*See Chapter 3.*)

9-2* Means of Egress Requirements.

9-2.1 General. Every aisle, passageway, corridor, exit discharge, exit location, and access shall be in accordance with Chapter 5.

9-2.2 Means of Egress Components.

9-2.2.1 Components of means of egress shall be limited to the types described in 9-2.2.2.

9-2.2.2 Doors complying with 5-2.1 shall be permitted.

9-2.2.2.1 Locks shall not be permitted on patient sleeping area doors.

Exception: Key locking devices that restrict access to the berth from the passageway and that are operable only by staff from the corridor side shall be permitted. Such devices shall not restrict egress from the berth.

9-2.2.2.2 Doors not in a required means of egress shall be permitted to be subject to locking.

9-2.2.2.3 Doors within a required means of egress shall not be equipped with a latch or lock that requires the use of a tool or key from the egress side.

9-2.2.2.4 Horizontal sliding doors, as permitted by 5-2.1.10, that are not automatic-closing shall be limited to a single leaf and shall have a latch or other mechanism that will ensure that doors will not rebound into a partially open position if forcefully closed in an emergency.

9-2.2.2.5 The minimum clear width for doors leading from sleeping areas; diagnostic and treatment areas, such as X-ray, surgery, or physical therapy; and nursery areas shall be 1 m (3.3 ft).

Exception No. 1: Doors that are located so as not to be subject to use by any health care occupant shall be not less than 0.8 m (26 in.) in clear width.

Exception No. 2: Doors in exit stair enclosures shall be not less than 0.8 m (26 in.) in clear width.

Exception No. 3: Where a pair of doors is provided, at least one of the doors shall provide a minimum 0.8-m (26-in.) clear width opening, and a rabbet, bevel, or astragal shall be provided at the meeting edge. The inactive leaf shall have an automatic flush bolt to provide positive latching.

9-2.3 Egress Capacity. Egress capacity for components of means of egress shall be based on the following:

- (a) Stairway width of 1.0 cm per person [0.4 in. per person]
- (b) Level components and ramps width 0.5 cm per person [0.2 in. per person]

9-2.4 Means of Egress Arrangement.

9-2.4.1 At least two exit accesses of the types described in 9-2.2.2, remotely located from each other, shall be provided.

Exception: A single exit access shall be permitted for medical, health care, and child care spaces with occupant load not exceeding five persons.

9-2.4.2 At least one exit access from each separate occupancy shall be one of the following:

- (a) A door to an embarkation area, or an area of refuge
- (b) A door to a stair
- (c) A door to a smokeproof enclosure
- (d) A door leading to a ramp
- (e) A door to an exit passageway

Any hospital area not meeting these requirements shall be considered part of an adjoining occupancy. Egress shall not require return through the compartment of fire origin.

9-2.4.3 At least two exits of the types described in 9-2.2.2 shall be accessible from each compartment. Egress shall be permitted through adjacent compartment(s) but shall not require return through the compartment of fire origin.

9-2.4.4 Every habitable area shall have an exit access door leading directly to an exit access corridor.

Exception No. 1: If there is an exit door opening directly outside the vessel or to an area of refuge.

Exception No. 2: Patient sleeping areas shall be permitted to have an intervening area if the intervening area is not used as an exit access for more than eight patient sleeping areas.

Exception No. 3: Special nursing suites shall be permitted to have one intervening area where the arrangement allows for direct and constant visual supervision by nursing personnel.

Exception No. 4: For areas other than patient sleeping areas, one or more adjacent areas shall be permitted to intervene in accordance with 9-2.4.7.

9-2.4.5 Any patient sleeping area, or any suite of more than 93 m² (1000 ft²) that includes patient sleeping areas, shall have at least two exit access doors remotely located from each other.

9-2.4.6 Any suite of berths that complies with the requirements of 9-2.5 shall be permitted to be subdivided with C-Class partitions.

9-2.4.7 Suites of berths, other than patient sleeping areas, shall be permitted to have one intervening area, where the travel distance within the area to the exit access door is not greater than 30 m (100 ft), and shall be permitted to have two intervening areas where the travel distance within the area to the exit access door is not greater than 15 m (50 ft).

9-2.4.8 Every corridor serving medical, health care, and child care spaces shall provide access to at least two exits without passing through any intervening areas or spaces.

9-2.5 Travel Distance to Exits. Travel distance shall be measured in accordance with Section 5-6. The following requirements shall also apply to travel distance:

- (a) The travel distance between any door required as an exit access and an exit shall not exceed 45 m (150 ft).
- (b) The travel distance between any point in a berth and an exit shall not exceed 60 m (200 ft).
- (c) The travel distance between any point in a health care sleeping area and an exit access door in that area shall not exceed 15 m (50 ft).
- (d) The travel distance between any point in a suite of sleeping berths, as permitted by 9-2.5, and an exit access door of that suite shall not exceed 30 m (100 ft) and shall meet the requirements of (b) above.

9-2.6 Emergency Lighting.

9-2.6.1 Emergency lighting shall be provided in accordance with Section 5-9.

9-2.6.2 Vessels equipped with or in which patients require the use of life-support systems shall have emergency lighting supplied by the life safety branch of the electrical system as described in NFPA 99, *Standard for Health Care Facilities*.

Exception: Self-luminous exit signs as permitted by the Exception to 5-10.3.3.

9-3 Protection.

9-3.1 Interior Finish. Interior finish shall comply with Section 6-3.

9-3.2 Detection, Alarm, and Communication Systems.

9-3.2.1 Medical, health care, and child care spaces shall be provided with a fire detection and alarm system in accordance with Section 7-1.

9-3.2.2 Initiation. Initiation of the required fire alarm systems shall be by manual means and by means of any required sprinkler system, water flow alarms, detection devices, or detection systems.

Exception: Fire alarm pull stations in patient sleeping areas shall not be required at exits if located at all nurses' control stations or other continuously attended staff location, provided such pull stations are visible and continuously accessible.

9-3.2.3 Notification.

9-3.2.3.1 Occupant Notification. Occupant notification shall be accomplished automatically in accordance with Section 7-1.

Exception: In lieu of audible alarm signals, visible alarm-indicating appliances shall be permitted to be used in critical care areas.

9-3.2.3.2 Emergency Forces Notification. Crew notification shall be accomplished in accordance with Section 7-1.

9-3.2.3.3 Alarm Annunciation. Alarm annunciation shall be provided in accordance with Section 7-1.

9-3.2.4 Emergency Control. Actuation of any initiating device in the required fire alarm system shall be arranged to accomplish automatically any control functions to be performed by that device.

9-3.3 Extinguishment Requirements. Medical, health care, and child care spaces shall be protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 7-2.

9-4 Vessel Services.

9-4.1 Power for alarms, emergency communications systems, and the illumination of generator set locations shall be in accordance with the life safety branch requirements of NFPA 99, *Standard for Health Care Facilities*.

9-4.2 Any health care occupancy that normally utilizes life-support devices shall have electrical systems designed and installed in accordance with NFPA 99, *Standard for Health Care Facilities*.

Exception: This requirement shall not apply to a facility that uses life-support equipment for emergency purposes only.

Chapter 10 Service Spaces

10-1 General Requirements.

10-1.1 Application. Service spaces shall comply with Chapter 10.

10-1.2* Subclassification of Occupancies. Any space containing heat-producing appliances capable of producing temperatures that exceed 120°C (248°F) shall be considered high risk.

Table 10-1.2 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirements for Low-Risk Service	Separation Requirements for High-Risk Service
High-risk accommodation	B-15	A-60
Medium-risk accommodation	B-15	A-0
Low-risk and sprinklered accommodation	B-0	A-0
Medical, health care, and child care	A-0	A-60
High-risk service	A-0	C
Low-risk service	A-0	C
Electrical and control	B-0	A-0
Low-risk engineering and machinery	A-0	A-0
High-risk engineering and machinery	A-0	A-60
High-risk storage	A-0	A-0
Low-risk storage	C	A-0
Cargo	A-0	A-0
Open deck	A-0	A-0
Helicopter platform	A-0	A-0
Voids	C'	A-0

See Table 10-1.2 for separation requirements for low-risk and high-risk service spaces.

10-1.3 Occupant Load. Occupant load shall not be required to be applied to service spaces. Sufficient egress capacity shall be provided in accordance with Section 5-3.

10-2 Means of Egress Requirements.

10-2.1 General. All means of egress shall be in accordance with Chapter 5 and Section 10-2.

10-2.2 Means of Egress Components.

10-2.2.1 General. Components of means of egress shall be limited to the types described in 10-2.2.2.

10-2.2.2 Doors. Doors shall comply with 5-2.1.

10-2.3 Number of Exit Accesses. Multiple exit accesses shall not be required.

Exception: High-risk service spaces greater than 15 m² (161.5 ft²) shall have at least two exit accesses.

10-2.4 Arrangement of Means of Egress.

10-2.4.1 Where multiple exit accesses are required, exit accesses shall be located remotely from each other and shall be arranged to minimize the possibility that they might be blocked by any emergency.

10-2.4.2 Means of egress shall be permitted through accommodations spaces.

10-2.4.3 Common path of travel shall not exceed 15 m (49.2 ft).

Exception: In vessels fully sprinklered in accordance with 7-2.6 or fully protected with a water mist system in accordance with 7-2.7, the common path of travel shall not exceed 25 m (82 ft).

10-2.5 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9.

10-3 Protection.

10-3.1 Interior Finish. Interior finish shall comply with 6-3.3.

10-3.2 Detection, Alarm, and Communication Systems.

10-3.2.1 All service spaces shall be provided with a manual alarm system in accordance with Section 7-1.

10-3.2.2 All service spaces shall be provided with heat detection in accordance with Section 7-1.

Exception: Service spaces that are provided with an automatic fire suppression system complying with 7-2.2.

10-3.3 Extinguishing Requirements.

10-3.3.1 Galley Extinguishing Requirements. An automatic fire-extinguishing system complying with UL 300, *Standard for Safety Fire Testing of Fire-Extinguishing Systems for Protection of Restaurant Cooking Areas*, shall be installed to protect all parts of the range, cooking appliances, plenum, and ducts. Commercial cooking equipment shall be installed in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

Exception: Except as provided in Chapters 17 through 19.

10-3.3.2 Portable Extinguishers. One B-II extinguisher complying with 7-2.15 shall be provided for each 250 m² (2691 ft²) of deck area or fraction thereof.

Chapter 11 Electrical and Control Spaces

11-1 General Requirements.

11-1.1 Application. Electrical and control spaces shall comply with this chapter.

11-1.2 Minimum Separation Requirements. Minimum separation requirements for electrical and control spaces shall comply with Table 11-1.2.

Table 11-1.2 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirements
High-risk accommodation	A-60
Medium-risk accommodation	A-0
Low-risk and sprinklered accommodation	B-0
Medical, health care, and child care	A-0
High-risk service	A-0
Low-risk service	B-0
Electrical and control	C'
Low-risk engineering and machinery	A-0
High-risk engineering and machinery	A-60
High-risk storage	A-0
Low-risk storage	A-0
Cargo	A-0
Open deck	A-0
Helicopter platform	A-60
Voids	C

Exception: Where redundant controls are provided, separation from high-risk engineering and machinery spaces shall be permitted to be reduced to A-0.

11-1.3 Occupant Load. Occupant load shall not be required to be applied to electrical and control spaces. Sufficient egress capacity shall be provided in accordance with Section 5-3.

11-2 Means of Egress Requirements.

11-2.1 General. All means of egress shall be in accordance with Chapter 5 and Section 11-2.

11-2.2 Means of Egress Components.

11-2.2.1 Components of means of egress shall be limited to the types described in 11-2.2.2.

11-2.2.2 Doors shall comply with 5-2.1.

11-2.3 Means of Egress Arrangement.

11-2.3.1 Multiple exit accesses shall not be required.

11-2.3.2 Means of egress shall be permitted through adjacent spaces of any type.

11-2.4 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9.

11-3 Protection.

11-3.1 Interior Finish. Interior finish shall comply with 6-3.3.

11-3.2 Detection, Alarm, and Communication Systems.

11-3.2.1 All manned electrical and control spaces shall be provided with a manual alarm system in accordance with Section 7-1.

11-3.2.2 All electrical and control spaces shall be provided with smoke detection in accordance with Section 7-1.

11-3.3* Extinguishing Requirements. One B:C II extinguisher shall be provided for each electrical and control space.

Exception: Spaces that present low fire risk shall not be required to be provided with portable fire extinguishers.

Chapter 12 Engineering and Machinery Spaces

12-1 General Requirements.

12-1.1 Application. The requirements of Chapter 12 apply to machinery spaces of high and low risk.

12-1.2 Special Definitions

Manned Space.* A space that is normally occupied.

Unmanned Space.* A space that is occasionally occupied.

12-1.3 Classification of Occupancy.

(a) Low risk—all engineering and machinery spaces which are not high risk.

(b) Engineering and machinery spaces which contain high-risk fuel(s).

12-1.4 Minimum Separation Requirements. Minimum separation requirements for engineering and machinery spaces shall comply with Table 12-1.4.

Table 12-1.4 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirements for Low-Risk Machinery Spaces	Separation Requirements for High-Risk Machinery Spaces
High-risk accommodation	A-60	A-60
Medium-risk accommodation	A-0	A-60
Low-risk and sprinklered accommodation	B-0	A-60
Medical, health care, and child care	A-0	A-60
High-risk service	A-0	A-60
Low-risk service	A-0	A-0
Electrical and control	A-0	A-60
Low-risk engineering and machinery	C'	A-0
High-risk engineering and machinery	A-0	A-0
Low-risk storage	C	C
High-risk storage	A-0	A-0
Cargo	A-0	A-0
Open deck	A-0	A-0
Helicopter platform	A-60	A-60
Voids	C'	A-0

12-2 Means of Egress Requirements.

12-2.1 General. All means of egress shall be in accordance with Chapter 5 and Section 12-2.

12-2.2 Means of Egress Components. A periodically unattended engine room shall be considered a manned space for purposes of fire protection and egress.

12-2.2.1 Means of egress components shall be limited to the types described in 12-2.2.2 through 12-2.2.5.

12-2.2.2* Doors. Doors shall comply with 5-2.1.

Exception No. 1: Watertight doors and weathertight doors need not comply with the construction requirements of Chapter 5.

Exception No. 2: Doors shall be permitted to have a minimum width of 700 mm (28 in.).

12-2.2.3 Stairs.

12-2.2.3.1 Service stairs and ladders complying with 5-2.7 shall be permitted.

12-2.2.3.2 Vertical ladders complying with 5-2.8 and alternating tread devices complying with 5-2.9 shall be permitted as a secondary means of egress.

12-2.2.3.3 In engineering and machinery space occupancies and in storage occupancies, the clear distance between intermediate rails measured at right angles to the rails shall not exceed 50 cm (19.7 in.).

12-2.2.4 Escape Trunks.

12-2.2.4.1 Where used, escape trunks shall be separated from the machinery space by minimum A-60 divisions; they shall be provided with emergency lighting complying with Section 5-9 and with self-closing doors complying with 5-2.1.7 to allow protected egress from the machinery space.

Exception: Escape trunks that are 5 m (16.4 ft) or less in height shall be permitted to be reduced to a minimum A-0 division.

12-2.2.4.2 Self-closing doors or hatches shall be provided at each escape trunk egress.

Exception: Escape trunks egressing to weather.

12-2.2.5 Shaft Tunnels. Shaft tunnels shall be permitted to serve as an egress route.

12-2.3 Means of Egress Arrangement.

12-2.3.1 All machinery spaces shall be provided with a minimum of two separated means of egress.

Exception No. 1: Low-risk machinery spaces.

Exception No. 2: Unmanned machinery spaces that open directly to weather or an exit access.

12-2.3.2 Exits shall be located remotely from each other and at least one shall not require passage through a watertight door.

12-2.3.3 Escape trunks shall be provided at the following locations:

- Every engine control room located within the fire-resistive boundaries of the machinery space
- At the lowest deck of the machinery space
- Every high-risk machinery space

Exception: Escape trunks shall not be required for machinery spaces where the vertical distance from the lower level of the space to the weather deck, exit enclosure, or exit access is less than 5 m (16.4 ft).

12-3 Protection.

12-3.1 High-risk machinery spaces shall be protected throughout by one of the following systems in accordance with Section 7-2:

- Water mist system
- Carbon dioxide extinguishing system
- Clean agent system

12-3.2 Energy Sources.

12-3.2.1 Fire protection equipment shall not be the sole protection for the space in which it is located.

12-3.2.2 All feeder and control wiring, switchgear, fuel oil and starting equipment shall be located such that fire damage in the protected spaces will not impair the system.

When such equipment is located outside the space it is protecting, all feeder and control wiring, switchgear, fuel oil and starting equipment shall be located such that fire damage in the protected spaces will not impair the system.

12-3.2.3 Automatic fire protection systems shall be provided with at least two sources of power, one of which shall be provided from outside the protected space.

12-3.2.4 Machinery space fire protection systems shall be provided with two sources of electrical power, one normal source and the second from an emergency source.

Exception: Gaseous systems.

12-3.2.5* For all vessels, at least one source of power for fire-protection systems shall be provided from outside the protected space.

Exception: Machinery spaces not exceeding 120 m³ (4237.8 ft³).

12-3.2.6 Wiring and switchgear for fire-protection system pumps and controls shall be such that fire damage in the protected space will not impair the system.

12-3.3 Hydrants.

12-3.3.1 Hydrants shall be located within or outside machinery spaces such that all areas of the space can be reached by at least two, single-length hose lines from separate outlets. The hose line closest to the machinery space shall not exceed 25 m (82 ft). At least one hydrant shall be located outside of the machinery space.

Exception: As otherwise provided by Chapters 17 through 19.

12-3.3.2 Hydrants within the machinery space and those immediately outside the protected space that are connected to a fixed foam system, shall be capable of providing low expansion AFFF or other suitable foam for 30 minutes at rated flow from any two hydrants.

12-3.4 Fire Alarm Detection. All machinery spaces shall be fitted with a manual alarm system and automatic fire detectors in accordance with Section 7-1. The system shall initiate visual and audible alarms in the machinery space, machinery control room, the bridge, and central control station.

Exception: In periodically unattended machinery spaces, the fire detection system shall be so designed and the detectors so positioned as to rapidly detect the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures.

12-3.5* Emergency Escape Breathing Device (EEBD). The minimum number of National Institutes for Occupational Safety and Health (NIOSH) approved EEBDs shall be distributed such that no point is more than 15 m (49.2 ft) horizontal travel distance from an EEBD. The number provided shall be the greater of the following:

- (a) Twice the number manning the watch
- (b) The maximum number of personnel expected to be working in the space at any given time

Exception: EEBDs shall not be required in engineering and machinery spaces where the horizontal travel distance does not exceed 15 m (49.2 ft).

12-4 Vessel Services.

12-4.1 Emergency Lighting. All of the following areas shall be provided with emergency lighting:

- (a) Manned spaces
- (b) Escape routes
- (c) Areas housing fire extinguishing equipment and damage-control equipment

12-4.2 Low-Location Lighting. In manned, high-risk machinery spaces, low-location lighting shall be provided in accordance with Section 5-11.

12-5 Compartmentation.

12-5.1 There shall be no access between cargo pump rooms and other machinery spaces.

12-5.2* There shall be no doors between high-risk machinery spaces, engine casings, or fiddley areas, and the following types of spaces:

- (a) Passenger egress stairs
- (b) Public spaces
- (c) Embarkation areas
- (d) Refuge areas
- (e) Passenger muster stations
- (f) Bridge
- (g) Radio room
- (h) Emergency generator space
- (i) Cabin areas for passengers
- (j) Fan rooms serving spaces other than the machinery space

Exception: As otherwise provided by Chapters 17 through 19.

12-6* Pressurized Oil Systems.

12-6.1 Flexible fuel and lubricating oil lines operating above 10 bar (145 psi) shall be provided with double-wall tubing and fittings in accordance with SOLAS Chapter II-2, Regulation 15.

12-6.2 Pressurized oil systems shall be provided with remote shutdown controls located as follows:

- (a) Immediately outside the machinery space and adjacent to the fixed fire-extinguishing system actuation controls
- (b) On the bridge deck in an area accessible to all officers

12-6.3* Splash guards to avoid oil spray or oil leakages onto hot surfaces or into machinery air intakes shall be provided for the following:

- (a) Strainers for pressurized oil systems
- (b) Fuel injection pumps
- (c)* Around all fittings, which include takedown joints (flanges, unions, and so forth), valve bonnets and other areas where leakage can occur.

12-6.4* Fuel injector pipelines operating in excess of 10 bar (145 psi) shall be double-walled with arrangements provided for an alarm to be given in case of leakage.

Exception: Machinery operating below 375 kW (500 hp).

12-7 Ventilation Systems. Machinery space ventilation systems shall be provided with remote shutdown controls located as follows:

- (a) Immediately outside the machinery space and adjacent to the fixed fire-extinguishing system actuation controls
- (b) On the bridge deck in an area accessible to all officers

12-8 Hot Surfaces.

12-8.1 Heated pipes, exhaust manifolds, flues, and other hot surfaces shall be insulated such that the exposed surfaces do not pose an ignition source for sprayed or spilled oils.

12-8.2 External surface temperatures shall not exceed 150°C (302°F).

12-9 Bilges.

12-9.1 Where a water-mist extinguishing system is installed in high-risk machinery spaces to satisfy the requirements of 12-3.1, one of the following systems shall be installed to protect the bilges:

- (a) Low-expansion foam
- (b) High-expansion foam
- (c) Water mist

12-9.2 Bilge plating shall be solid for walkways to escape routes.

12-10* Incinerator Spaces. Incinerator spaces shall be provided with remote shutdown controls located immediately outside the machinery space and adjacent to the fixed fire-extinguishing system actuation controls. Incinerator spaces shall be considered high-risk machinery spaces.

12-11 Portable Extinguishers. Portable fire extinguishers shall be provided in accordance with 7-2.14 and the following:

(a) One B-II for each 750 kW (1000 hp) of internal combustion or gas turbine machinery, but not less than 2 or more than 6, and one B-III.

(b) One B-V and 2 B-II for spaces containing oil-fired boilers or oil fuel units.

(c) One C-II for each electric generator.

Exception: For unmanned machinery spaces, at least one B:C II extinguisher shall be provided inside the space.

Chapter 13 Storage Spaces

13-1 General Requirements.

13-1.1 Application. Storage spaces shall comply with Chapter 13.

13-1.2 Subclassification of Occupancies. A high-risk storage space shall be considered to be any space that contains high-risk fuels or flammable aerosols. It shall also include any space that is dedicated for trash storage or that contains pyrotechnics or explosives. All storage spaces that are not high risk shall be considered to be low-risk storage spaces.

Exception No. 1: Alcohol beverages less than 100 proof or stored in containers not exceeding 10 L (2.64 gal).

Exception No. 2: Flammable liquids and aerosols stored in containers in accordance with NFPA 30, Flammable and Combustible Liquids Code.

13-1.3 Minimum Separation Requirements. Minimum separation requirements for storage spaces shall comply with Table 13-1.3.

13-1.4 Occupant Load. Occupant load shall not be applied to storage spaces.

13-2 Means of Egress Requirements.

13-2.1 General. All means of egress shall be in accordance with Chapter 5 and Section 13-2.

13-2.2 Means of Egress Components.

13-2.2.1 General. Components of means of egress shall be limited to the types described in 13-2.2.2 through 13-2.2.3.

13-2.2.2 Doors. Doors shall comply with 5-2.1.

13-2.2.3 Ramps. Ramps shall comply with 5-2.5.

13-2.3 Means of Egress Arrangement.

13-2.3.1 Multiple exit accesses shall not be required from storage spaces.

13-2.3.2 Means of egress shall be permitted through adjacent spaces of any type.

Table 13-1.3 Minimum Separation Requirements

Adjoining Occupancies	Separation Requirements for Low-Risk Storage	Separation Requirements for High-Risk Storage
High-risk accommodation	B-15	A-60
Medium-risk accommodation	B-0	A-60
Low-risk and sprinklered accommodation	C	A-0
Medical, health care, and child care	B-0	A-0
High-risk service	A-0	A-0
Low-risk service	C	A-0
Electrical and control	A-0	A-0
Low-risk engineering and machinery	C	A-0
High-risk engineering and machinery	C	A-0
High-risk storage	A-0	A-0
Low-risk storage	C	A-0
Cargo	A-0	A-0
Open deck	A-0	A-0
Helicopter platform	A-0	A-0
Voids	A-0	A-0

13-2.4 Travel Distance to Exits. Exits shall be arranged so that the total length of travel from any point to reach an exit shall not exceed 40 m (131 ft).

13-2.5 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9 in storage spaces larger than 50 m² (538.2 ft²).

13-3 Protection.

13-3.1 Interior Finish. Interior finish shall comply with 6-3.3.

13-3.2 Detection, Alarm, and Communication Systems. All storage spaces shall be provided with a smoke detection system in accordance with Section 7-1. Flammable materials storage and flammable materials lockers with flammable liquids shall additionally be provided with a heat detection system in accordance with Section 7-1.

Exception: Where otherwise provided by Chapters 17 through 19.

13-3.3 Extinguishing Requirements. High-risk storage spaces and storage spaces exceeding 5 m² (53.8 ft²) shall be fitted with a fixed automatic fire-protection system in accordance with Section 7-2.

13-4 Special Provisions for High-Risk Fuels Storage.

13-4.1 The provisions of Sections 13-1 through 13-3 shall be met except as modified by 13-4.2 through 13-4.3.

13-4.2 Storage of high-risk fuels shall be in sealed, shatterproof containers. Shelves and storage fixtures shall prevent excessive movement of containers with the normal motion of the vessel.

13-4.3 Electrical equipment in high-risk fuels storage shall be installed in accordance with Article 500, NFPA 70, *National Electrical Code*.

Chapter 14 Cargo Spaces and Fuel Tanks

14-1 General Requirements.

14-1.1 Application. Cargo spaces and fuel tanks shall comply with Chapter 14.

14-1.2 Special Definitions.

Restricted Access Spaces.* 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.

14-1.3 Protection Schemes. Cargo spaces and fuel tanks shall be separated from all spaces by minimum A-0 construction.

Exception No. 1: Where otherwise provided by Chapters 17 through 19.

Exception No. 2: High-risk accommodations spaces, and medical, health care and child care spaces shall be separated from cargo spaces with A-60 construction.

14-1.4 Occupant Load. Occupant load shall not be applied to cargo spaces and fuel tanks.

14-2 Means of Egress Requirements.

14-2.1 Means of egress shall be in accordance with Chapter 5 and Section 14-2.

14-2.2 Means of egress from restricted access cargo spaces and fuel tanks shall not be required to comply with Chapter 5.

Exception: Where required by Chapters 17 through 19.

14-3 Protection. Protection shall be provided in accordance with Chapters 17 through 19.

Chapter 15 Open Decks

15-1 General Requirements.

15-1.1 Application. Open decks shall comply with Chapter 15.

15-1.2* Minimum Separation Requirements.

15-1.2.1 Protection from open decks to other spaces is only required to be C Class.

Exception: Open decks and helicopter platforms.

15-1.2.2 Open deck separation requirements shall also apply to sideshell integrity.

15-1.3* Where not required to be protected or rated by other sections of this code, windows in exterior locations or facing open decks shall not be required to be rated and shall be permitted to be openable or omitted.

Exception: Unrated windows shall not be permitted where open decks face machinery spaces.

15-1.4 Occupant Load. The occupant load permitted on any open deck shall be determined on the basis of the following occupant load factors:

- (a) Fixed seating: design capacity
- (b) Bleachers, pews, and other bench-type seating: one person per 45 cm (18 in.)
- (c) Open areas: one person for each 1 m² (10 ft²) of gross deck area and 0.65 m² (7 ft²) of net area

Exception: Occupant load shall not be required to be applied to open deck areas which are not intended to normally be occupied.

15-1.5 Storage of Cargo. Open decks intended for the carriage of cargo shall also meet the requirements of Chapter 14.

15-1.6 Storage. Open decks intended for the storage of ship's stores shall comply with Section 15-3.

15-2 Means of Egress Requirements. All means of egress shall be in accordance with Chapter 5.

Exception: Means of egress shall be permitted to be entirely by exterior stairways and open decks.

15-3 Special Considerations for Open Decks Intended for Storage of Ship's Stores.

15-3.1 Storage areas shall not impede means of egress.

15-3.2 Storage areas shall be capable of being reached by two, fire hose streams.

15-3.3 Deck house construction adjacent to storage area shall be at least A-0.

15-3.4 Storage area shall be designed with provisions for spill or leak containment.

15-3.5 Storage area shall be provided, remote from the vessel superstructure, with permanent means for fastening or lashing containers to vessel.

Chapter 16 Helicopter Decks

16-1* General Requirements.

16-1.1 Application. Helicopter decks shall comply with Chapter 16.

16-1.2 Minimum Separation Requirements. Minimum separation requirements for helicopter decks shall comply with Table 16-1.2.

16-1.3 Occupant Load. Occupant load shall not be required to be applied to helicopter decks.

16-2 Means of Egress Requirements. Means of egress shall be in accordance with Chapter 5 and this section.

16-2.1 Means of Egress Components. Means of egress components shall be limited to the types described in 16-2.1.1 through 16-2.1.2.

16-2.1.1 Stairs. Steel stairs complying with 5-2.2 shall be permitted.

16-2.1.2 Service Stairs and Ladders. Service stairs and ladders complying with 5-2.7 shall be permitted.

16-2.2 Each helicopter deck shall have two means of egress.

16-3 Protection.

16-3.1* Each helicopter deck shall be fitted with a foam system complying with 7-2.9. Hydrants for manual application of foam shall be accessible from each of the means of egress required by 16-2.1.

Table 16-1.2 Minimum Separation Requirements

Adjoining Occupancies	Separation Required
High-risk accommodation	A-60
Medium-risk accommodation	A-60
Low-risk and sprinklered accommodation	A-60
Medical, health care, and child care	A-60
High-risk service	A-0
Low-risk service	A-0
Electrical and control	A-60
Low-risk engineering and machinery	A-60
High-risk engineering and machinery	A-60
High-risk storage	A-0
Low-risk storage	A-0
Cargo	A-0
Open deck	C
Helicopter platform	N/A
Voids	A-0

16-3.1.1 Four B:C:II extinguishers shall be provided.

16-3.1.2 Each helicopter hangar shall be equipped with an overhead deluge foam–water sprinkler system complying with 7-2.2. Control switches shall be provided inside and outside the hangar.

There shall be at least one foam station per hangar for manual application of foam.

16-3.2 Drainage. Each helicopter deck shall have drainage facilities that collect liquids and prevent liquids from spilling on other parts of the ship. Drainage shall be overboard. Drainage piping shall extend down at least 30 mm (12 in.) over the side.

16-3.3* Communications. Reliable communication capability shall be available between the bridge, fire-fighting foam control stations, hangar, and the helicopter deck.

Chapter 17 Towing Vessels

17-1 General Requirements.

17-1.1 Application. This chapter shall apply to all towing vessels 12 m (39.4 ft) or more in length greater than 375 kW (500 hp).

Exception:* Towing vessels shall not be required to comply with this chapter if they are excepted by the authority having jurisdiction, or used in the following manner:

- (a) Solely in a limited geographic area, such as a fleeting area for barges or a commercial facility, and solely for a restricted service, such as making up or breaking up larger tows
- (b) Solely for assistance towing as defined in 46 CFR, Part 10.103
- (c) Solely for pollution response

17-1.2 Occupant Load. Occupant load shall not be required to be applied to towing vessels.

17-2 Means of Egress. Chapter 5 shall not apply to towing vessels.

17-3 Protection. (Reserved.)

17-4 Accommodations Spaces. Chapter 8 shall not apply to towing vessels. Accommodations spaces on towing vessels shall comply with this section.

17-4.1 Separation. Accommodations spaces shall be separated from engineering and machinery spaces and from fuel tanks with at least A-0 barriers.

17-4.2 Detection. Single-station smoke detectors complying with UL 217, *Single and Multiple Station Smoke Detectors*, shall be provided in each accommodations space.

17-5 Medical, Health Care, and Child Care Spaces. Chapter 9 shall not apply to towing vessels.

17-6 Service Spaces. Chapter 10 shall not apply to towing vessels.

17-7 Electrical and Control Spaces. Chapter 11 shall not apply to towing vessels.

17-8 Engineering and Machinery Spaces. Chapter 12 shall not apply to towing vessels. Engineering and machinery spaces on towing vessels shall comply with this section.

17-8.1 Separation. Engineering and machinery spaces shall be separated from accommodations spaces with at least A-0 barriers.

17-8.2 Detection. Smoke or heat detectors complying with 7-1.3 shall be provided in all engineering and machinery spaces. Means shall be provided such that detector activation is indicated on the bridge.

17-8.3 Fire Protection Systems and Equipment. All engine rooms on towing vessels greater than 24 m (78.7 ft) in length shall be provided with a fixed suppression system complying with Section 7-2.

17-8.4 Remote Main Engine Shutdown/Fuel Shutoff. All towing vessels shall be fitted with a main engine shutdown that is capable of securing ventilation and dampers, and a means of securing the flow of fuel to the machinery located outside the engine room.

17-8.5 Fuel Systems.

17-8.5.1 Portable Fuel Systems. Portable fuel systems shall not be permitted.

Exception: Where used for portable bilge pumps, portable tanks and fuel lines meeting ABYC-25, *Portable Containers for Flammable Liquids*, shall be permitted.

17-8.5.2 Fuel Restrictions. Fuel for main propulsion and ship's service generators shall not have a flash point less than 43°C (110°F).

17-8.5.3 Pressurized Oil Systems. Pressurized oil systems shall comply with Section 12-6.

17-9 Storage Spaces. Chapter 13 shall not apply to towing vessels.

17-10 Fuel Tanks. Chapter 14 shall not apply to towing vessels. Integral fuel tanks shall comply with this section.

17-10.1 Each fuel tank shall be fitted with a vent pipe connected to the highest point of the tank that terminates in a 3.14 radians (180 degree) bend on a weather deck and that is fitted with a flame screen.

17-10.2 The net cross-sectional area of the vent pipe required by 17-10.1 shall be 300 mm² (0.465 in²).

Exception: Where provisions are made to fill a tank under pressure, the net cross-sectional area of the vent pipe shall be permitted to be reduced to not less than the net cross-sectional area of the fill pipe.

17-10.3 Fuel Piping.

17-10.3.1 Fuel piping shall be seamless; shall be made of steel, copper–nickel, annealed copper, or nickel–copper; and shall have a wall thickness of at least 0.9 mm (0.035 in.)

Exception No. 1: Aluminum piping shall be permitted on aluminum vessels if it is installed outside the machinery space and is at least 2.4 mm (0.095 in.) thickness (Schedule 80).

Exception No. 2: Nonmetallic flexible hose is permitted if it meets the following conditions:

- (a) Not used in a length exceeding 0.8 m (2.6 ft)
- (b) Installed in a visible location
- (c) Does not penetrate any watertight bulkheads
- (d) Fabricated with an inner tube and a cover of synthetic rubber reinforced with a wire braid
- (e) Fitted with corrosion-resistant compression fittings
- (f) Installed with two clamps that do not rely on spring tension at each end of the hose, if the hose is intended to be secured with clamps

17-10.3.2 A fuel line subject to internal head pressure from fuel in the tank shall be fitted with a positive shutoff valve that is operable from outside the machinery space.

17-11 Open Decks. Chapter 15 shall not apply to towing vessels.

17-12 Helicopter Decks. Chapter 16 shall not apply to towing vessels.

17-13 Vessel Services.

17-13.1 Fire Protection Systems and Equipment.

17-13.1.1 Fire Pumps, Fire Mains, Hydrants, and Hose. Fire pumps, fire mains, hydrants, and hose shall comply with Section 17-13.

Exception: In lieu of the requirements of Section 17-13, towing vessels less than 24 m (78.7 ft) in length shall be permitted to install a fixed or portable fire pump capable of delivering 300 L/min (80 gal/min) at a pressure not less than 350 kPa (50 psi).

17-13.1.1.1 Fire Pumps. A fire pump capable of supplying the two highest outlets at a flow rate not less than 300 L/min (80 gal/min), at a pressure not less than 350 kPa (50 psi), shall be provided.

17-13.1.1.2 Fire Main and Hydrants. A fire main and hydrants shall be installed such that all portions of the vessel can be reached with a single length of hose of a maximum of 25 m (82 ft) in length.

17-13.1.1.3 Fire Hose. A fire hose and nozzle meeting the requirements of 7-2.16 shall be provided for each hydrant.

17-13.1.2 Portable Fire Extinguishers. A B-V portable extinguisher shall be provided.

Exception: On towing vessels not exceeding 24 m (78.7 ft) in length, a B-III extinguisher shall be permitted.

17-13.2 Fire-Fighting Clothing and Equipment.

17-13.2.1 Towing vessels of greater than 3000 kW (2238 hp) shall be equipped with two sets of fire-fighter protective clothing meeting 7-3.1.

17-13.2.2 Towing vessels of greater than 3000 kW (2238 hp) shall be equipped with two sets of self-contained breathing apparatus meeting 7-3.2.

17-13.3 General Alarm. A general alarm shall be installed. The general alarm shall be equipped with both an audible and a visual component in spaces other than the machinery space, and a visual component in the engine room.

17-13.4 Two-Way Communication. A fixed internal communication system capable of providing two-way communication between the wheelhouse and the engine room or a space adjacent to the engine room shall be provided.

Chapter 18 Cargo and Tank Vessels

18-1 General Requirements.

18-1.1 Application. This section shall apply to all vessels that carry cargo.

18-1.2* Application to Vessels that Engage in International Voyages. Vessels that engage in international voyages shall comply with the International Convention for the Safety of Life at Sea, as amended, and shall not be required to comply with Chapter 18.

18-1.3 Special Definition.

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

18-1.4 Occupant Load. Occupant load shall be in accordance with Chapters 8 through 16.

18-2 Means of Egress. Means of egress shall only be required to comply with Chapter 5 as specified in this section.

18-2.1 Definitions. The definitions in 5-1.2 shall apply.

18-2.2 Separation of Means of Egress. Separation of means of egress shall comply with 5-1.3.

18-2.3 Interior Finish and Furnishings in Exits and Exit Accesses. Interior finish and furnishings in exits and exit accesses shall comply with 5-1.4.

18-2.4 Impediments to Egress. Impediments to egress shall comply with 5-1.7.

18-2.5 Means of Egress Components. Means of egress components shall be limited to those described in 18-2.5.1 through 18-2.5.7.

18-2.5.1 Doors.

18-2.5.1.1 A door assembly, including the door opening, frame, door and necessary hardware shall be designated as a door.

18-2.5.1.2 Doors shall comply with 5-2.1.2, 5-2.1.4.2, 5-2.1.4.3, 5-2.1.5.1, and 5-2.1.5.3. The Exception to 5-2.1.5.1 shall be specifically authorized.

18-2.5.1.3 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. Doors shall swing in the direction of egress travel.

Exception: Stateroom doors and doors opening to exit passageways.

18-2.5.1.4 A door designed normally to be kept closed in a means of egress shall be a self-closing door and shall not be secured in the open position at any time.

18-2.5.1.5 Watertight doors in a means of egress shall be either a quick-acting type or a power-operated door complying with the requirements in 46 CFR, Part 170.

18-2.5.2 Stairs.

18-2.5.2.1 Stairs shall comply with 5-2.2.1 through 5-2.2.3.6.

Exception No. 1: Noncombustible, grated treads and landings shall be permitted to be used in machinery spaces.

Exception No. 2: For stairs continuing beyond the level of exit discharge, the partitions, doors, or other means required to serve as interruptions at the level of exit required by 5-2.2.3.6 are not required, provided the exit discharge is clearly marked.

18-2.5.2.2 Where there are more than two decks, not including the bridge deck, a minimum of one stairtower shall be used to connect them. Stairs, platforms, and landings used in the construction of stairtowers shall be of noncombustible materials throughout and protected in accordance with 5-1.3.1.

Exception: Stairs with a minimum clear width of 70 cm (28 in.) shall be permitted.

18-2.5.2.3 Exterior Stairs.

18-2.5.2.3.1 Exterior stairs complying with 5-2.2.5.2 through 5-2.2.5.4 shall be permitted to be used as a means of egress.

18-2.5.2.3.2 The dimensions of the stairs shall be required to comply only with the requirements in Table 5-2.2.5.5 for exterior stairs serving 10 or fewer persons.

18-2.5.2.3.3 The separation required by 5-2.2.6.2 shall not be required.

18-2.5.3 Smokeproof Enclosures. Where provided, smokeproof enclosures shall comply with 5-2.3.1 through 5-2.3.6, 5-2.3.7, 5-2.3.10, and 5-2.3.13.

18-2.5.4 Exit Passageways. Exit passageways shall comply with 5-2.6.1 through 5-2.6.3.

18-2.5.5 Service Stairs and Ladders. Service stairs and ladders shall comply with 5-2.7.1 through 5-2.7.3.

18-2.5.6 Vertical Ladders.

18-2.5.6.1 Vertical ladders shall comply with 5-2.8.

18-2.5.6.2 Vertical ladders shall be permitted to be used as one of the required means of egress.

18-2.5.7 Alternating Tread Devices. Alternating tread devices complying with 5-2.9 shall be permitted to be used as one of the required means of egress.

18-2.6 Guards.

18-2.6.1 Guards shall comply with 5-2.2.4.1 and 5-2.2.4.3.

18-2.6.2 Guard details shall comply with 5-2.2.4.6(a) and (b).

18-2.7 Handrails.

18-2.7.1 Handrails shall comply with 5-2.2.4.2 and 5-2.2.4.3.

18-2.7.2 Handrail details shall comply with 5-2.2.4.5(a), (b), (d), (e), and (g).

18-2.8 Number of Separate Means of Egress.

18-2.8.1 The number of separate means of egress shall comply with Section 5-4.

18-2.8.2 Access to at least one of the required exits shall be independent of watertight doors.

18-2.9 Arrangement of Means of Egress.

18-2.9.1 The arrangement of the means of access shall comply with 5-5.1.3, 5-5.1.4, and 5-5.2.1.

Exception: Galley areas shall be permitted to be used as a means of egress from mess areas.

18-2.9.2 Dead-end corridors not exceeding 7 m (22 ft) in length shall be permitted.

18-2.10 Travel Distance to Exits. Travel distance shall not be limited on cargo or tank vessels.

18-2.11 Discharge from Exit.

18-2.11.1 All exits shall terminate directly at an exit discharge, an embarkation area, or to an open deck area that leads to an embarkation area that is readily visible and identifiable from the point of discharge from the exit.

18-2.11.2 Weatherdeck exit discharge shall be permitted in accordance with 5-7.5.

18-2.12 Illumination of Means of Egress. Illumination of means of egress shall comply with Section 5-8.

18-2.13 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9.

18-2.14 Marking of Means of Egress. Means of egress shall be marked in accordance with Section 5-10.

18-3 Protection.

18-3.1 Protection of Vertical Openings. Any vertical opening shall be enclosed in accordance with 6-2.4.

18-3.2 Passageways. Passageways shall be constructed in accordance with 5-1.3.5.

18-3.3* On tank vessels, exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks that support such accommodation shall be insulated to A-60 for the whole of the portions that face the cargo area and on the outward sides for a distance of 3 m (9.8 ft) from the end boundary facing the cargo area.

18-4 Accommodation Spaces.

18-4.1 Accommodation spaces shall be in accordance with Chapter 8 and this section.

18-4.1.1* Isolation from Cargo Tanks. On tank ships, all accommodation spaces shall normally be positioned aft of all cargo tanks, slop tanks, and spaces that isolate cargo or slop tanks from machinery spaces.

18-4.1.2 Accommodation spaces shall not be situated above cargo spaces.

Exception: RO/RO vessels and open-deck cargo spaces.

18-4.2* Isolation from Deck Spills. On tank ships, a means shall be provided to keep deck spills away from the accommodation and service areas.

18-4.3 Openings. On tank ships, access doors, air inlets, and openings to accommodation spaces shall not face the cargo area. They shall be located on the transverse bulkhead not

facing the cargo area or on the outboard side of the superstructure or deckhouse at a distance of at least 4 percent of the length of the ship but not less than 3 m (9.8 ft) from the end of the superstructure or deckhouse facing the cargo area. This distance shall not be required to exceed 5 m (16.4 ft).

18-4.4 Windows and Sidescuttles. On tank ships, windows and sidescuttles facing the cargo area and on the sides of the superstructures and deckhouses within the limits specified in 18-4.3 shall be of the fixed, non-opening type. Such windows and sidescuttles in the first tier on the main deck shall be fitted with inside covers of steel or other equivalent material.

18-4.5 Automatic sprinkler systems and water-mist systems shall not be required in overnight crew accommodation spaces.

18-5 Medical Spaces. Medical spaces shall be in accordance with Chapter 9.

18-6 Service Spaces.

18-6.1 Service spaces shall be in accordance with Chapter 10.

18-6.2 Service spaces shall not be required to be protected with an automatic fire sprinkler system or an automatic water-mist system.

18-7 Electrical and Control Spaces. Electrical and control spaces shall be in accordance with Chapter 11.

18-8 Engineering and Machinery Spaces. Engineering and machinery spaces shall be in accordance with Chapter 12.

18-9 Storage Spaces. Storage spaces shall be in accordance with Chapter 13.

Exception: Automatic actuation shall not be permitted for carbon dioxide extinguishing systems protecting manned high-risk storage spaces.

18-10 Cargo Spaces and Fuel Tanks. Cargo spaces and fuel tanks shall be in accordance with Chapter 14 and this section.

18-10.1 Requirements for Tank Vessels.

18-10.1.1 Inert Gas System. Tankers carrying crude oil, petroleum oils other than crude, or any products with a flash point less than 60°C (140°F) shall be fitted with an inert gas system complying with 7-2.13.

18-10.1.2* Tank vessels shall be fitted with a deck foam system in accordance with 7-2.8. The type of foam required for chemical cargoes and the application rates shall be as provided in 7-2.8.

Exception: Tanks vessels carrying cargoes that are not flammable or combustible liquids.

18-10.2 Requirements for Cargo Vessels.

18-10.2.1 General. A fire-protection system meeting the requirements of Section 7-2 shall be installed in all cargo spaces.

Exception No. 1: Cargo spaces intended solely for the carriage of ore, coal, grain, unseasoned timber, or any cargo in Emergency Schedules (EmS) B2, B3, B4, B5, B6, B7, B9, B10, B12, or B14 as defined in the IMO, International Maritime Dangerous Goods Code.

Exception No. 2: Spaces intended solely for the carriage of liquids or gases.

18-10.2.2 Protection of Vehicle Spaces. Vehicle spaces shall be protected with a fire-protection system meeting the requirements of Section 7-2. Portable foam equipment or foam hy-

drants meeting the requirements of 7-2.8 shall be available on each vehicle deck.

Exception: Covered open decks shall be permitted to be protected with manual sprinkler systems in accordance with 46 CFR, Part 76.23.

18-11 Open Decks. Open decks shall be in accordance with Chapter 15.

18-12 Helicopter Decks. Helicopter decks shall be in accordance with Chapter 16.

18-13 Vessel Services.

18-13.1 Fire Detection and Alarm. A fire detection and alarm system complying with Section 7-1 shall be installed in all accommodation spaces, cargo holds, service spaces, and means of egress.

Exception: A heat detection system shall be permitted to be used in RO/RO cargo space areas in lieu of smoke detectors.

18-13.2 Fire-Protection Systems and Equipment.

18-13.2.1 Sprinkler Systems. Where installed, sprinkler systems shall comply with 7-2.6.

18-13.2.2 Fire Pumps, Fire Mains, Hydrants, and Hose.

18-13.2.2.1 General. Fire-main hydrants complying with Section 7-2 and Table 18-13.2.2.1 shall be provided.

Exception: Where 65-mm (2.5-in.) hose is required, two 40-mm (1.5-in.) hose with nozzles connected to a wye fitting shall be permitted.

18-13.2.2.2 Placement.

18-13.2.2.2.1 Hydrants shall be located so that each part of the ship that is accessible by the crew is able to be reached by a single 25-m (75-ft) maximum length of hose.

18-13.2.2.2.2 Weather deck hydrants on tank ships shall be equipped with a length of hose sufficient to permit "goose-necking" a hose over the side for a floating oil fire.

18-13.2.2.3 Fire Pumps. Fire pumps shall comply with 7-2.15 and Section 18-13.

18-13.2.2.3.1 Capacity of Fire Pumps. Each of the required fire pumps (other than any emergency pump) shall have a capacity not less than 80 percent of the total required capacity divided by the minimum number of required fire pumps but, in any case, not less than 25 m³/hr (110 gal/min); and each such pump shall, in any event, be capable of delivering at least two required jets of water 344.75 kPa (50 psi) at the hydraulically most remote point. These fire pumps shall be capable of supplying the fire-main system under the required conditions. Where 40-mm (1.5-in.) hose is permitted in lieu of 65-mm (2.5-in.) hose by Table 18-13.2.2, the pump capacity shall be determined on the same basis as if 65-mm (2.5-in.) hose had been required.

18-13.2.2.3.2 Number of Fire Pumps. At least two independently driven fire pumps shall be provided.

18-13.2.2.3.3 Multiple-Use Pumps. Sanitary, ballast, bilge, or general service pumps shall be permitted to be accepted as fire pumps, provided that they are not used for pumping oil.

18-13.2.2.3.4 Isolation Valves. Isolation valves shall be fitted in the fire main in a position protected from the cargo tanks at the forward bulkhead of the deck house and on the tank deck at intervals of not more than 40 m (131.2 ft) to preserve the integrity of the fire-main system in case of fire or explosion.

Table 18-13.2.2.1 Requirements for Fire Hose and Nozzles

Vessel Length		Area of Vessel (Exterior)		Area of Vessel (Interior)	
		Hydrant, Hose, and Nozzle Size		Hydrant, Hose, and Nozzle Size	
m	ft	mm	in.	mm	in.
0–20	0–65.6	1 B-V Extinguisher (instead of nozzle)		1 B-V Extinguisher (instead of nozzle)	
20–80	65.6–262.4	40	1.5	40	1.5
80–130	262.4–426.5	65	2.5	40	1.5
130 +	426.5 +	65	2.5	65	2.5

18-13.2.2.4 Fire Hose. Fire hose meeting 7-2.16.10 and Table 18-13.2.2 shall be provided.

18-13.2.3 Portable Fire Extinguishers. All fire extinguishers shall be as specified in 7-2.14 and provided in accordance with classification society rules.

18-13.2.4 Spare Charges. Charges for 100 percent of all extinguishers that are capable of onboard recharging shall be provided.

Exception No. 1: Where the extinguishers cannot be recharged aboard the vessel, an additional 10 percent extinguishers shall be maintained.

Exception No. 2: For periodically unattended engine rooms, the number of duplicate extinguishers required shall be equal to the number of extinguishers on the most remote engine room level.

18-13.3 Fire-Fighting Clothing and Equipment.

18-13.3.1 Eight sets of fire-fighter protective clothing meeting the requirements of 7-3.1 shall be provided.

Exception: Vessels under 60 m (197 ft) shall only be required to carry two fire-fighter's outfits.

18-13.3.2 A corresponding number of self-contained breathing apparatus meeting the requirements of 7-3.2 shall be provided for each set of fire-fighter protective clothing as required by 18-13.3.1.

18-13.3.3 Flashlights shall be constructed and marked Type I or Type III and shall comply with ASTM F 1014.

18-13.4 Ventilation Systems. Ventilation systems shall comply with Section 7-4.

18-13.5 Elevators, Escalators, and Dumbwaiters. Where installed, elevators, escalators, and dumbwaiters shall comply with Section 7-7.

18-13.6 Electrical installations shall comply with Section 7-6.

Chapter 19 Passenger Vessels

19-1 General Requirements.

19-1.1 Application. This chapter shall apply to all vessels that carry more than twelve passengers. Portions of vessels that are primarily intended for another service that also carry passengers (i.e., a cargo vessel with passenger accommodations for more than twelve people) shall comply with this chapter.

Exception: Cargo or tank vessels that carry not more than 12 passengers shall not be required to comply with this chapter.

19-1.1.1 Group I and II Passenger Vessels. Group I and II passenger vessels shall comply with Sections 19-1 through 19-13.

19-1.1.2 Group III Passenger Vessels. Group III passenger vessels shall comply with Sections 19-1 and 19-14.

19-1.1.3 Group IV Passenger Vessels. Group IV passenger vessels shall comply with Sections 19-1, 19-13, and 19-15.

19-1.2 Definitions.

High Speed Vessels. A craft capable of a maximum speed, in meters per second (knots) equal to or exceeding the following:

- $m/sec \geq 3.7 \times \text{displacement}^{(.1667)}$ [knots $\geq 7.4 \times \text{displacement}^{(.1667)}$]
- displacement in m^3 or long tons

Passenger. An individual carried on a vessel who is not one of the following:

- An owner, a representative of the owner, a charterer, or a representative of a charterer
- The vessel's master
- A member of the vessel's crew who is paid for onboard services.

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

19-1.3 Subclassification of Passenger Vessels. Passenger vessels shall be categorized as in Table 19-1.3.

Table 19-1.3 Passenger Vessel Subclassification

Category	Number of Day Passengers	Overnight Passengers
I	>3000 day	>300 overnight
II	>150 ≤3000	≥50 ≤300
III	≤450	0
IV	≤150	<50

19-1.3.1 Group I Passenger Vessels. Passenger vessels that operate with more than 3000 day passengers or carry more than 300 overnight passengers shall be categorized as Group I.

19-1.3.2 Group II Passenger Vessels. Passenger vessels that operate with more than 150 day-passengers or carry more

than 49 overnight-passengers shall be categorized as Group II.

19-1.3.3* Group III Passenger Vessels. High-speed passenger vessels that operate with no more than 450 day passengers no further than 4 hours from a harbor of safe refuge shall be categorized as Group III.

19-1.3.4 Group IV Passenger Vessels. Passenger vessels that operate with no more than 150 day passengers or carry no more than 49 overnight passengers shall be categorized as Group IV.

19-1.4 Occupant Load. Occupant load shall be in accordance with Chapters 8 through 16.

19-2 Means of Egress. Means of egress shall comply with Chapter 5 and this section.

19-2.1 Changes in Level of Means of Egress. The elevation of the deck surfaces on both sides of a door shall not vary by more than 50 mm (2 in.). The elevation shall be maintained on both sides of the door opening for a distance at least equal to the width of the widest leaf. Sills at door openings shall not exceed 15 mm (0.6 in.) in height.

Exception No. 1: Doors required to have sill heights to meet down-flooding or load-line requirements.

Exception No. 2: For decks that have sheer and/or camber, the maximum elevation changes shall be 75 mm (3.0 in.).

19-2.2 Doors. Doors shall comply with 5-2.1.

19-2.2.1 Revolving Doors.

19-2.2.1.1 All revolving doors shall comply with the following:

(a) Revolving doors shall be capable of being collapsed into a book-fold position.

(b) When in the book-fold position, the parallel egress paths formed shall provide an aggregate width of 90 cm (35.4 in.).

(c) Revolving doors shall not be used within 3 m (9.8 ft) of the foot of or top of stairs or escalators. Under all conditions, there shall be a dispersal area acceptable to the authority having jurisdiction between the stairs or escalators and the revolving door.

(d) The revolutions per minute (rpm) of revolving doors shall not exceed those listed in Table 19-2.2.1.1(d).

(e) Each revolving door shall have a conforming side-

hinged swinging door in the same wall as the revolving door and within 3 m (9.8 ft) of the revolving door.

19-2.2.1.2 Revolving doors shall be permitted as a component in a means of egress under the following conditions:

(a) Revolving doors shall not be given credit for more than 50 percent of the required egress capacity.

(b) Each revolving door shall be credited with no more than 50 persons capacity.

Exception to (b): Revolving doors with a minimum 2.5-m (8.2-ft) diameter shall be permitted egress capacity based on the clear opening width provided.

(c) Revolving doors shall be capable of being collapsed into a book-fold position when a force that shall not be required to exceed 575 N (130.9 lbf) is applied to wings within 7.5 cm (3 in.) of the outer edge.

19-2.2.2 Doors in Folding Partitions. Where permanently mounted folding or movable partitions are used to divide a room into smaller spaces, a swinging door or open doorway shall be provided.

Exception: Where a subdivided space is provided with at least two means of egress meeting the remoteness criteria of 5-5.1.4, the swinging door in the folding partition shall not be required.

19-2.3 Stairs. Stairs shall comply with 5-2.2 and 19-2.3.

19-2.3.1 Curved Stairs. Curved stairs shall be permitted as a component in a means of egress provided the minimum depth of tread is 25 cm (9.8 in.) at a point 30 cm (11.8 in.) from the narrower end of the tread, and the smallest radius is not less than twice the stair width.

19-2.3.2 Spiral Stairs. Spiral stairs shall be permitted as a component in a means of egress as provided by 5-2.2.3.7.

19-2.4 Ramps. Every ramp used as a component in a means of egress shall comply with 5-2.5.

19-2.5 Number of Exits.

19-2.5.1 A minimum of two exits, remotely located in accordance with 5-5.1.4, shall be accessible from all spaces.

19-2.5.2* Access to at least one of the required exits from areas normally accessible to passengers and crew accommodation spaces shall be independent of watertight doors.

19-2.5.3 Dead-end corridors not exceeding 7 m (20 ft) in length shall be permitted.

Exception: Dead-end corridors shall not be permitted on Group I passenger vessels.

19-2.5.4 Common path of travel shall not exceed 25 m (82 ft).

19-2.6 Horizontal Exits.

19-2.6.1 Application. Horizontal exits shall be permitted as provided by 5-2.4 and 19-2.6.

19-2.6.2 Horizontal exits shall be permitted to be reduced to A-0 if the separation is between low-risk accommodation spaces.

19-2.7 Travel Distance to Exits. Travel distance to exits shall not exceed 50 m (164 ft).

19-2.8 Areas of Refuge. Areas of refuge shall meet the requirements of 5-2.10 and 19-2.8.

Table 19-2.2.1.1(d) Revolving Door Specifications

Inside Diameter	Power Driven-Type Speed Control (rpm)	Manual-Type Speed Control (rpm)
2.0 m (6.6 ft)	11	12
2.1 m (6.9 ft)	10	11
2.3 m (7.5 ft)	9	11
2.4 m (7.9 ft)	9	10
2.6 m (8.5 ft)	8	9
2.7 m (8.9 ft)	8	9
2.9 m (9.5 ft)	7	8
3.0 m (9.8 ft)	7	8

19-2.8.1 An emergency evacuation plan shall be prepared to identify possible fire scenarios and identify procedures for evacuating the vessel for each scenario. Sufficient areas of refuge shall be provided such that for each scenario, passengers are protected from the effects of fire during sufficient time for the crew to attempt fire fighting or prepare for evacuation. At least two areas of refuge that meet the requirements of 5-2.10 shall be provided. Each area of refuge shall have enough net area to provide 0.3 m² (3.2 ft²) for each person to be accommodated on the vessel.

19-2.8.2 Boundaries of areas of refuge shall be permitted to be in accordance with Chapters 8 through 16 where the area of refuge is bounded by voids, open decks, or low-risk machinery spaces. Where so reduced, exterior boundaries of high- and medium-risk accommodation spaces; machinery spaces; high-risk service spaces; storage spaces; cargo spaces and fuel tanks; and medical, health care, and child care spaces located below the area of refuge shall be minimum A-0.

19-2.9* General Requirements for Aisles and Aisle Accessways.

19-2.9.1 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.

19-2.9.2 Those portions of aisle accessways and aisles where egress is possible in either direction shall be uniform in required width.

19-2.9.3 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.

19-2.9.4 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.

19-2.9.5 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).

19-2.9.6 The minimum clear width of aisles shall be 50 cm (19.7 in.).

19-2.9.7 Aisle Stairs and Ramps.

19-2.9.7.1 Aisles having a gradient steeper than 1 in 20, but not steeper than 1 in 8, shall consist of a ramp. Aisles having a gradient steeper than 1 in 8 shall consist of an aisle stair.

19-2.9.7.2 Aisle stairs shall conform to the following:

(a) There shall be no variation exceeding 0.5 cm (0.2 in.) in the depth of adjacent treads.

(b) Treads shall be a minimum 28 cm (11 in.).

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

19-2.9.8 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.

19-2.10 Discharge from Exits. Exit discharge shall comply with Section 5-7.

19-2.11 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 5-8.

19-2.12 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 5-9.

19-2.13 Marking of Means of Egress.

19-2.13.1 Means of egress shall have signs in accordance with Section 5-10.

19-2.13.2 Where overnight passengers are carried, a diagram shall be placed in each cabin that clearly shows all escape routes to the open deck or area of refuge.

19-3 Protection.

19-3.1 Protection of Vertical Openings. Any vertical opening shall be enclosed or protected in accordance with 6-2.4 or shall be protected in accordance with 19-3.1.

19-3.1.1 Galleries. Galleries complying with the following shall be permitted:

(a) The entire deck area of the communicating space shall be open and unobstructed such that a fire in any part of the space will be readily obvious to the occupants of the space prior to the time it becomes a hazard to them.

(b) Each level of the space containing the gallery shall have two independent means of egress.

(c) The communicating space shall be protected throughout by an approved, automatic sprinkler system in accordance with 7-2.2.

(d) Egress capacity shall be sufficient to provide for all the occupants of all levels within the communicating space to simultaneously egress the communicating space by considering it as single-deck area when determining the required egress capacity.

(e) No horizontal dimension between opposite edges of the deck opening shall be less than 6 m (20 ft), and the opening shall have a minimum 100 m² (1000 ft²) unobstructed area.

Exception to (e): Smaller openings are acceptable, if protected by the methods detailed in NFPA 13, Standard for the Installation of Sprinkler Systems.*

19-3.1.2 Atriums. An atrium shall be permitted, provided the following conditions are met:

(a) No horizontal dimension between opposite edges of any deck opening shall be less than 6 m (20 ft), and the unobstructed opening shall be a minimum of 100 m² (1000 ft²).

Exception to (a): Atriums and spaces where the largest deck has a gross area less than 500 m² (5382 ft²) shall be permitted to have a minimum opening area not smaller than 20 percent of the gross area of the largest deck in the space, provided that the minimum dimension is not smaller than 50 percent of the beam of the vessel or 6 m (20 ft), whichever is smaller.

(b) Exit access shall be required at each level of the atrium. Exits shall be separately enclosed from the atrium in accordance with 6-2.4.

(c) Except as required by (b), stairs or ramps shall be permitted to be unenclosed within the atrium.

(d) The occupancy(ies) of the space shall meet the specifications for classification as low or medium risk in accordance with 8-1.2.1.

(e) The entire atrium and spaces opening directly into the atrium shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 7-2.

Exception to (e): Where the ceiling of the atrium is more than 17 m (55 ft) above the lowest deck, the authority having jurisdiction shall be permitted to allow the omission of sprinklers at the top of the atrium.

(f) The entire atrium and spaces opening directly into the atrium shall be protected throughout by an approved smoke-detection system in accordance with Section 7-1.

Exception to (f): On vessels with no overnight accommodations, smoke detectors are permitted to be omitted.

(g) An engineered smoke-control system complying with 7-4.8 shall be provided.

(h) If a mechanical system is installed to meet the requirements of (g) above, the mechanical system shall be independently activated by each of the following:

1. Approved smoke detectors located to detect smoke above the highest floor deck level of the atrium and at return air intakes from the atrium
2. The required automatic sprinkler system
3. Manual controls that are readily accessible to the fire personnel

(i)* Corridors, separated from the atrium by construction in accordance with 5-1.3.5 shall be provided at each deck for movement fore and aft so that occupants do not have to traverse the atrium.

Exception to (i): If fore and aft communication possible on the weather deck.

19-3.2 Mezzanines.

19-3.2.1 Where utilized, mezzanines shall be in accordance with 6-2.5.

19-3.2.2 Stairs or ramps shall be permitted to be unenclosed between balconies or mezzanines and the main accommodation areas located below the balcony or mezzanine, provided the balcony or mezzanine is open to the main accommodation area.

19-3.3 Vessel Construction.

19-3.3.1 The hull, superstructure, structural bulkheads, decks, and deckhouses shall be constructed of noncombustible material.

19-3.3.2* Load-carrying structures shall be arranged to distribute load such that there shall be no collapse of the construction of the hull and superstructure when it is exposed to fire for the appropriate fire-protection time.

19-3.3.3 The hull, superstructure, and deck houses shall be subdivided by fire barriers as prescribed by Chapters 8 through 16 and 6-2.3.

19-4 Accommodation Spaces. Accommodations spaces shall comply with Chapter 8 and this section.

19-4.1 Furniture and Furnishings.

19-4.2 Interior Finish. Interior finish shall comply with Section 6-3.

19-4.2.1 Interior finish with a maximum flame spread of 75 and a maximum smoke-developed rating of 450, when tested in actual use thickness or at a maximum thickness of up to 10.16 cm (4 in.), shall be permitted in sprinklered accommodation areas, if the system has demonstrated satisfactory behavior by testing in accordance with UBC 26-3, *Uniform Building Code Room Fire Test Standard for Interior of Foam Plastic Systems*. Such testing shall be performed on the finished manufactured assembly and on the maximum thickness intended for use.

19-4.2.2 The total area of combustible face trim, moldings, and decorations, including veneers, shall not exceed 10 percent of the total bulkhead and overhead area in fully sprinklered accommodation spaces.

19-5 Medical, Health Care, and Child Care Spaces. Medical, health care, and child care occupancies shall be in accordance with Chapter 9.

19-6 Service Spaces.

19-6.1 Service areas shall be in accordance with Chapter 10.

19-6.2 Laundry and clothes-drying facilities greater than 4 m² (43 ft²) shall be considered high-risk service spaces.

19-7 Electrical and Control Spaces. Electrical and control spaces shall be in accordance with Chapter 11.

19-8 Engineering and Machinery Spaces. Engineering and machinery spaces shall be in accordance with Chapter 12.

19-9 Storage Spaces. Storage spaces shall be in accordance with Chapter 13.

19-10 Cargo Spaces and Fuel Tanks. Cargo spaces and fuel tanks shall comply with Chapter 14 and this section.

19-10.1 Cargo spaces, other than vehicle spaces, shall be protected in accordance with Section 18-10.

19-10.2 Vehicle spaces shall be protected with a fire-protection system meeting the requirements of Section 7-2. Portable foam equipment or foam hydrants meeting 7-2.8 shall be available on each vehicle deck.

Exception No. 1: Covered open decks shall be permitted to be protected with manual sprinkler systems in accordance with 46 CFR, Part 76.23.

Exception No. 2: Vehicle spaces that are accessible to passengers shall not be protected with a carbon dioxide extinguishing system.

19-11 Open Decks. Open decks shall be in accordance with Chapter 15.

19-12 Helicopter Decks. Helicopter decks shall be in accordance with Chapter 16.

19-13 Vessel Services. On Group I, II, and III passenger vessels, low-location lighting shall be provided in accordance with Section 5-11.

19-13.1 Fire Detection and Alarm. A fire detection and alarm system complying with Section 7-1 shall be installed to protect all accommodations, service and storage spaces, and all means of egress.

Exception: On vessels with no overnight accommodations, accommodations spaces that can be assumed to be normally occupied are only required to be served by a manual alarm system.

19-13.2 Fire-Protection Systems and Equipment.

19-13.2.1 Sprinkler Systems. Where installed, sprinkler systems shall comply with 7-2.6.

19-13.2.1.1 On Group I, II, or III passenger vessels, an automatic sprinkler system complying with 7-2.6 or a water-mist system complying with 7-2.7 shall be installed to protect all accommodation, service, and storage spaces.

19-13.2.1.2 On all passenger vessels, overnight accommodation spaces shall be sprinklered in accordance with 7-2.6 or protected with a water-mist system in accordance with 7-2.7.

19-13.2.2 Fire Pumps, Fire Mains, Hydrants, and Hose.

19-13.2.2.1 Fire Pumps. Power-driven fire pumps complying with 7-2.15 and Table 19-13.2.2.1 shall be installed.

Table 19-13.2.2.1 Fire Pump Requirements

Vessel Type	Minimum Number of Fire Pumps	Minimum Capacity Per Pump (L/min)
I	3	800
II	2	600
III	2	400
IV	1	200

Exception No. 1: On Group IV passenger vessels that are less than 20 m (65.6 ft) in length, the required capacity shall be permitted to be reduced to 40 L/min (10.6 gal/min).

Exception No. 2: On Group II passenger vessels that carry less than 600 passengers the fire pump shall not be required to be located in separate spaces or be provided with a separate source of power.

Exception No. 3: On Group II passenger vessels that carry less than 600 passengers the fire pump shall not be required to be located in separate spaces if the space containing the pump is protected with a fire-protection system in accordance with Section 7-2.

Exception No. 4: One less fire pump shall be permitted on vessels that are fully protected with an automatic sprinkler system complying with 7-2.6 or a water-mist system complying with 7-2.7. In no case shall less than one fire pump be provided.

Exception No. 5: On Group II passenger vessels that carry less than 600 passengers the minimum capacity per pump shall be permitted to be reduced to 400 L/min (106 gal/min).

19-13.2.2.2 Fire Main and Hydrants.

19-13.2.2.2.1 On all passenger vessels, 40-mm (1.5-in.) fire main and hydrants, hose, and nozzles shall be installed.

19-13.2.2.2.2 Hydrants shall be provided such that any part of the vessel, except void spaces, can be reached using a single 23-m (75-ft) maximum length of fire hose.

19-13.2.2.2.3* All vessels shall be equipped with an international shore connection on both sides of the vessel.

19-13.2.2.3 Fire Hose. Fire hose meeting 7-2.16.10 shall be provided.

19-13.2.3 Portable Fire Extinguishers. Portable fire extinguishers shall be installed in accordance with 7-2.12 and 19-13.2.3.

19-13.2.3.1 Group I Passenger Vessels. Portable fire extinguishers shall be provided in accordance with Section 4/9 of the American Bureau of Shipping (ABS) steel vessel rules.

19-13.2.3.2 Group II Passenger Vessels. Portable fire extinguishers shall be provided in accordance with Table 19-13.2.3.2.

Table 19-13.2.3.2 Portable Fire Extinguisher Requirements

Space	No. Required	Type
Control space	1 for each space	B-I, C-I A-II, B-II, C-II
Engineering and machinery spaces	1 for each space	B-II, C-II and B-V if oil fired boilers are present
Cargo spaces used for vehicles	1 for every 10 vehicles	B-II
Accommodations	1 for each 250 m ²	A-II
Service spaces	1 for each space	A-II, B-II

19-13.2.3.3 Group III Passenger Vessels. Portable fire extinguishers shall be provided in accordance with Table 19-13.2.3.2.

19-13.2.3.4 Group IV Passenger Vessels. Portable fire extinguishers shall be provided in accordance with Table 19-13.2.3.2.

19-13.3 Fire-Fighting Clothing and Equipment.

19-13.3.1 Requirements for Group I and Group II Passenger Vessels that Carry More than 600 Passengers.

19-13.3.1.1 A minimum of two sets of fire-fighter protective clothing meeting the requirements of 7-3.1 shall be provided. Three additional sets of fire-fighter protective clothing meeting the requirements of 7-3.1 shall be provided for each 40 m (131.2 ft) of vessel length. The required fire-fighter protective clothing shall be stowed in widely separated compartments.

19-13.3.1.2 A minimum of two sets of self-contained breathing apparatus meeting the requirements of 7-3.2 shall be provided. Three additional sets of self-contained breathing apparatus meeting the requirements of 7-3.2 shall be provided for each 40 m (131.2 ft) of vessel length. The required self-contained breathing apparatus shall be stowed in widely separated compartments.

19-13.3.1.3 On Group I passenger vessels, a self-contained breathing apparatus recharging station meeting 7-3.2 shall be provided.

19-13.3.2 Group II Carrying 600 or Less Passengers, Groups III and IV. Fire-fighting clothing and equipment shall not be required.

19-13.4 Ventilation Systems. Ventilation systems shall comply with Section 7-4.

Exception: Group IV passenger vessels.

19-13.5 Elevators, Escalators, and Dumbwaiters. Where installed, elevators, escalators, and dumbwaiters shall comply with Section 7-5.

19-13.6 Electrical installations on Group I and II passenger vessels. Electrical installations shall comply with Section 7-6.

19-14* Group III Passenger Vessels. Group III passenger vessels shall comply with the *HSC Code*.

19-14.1 Occupant Load. Occupant load shall be determined in accordance with 8-1.4.1.

19-14.2 Materials of Construction. When fiber-reinforced plastic (FRP) is used, the requirements of 19-14.2 apply. The ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, flame-spread rating shall not exceed 25.

Exception: The ASTM E 84 flame-spread rating shall not be permitted to exceed 100 for Group IV vessels.

19-14.3 Machinery Spaces. All machinery spaces shall be separated from accommodations, and electrical and control spaces, by bulkheads and decks of minimum A-30 integrity in Group III vessels and B-0 integrity in Group IV vessels.

19-14.4 Overnight Accommodations. Group III passenger vessels shall not have overnight accommodations.

Exception: Overnight accommodations shall be permitted in Group III vessels with combustible barriers as prescribed in 6-2.3 provided the barriers meet the performance criteria of the protection required.

19-14.5 Protection of Accommodation Spaces. Accommodation spaces in Group III vessels shall be fully sprinklered in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

19-14.6* Means of Egress.

Exception: Group III vessels are required to have two areas of safe refuge, at least one protected area of safe refuge and one area of safe refuge open to the weather, suitably protected from other spaces.

19-15 Group IV Passenger Vessels.

19-15.1 General Requirements.

19-15.1.1 Chapters 5 through 16 shall not apply to Group IV passenger vessels, except as specified in Section 19-15.

19-15.1.2 Occupant load shall be determined in accordance with 8-1.4.1.

19-15.2* Means of Egress.

19-15.2.1 Doors. Doors shall be a minimum 860 mm (34 in.) in width. Doors shall meet the swing and force-to-open requirements of 5-2.1.4.

Exception: Doors accessible only to crew shall be permitted to be reduced to a minimum of 700 mm (28 in.) in width.

19-15.2.2 Stairs. Stairs shall meet the minimum dimensional criteria of 5-2.2.2.1.

19-15.2.3 Ladders. Where permitted as a component in a means of egress, a ladder shall comply with the dimensional criteria of 5-2.8.

19-15.2.4 Deck Scuttles. Deck scuttles shall be permitted as a means of egress provided they are a minimum 450 mm (18 in.) in width or diameter and are fitted with a quick-acting release and a hold-back hook.

19-15.2.5 Capacity of Means of Egress. Egress capacity shall be in accordance with 5-3.3.

19-15.2.6 Number of Exits.

19-15.2.6.1 A minimum of two exits, remotely located in accordance with 5-5.1.4, shall be accessible from all spaces.

Exception: A single means of egress shall be acceptable from a space less than 30 m² (323 ft²) in gross deck area where the following applies:

- (a) The means of egress is located as far from machinery spaces and fuel tanks as possible.

- (b) There is no stove, heater, or other source of fire in the space.

- (c) If from an accommodations space, the means of egress does not include a deck scuttle or vertical ladder.

19-15.2.6.2 Access to at least one of the required exits shall be independent of watertight doors.

19-15.2.6.3 A ladder leading to a deck scuttle shall be permitted as not more than one of the required means of egress where at least one of the following applies:

- (a) It is accessible only to crew.
- (b) It is fitted on a vessel not more than 20 m (65.6 ft) in length.

19-15.2.6.4 A window shall be permitted as not more than one of the required means of egress where the following applies:

- (a) It is fitted on a vessel not more than 20 m (65.6 ft) in length.
- (b) It does not lead directly overboard.
- (c) It can be easily opened or is designed to be kicked or pushed out.
- (d) It is marked in accordance with Section 5-10.
- (e) It is a minimum 450 mm (18 in.) in width or diameter.

19-15.2.6.5 Dead-end corridors exceeding 7 m (20 ft) in length shall not be permitted.

19-15.2.6.6 Means of egress shall be marked in accordance with Section 5-10.

19-15.3 Accommodations Spaces. Accommodations spaces shall be separated from machinery spaces and fuel tanks by a minimum C' Class boundary.

19-15.4 Medical, Health Care, and Child Care Spaces—Reserved.

19-15.5 Service Spaces.

19-15.5.1 All surfaces within 1 m (3.3 ft) of cooking appliances shall meet ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, with a flame-spread rating not exceeding 75.

19-15.5.2 Curtains, draperies, or free-hanging fabrics shall not be fitted within 1 m (3.3 ft) of cooking or heating appliances.

19-15.6 Electrical and Control Spaces—Reserved.

19-15.7 Engineering and Machinery Spaces.

19-15.7.1 Dry exhaust systems on vessels of wooden or combustible composite construction shall comply with ABYC P-1, *Installation of Exhaust Systems for Propulsion and Auxiliary Engines*.

19-15.7.2 Fuel lines and hose shall be located as far as possible from heat sources.

19-15.8 Storage Spaces. Paint, high-risk fuels, and flammable aerosols shall be stored in containers in accordance with NFPA 30, *Flammable and Combustible Liquids Code*, and NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*.

Exception: Alcohol in containers not exceeding 10 L (2.6 gal).

19-15.9 Cargo Spaces and Fuel Tanks—Reserved.

19-15.10 Open Decks—Reserved.

19-15.11 Helicopter Decks—Reserved.

19-15.12 Materials of Construction. When fiber-reinforced plastic (FRP) is used, the requirements of 19-15.12 shall apply.

Exception: FRP using resin meeting the requirements of ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, with a flame-spread rating not exceeding 100.

19-15.12.1 All service spaces shall be enclosed with bulkheads and decks meeting minimum B-15 integrity.

Exception: Service spaces that do not contain any cooking equipment with a surface temperature exceeding 120°C (248°F).

19-15.12.2 Electrical equipment including switchboards shall be separated from fuel and water sources.

19-15.12.3 A fire-detection system meeting the requirements of Section 7-1 shall be installed to protect all accommodations, service, and storage spaces and all voids that contain surfaces that might exceed a surface temperature of 120°C (248°F).

19-15.12.4 All furniture and furnishings shall meet the criteria for low- and medium-risk accommodations spaces of 19-4.1.

19-15.12.5 All machinery spaces shall be separated from accommodations, electrical, and control spaces by bulkheads and decks of minimum B-0 integrity.

19-15.12.6 Group IV vessels shall not have overnight accommodations for more than 12 persons.

19-15.12.7 Gasoline shall not be used for the propulsion machinery.

Exception: Outboard engines shall be permitted to be powered by gasoline provided the fuel is stored in an open area aft.

19-15.12.8 Group IV vessels shall not carry high-risk or low-risk fuels or combustible materials as cargo.

19-15.12.9 Internal combustion exhausts, boiler and galley uptakes, and similar sources of ignition shall be kept clear and suitably insulated from combustible material.

19-15.13 Ventilation Systems.

19-15.13.1 Ventilation of Enclosed and Partially Enclosed Spaces.

19-15.13.1.1* All spaces shall be ventilated in a manner suitable for the space.

19-15.13.1.2 Power ventilation systems shall be capable of being shut down from the pilot house.

19-15.13.1.3 Enclosed spaces accessible only to crew shall be ventilated by a power ventilation system.

Exception: Where the space is capable of being ventilated by natural ventilation.

19-15.13.1.4 Exhaust ducts ventilating frying equipment shall be a minimum 3.2 mm (11 gauge) steel.

19-15.13.1.5 Combustible materials shall not be located in ventilation ducts.

Exception: Piping or electrical wiring installed in metal conduit that would not interfere with the operation of dampers. Piping or wiring shall not be permitted in exhaust ducts ventilating frying equipment.

19-15.13.2 Ventilation of Machinery and Fuel Tank Spaces. - Ventilation of machinery and fuel tank spaces shall comply with 46 CFR, Part 182.

19-15.14 Electrical Installations. Electrical installations shall be in accordance with 46 CFR, Part 183.

Chapter 20 Referenced Publications

20-1 The following documents or portions thereof are referenced within this code as mandatory requirements and shall be considered part of the requirements of this code. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this code. Some of these mandatory documents might also be referenced in this code for specific informational purposes and, therefore, are also listed in Appendix C.

20-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-1901.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1998 edition.

NFPA 11, *Standard for Low-Expansion Foam*, 1998 edition.

NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems*, 1994 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1996 edition.

NFPA 16, *Standard for the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*, 1995 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 1998 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 1998 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 1998 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire-Protection Systems*, 1998 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 1996 edition.

NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*, 1998 edition.

NFPA 70, *National Electrical Code®*, 1999 edition.

NFPA 72, *National Fire Alarm Code®*, 1996 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1995 edition.

NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, 1996 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 1998 edition.

NFPA 99, *Standard for Health Care Facilities*, 1996 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 1995 edition.

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 1996 edition.

NFPA 266, *Standard Method of Test for Fire Characteristics of Upholstered Furniture Exposed to Flaming Ignition Source*, 1998 edition.

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*, 1998 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*, 1996 edition.

NFPA 750, *Standard on Water Mist Fire-Protection Systems*, 1996 edition.

NFPA 1964, *Standard for Spray Nozzles (Shutoff and Tip)*, 1998 edition.

NFPA 1971, *Standard on Protective Ensemble for Structural Fire Fighting*, 1997 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 edition.

NFPA 2001, *Standard on Clean Agent Fire-Extinguishing Systems*, 1996 edition.

20-1.2 Other Publications.

20-1.2.1 ABS Publications. American Bureau of Shipping, 2 World Trade Center, 106th Floor, New York, NY 10048.

Rules for Building and Classing Steel Vessels Under 90 Meters in Length, Part 4, Section 1, Table 4/1.1, 1997.

20-1.2.2 ABYC Publications. American Boat & Yacht Council, Inc., 3069 Solomons Island Road, Edgewater, MD 21037-1416.

H-25, *Standards and Recommended Practices for Small Craft—Portable Fuel Systems for Flammable Liquids*, 1986.

P-1, *Installation of Exhaust Systems for Propulsion and Auxiliary Engines*, 1993.

20-1.2.3 ASME Publications. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ASME A17.1, *Safety Code for Elevators and Escalators*, 1996.

ASME A17.2, *Inspectors' Manual for Electric Elevators*, 1996.

ASME A17.2.1, *Inspectors' Manual for Electric Elevators*, 1996.

20-1.2.4 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 1997.

ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 1997.

ASTM E 648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 1997.

ASTM E 662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*, 1995.

ASTM E 814, *Standard Test Method for Fire Tests of Through-Penetration Firestops*, 1994.

ASTM E 1537, *Standard Method for Fire Testing of Upholstered Furniture Items*, 1996.

ASTM F 840, *Standard Specification for Ladders, Fixed, Vertical, Steel, Ship's*, 1983.

ASTM F 1384, *Standard Test Method for Fire Tests of Marine Joiner Doors*, 1993.

ASTM F 1626, *Standard Practice for Preparing Shipboard Fire Control Plans*, 1995.

20-1.2.5 Compressed Gas Association Publications. 1235 Jefferson Davis Highway, Arlington, VA 22202.

Commodity Specifications for Air, G-7.1, 1989.

20-1.2.6 IEEE Publications. Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

Standard 45, *Recommended Practice for Electric Installations on Shipboard*, 1988.

20-1.2.7 IMO Publications. International Maritime Organization, 4 Albert Embankment, London, SE1 7SR.

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

A754(18), *Recommendations of Fire Resistance Test for "A," "B," and "F" Class Divisions*.

Fire Test Procedures Code.

Chapter II-2, *International Convention for Safety of Life at Sea*, 1974, and its Protocol of 1978: Articles, Annex, and Certificate Consolidated Edition, 1992.

20-1.2.8 ISO Publications. International Standards Organization, 1 Rue de Varembe, Case postale 56, CH-1211, Genève 20, Switzerland.

834, *Fire Resistance Tests — Elements of Building Construction*, 1994.

1716, *Building Materials — Determination of Calorific Potential*, 1973.

20-1.2.9 NVIC Publication. Coast Guard Headquarters, 2100 2nd Street, SW, Washington, DC 20593-0001.

6-80, *Guide to Structural Fire Protection Aboard Merchant Vessels*.

20-1.2.10 UBC Publication. International Fire Code Institute, 5360 Workman Mill Road, Whittier, CA 90601-2298.

26-3, *Uniform Building Code Room Fire Test Standard for Interior of Foam Plastic Systems*, 1997.

20-1.2.11 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 19, *Standard for Safety Lined Fire Hose and Hose Assemblies*, 1995.

UL 217, *Single and Multiple Station Smoke Detectors*, 1993.

UL 300, *Standard for Safety Fire Testing of Fire-Extinguishing Systems for Protection of Restaurant Cooking Areas*, 1996.

UL 555S, *Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems*, 1993.

UL 1056, *Fire Test of Upholstered Furniture*, 1989.

UL 1895, *Fire Test of Mattresses*, 1995.

20-1.2.12 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 16, *Code of Federal Regulations*, Parts 16, 1630 and 1632.

Title 46, *Code of Federal Regulations*, Parts 1–199.

Title 49, *Code of Federal Regulations*, Part 173.

20-1.2.13 International Chamber of Shipping, Witherby & Co., Ltd., 32/36 Aylesbury Street, London, EC1R 0ET, England.

International Safety Guide for Oil Tankers and Terminals, 4th Edition.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-1 Fundamental requirements applicable to all vessels are found in Chapters 1 through 7. These fundamental requirements are modified as applicable for any type of space in Chapters 8 through 16. The requirements in Chapters 1 through 16 are modified as applicable for any given vessel type in Chapters 17 through 19. For example, a passenger vessel would follow the requirements of Chapters 1 through 16 and Chapter 19.

A-1-2.3 Requirements for crew training can be found in 46 CFR, Part 30, Subchapter B and the IMO *International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers*.

A-1-3.4 Permanently moored vessels fall within the scope of NFPA 101®, *Life Safety Code*®.

A-1-4.1 It is not the intention that this standard be applied in addition to SOLAS for vessels in international service.

A-1-4.6 Such vessels should comply with the *International Convention for the Safety of Life at Sea*, as amended.

A-1-7.1 The intention of this document is that the requirements be applied in their entirety.

A-2-1 The following are secondary benefits that could be met in applying this code:

- (a) Prevent pollution of the marine environment from fuels, lubricants, cargo, and extinguishing agents
- (b) Avoid obstruction of maritime commerce

A-3-2 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-3-2 Authority Having Jurisdiction. The phrase “authority having jurisdiction” is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-3-2 Ceiling. A ceiling is not considered part of the overhead structural deck.

A-3-2 Code. The decision to designate a standard as a “code” is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A-3-2 Deck Covering. The term “deck coverings,” as used in this document, should not be confused with the term “deck coverings” as used in SOLAS, which are analogous to “deck overlays,” which are considered interior finish.

A-3-2 Deck Finish. Examples include carpet, wood flooring, vinyl tiles, and so forth.

A-3-2 Draft Stop. The purpose of a draft stop is to prevent the spread of fire or smoke within concealed spaces.

A-3-2 Fire Damper. The damper is designed to slow the spread of fire through the ductwork.

A-3-2 Fire-Rated Glazing. The glass might or might not be wire reinforced.

A-3-2 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as

listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A-3-2 Major Modification. Replacement in kind of structural material for hull and superstructure, replacement of a vessel’s piping or electrical systems, and replacement of vessel propulsion systems does not constitute cause for determination of major modification. Where a part of a vessel or an occupancy is changed or replaced and that does not constitute a major modification, the requirements of this document should apply only to the portion of the vessel that was modified. The authority having jurisdiction should encourage owners to enhance the fire-protection features of existing vessels without imposing new requirements via the major modification clause.

A-3-2 Structural Fire Protection. Additional items considered are joinerwork details and penetrations of structural elements. Structural, or fire, insulation refers to insulation employed as a part of the structural fire-protection system.

A-3-2 Survival Craft. The term includes lifeboats, liferafts, buoyant apparatus, and lifeboats.

A-3-2 Trunk. Trunks are also designed for access to and egress from ship spaces, and as escape routes. Trunks penetrating fire-rated bulkheads and decks should not destroy the structural and fire-resistance integrity of the affected division.

A-4-1.3 Medical, health care, and child care occupancies are occupied by persons who are mostly incapable of self-preservation because of age or physical disability.

A-4-1.6 If the engineering and machinery control space is located in and not isolated from the engine room, it is treated as part of the engine room.

The following are examples of engineering and machinery spaces:

- (a) Spaces containing pipes, hose, or processing equipment handling pressurized flammable or combustible liquids or gases including fuel oil
- (b) Lubrication oil, hydraulic oil, or ammonia
- (c) Internal combustion engines
- (d) Boiler rooms
- (e) Motor rooms
- (f) Incinerator rooms

A-4-1.13 For example, for a cargo vessel that also carries more than 12 passengers Chapter 19 would apply to areas carrying passengers, and Chapter 17 would apply to areas that support carrying cargo.

A-5-1.2 Area of Refuge. Areas of refuge should be properly sized, protectively bounded from fire and smoke, and should provide protected access to the embarkation area.

A-5-1.2 Common Path of Travel. Paths that merge are common paths of travel. Common path of travel is measured in the same manner as travel distance but terminates at that point where two separate and distinct routes become available.

A common path of travel exists where a space is arranged so that occupants within that space are able to travel in only one direction to reach any of the exits or to reach the point at which the occupants have the choice of two paths of travel

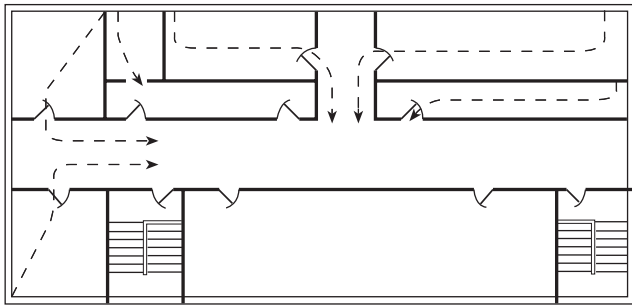


Figure A-5-1.2(a) Common paths of travel. The portion of the exit access travel for which an occupant is steered in one direction only, without the option of traveling in another independent direction toward an exit, is common path of travel. Common paths of travel are illustrated by the dashed lines.

to remote exits. Figure A-5-1.2(a) is an example of a common path of travel.

A-5-1.2 Exit. Exits include exterior exit doors, exit passageways, separated exit stairs, and separated exit ramps.

A-5-1.2 Horizontal Exit. A horizontal exit should not be confused with egress through doors. Horizontal exits provide protection against serious fire for a long period of time in addition to providing immediate protection from smoke. Horizontal exits are similar in concept to main vertical zones but do not have restrictions on length. Figure A-5-1.2(b) is an example of a horizontal exit.

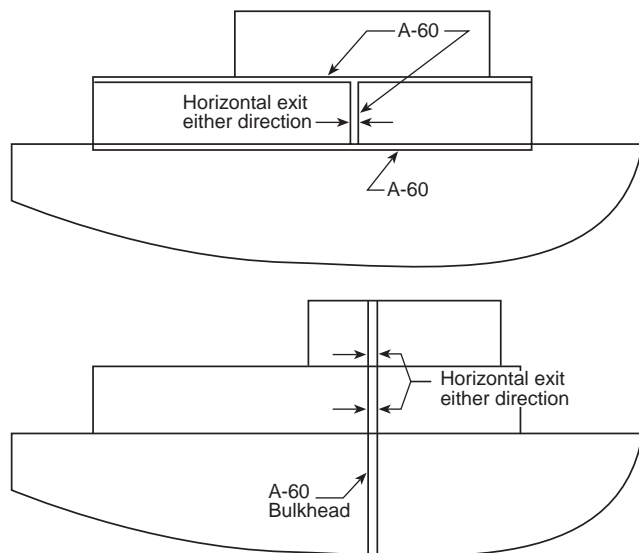


Figure A-5-1.2(b) Horizontal exit. A-60 is generally required for horizontal exits, but can be modified as allowed by Chapters 17 through 19.

A-5-1.2 Means of Egress. A means of egress comprises the vertical and horizontal travel and includes intervening room spaces or open decks, doorways, passageways, mezzanines, galleries, ramps, stairs, enclosures, lobbies, and escalators.

Means of egress is intended to be synonymous with means of escape.

A-5-1.5 Headroom on stairs is the vertical distance above a plane parallel to and tangent with the most forward projection of the stair tread.

A-5-2.1.2 Figure A-5-2.1.2 illustrates clear door width.

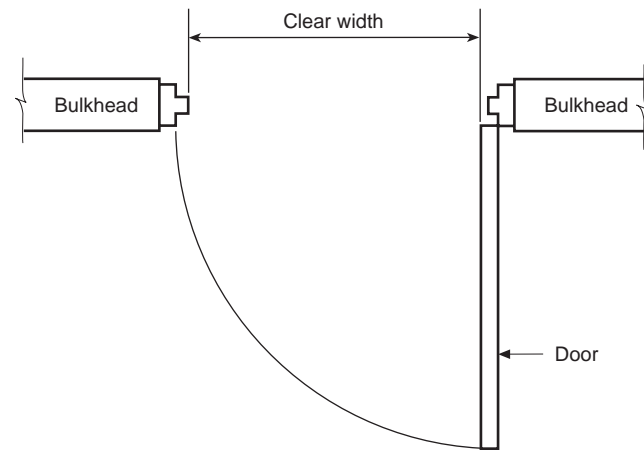


Figure A-5-2.1.2 Clear door width.

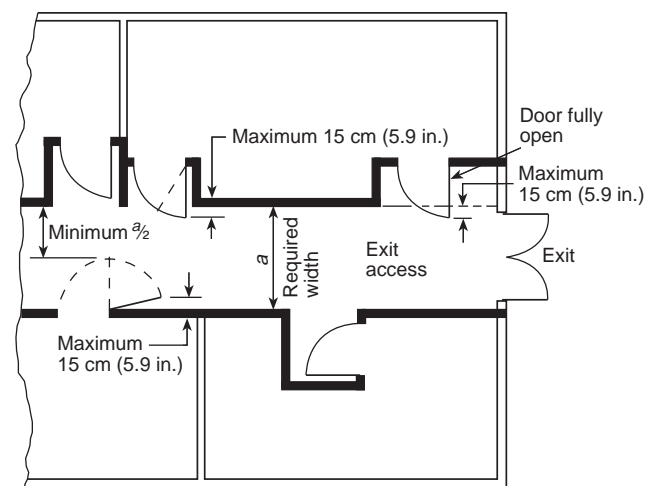


Figure A-5-2.1.4.2 Door swing into a corridor.

A-5-2.1.4.2 Figure A-5-2.1.4.2 illustrates the requirements for door swing into a corridor. Doors that swing within a recessed pocket of the corridor so as not to protrude into the required corridor width provide the best arrangement for clear passage through an exit access corridor. Doors that swing 180 degrees to come to rest against a bulkhead and do not extend into more than 15 cm (5.9 in.) of required corridor width provide an acceptable arrangement. A door swinging 90 degrees to come to rest in the path of travel is considered as not encroaching excessively on the exit access corridor width if not more than 15 cm (5.9 in.) of the required width of the corridor remains obstructed. Any door swinging into the corridor must leave unobstructed during its entire swing at least one half of the required corridor width.

A-5-2.2.2.1 Stair design should avoid a rise of 1-to-1 ratio.

A-5-2.2.2.3 Figures A-5-2.2.2.3(a) through (e) illustrate stair tread slopes and depths.

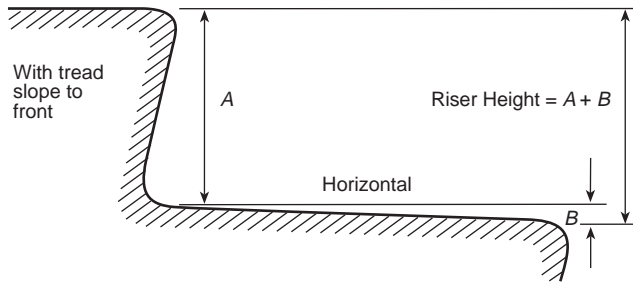


Figure A-5-2.2.2.3(a) Riser measurement with tread slope to front.

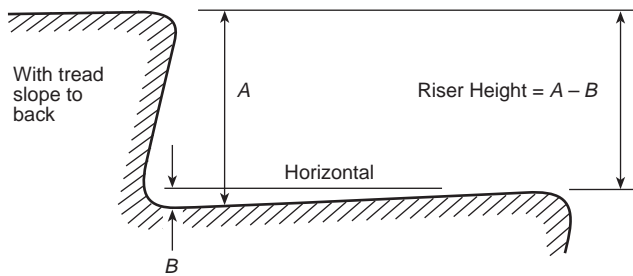


Figure A-5-2.2.2.3(b) Riser measurement with tread slope to back.

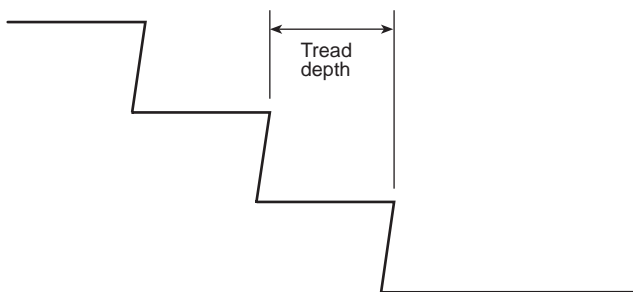


Figure A-5-2.2.2.3(c) Tread depth.

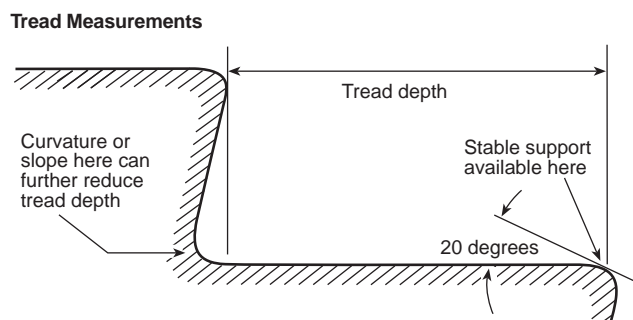


Figure A-5-2.2.2.3(d) Tread measurement with stable support at leading edge.

Carpeted Stair

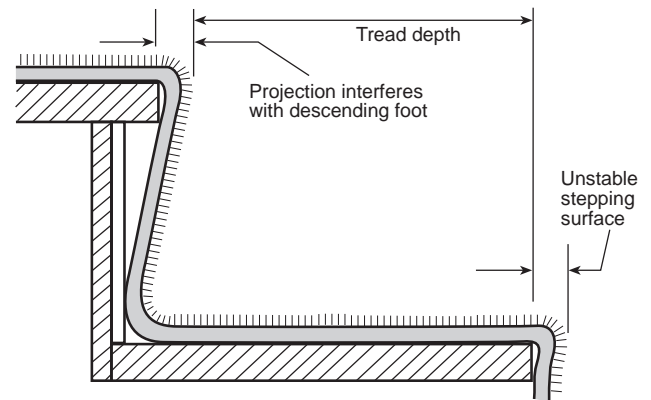


Figure A-5-2.2.2.3(e) Tread measurement with unstable stepping surface at leading edge.

A-5-2.2.4.5 Figure A-5-2.2.4.5 illustrates handrails on stairs.

A-5-2.2.6.2 Figure A-5-2.2.6.2 illustrates outside stair protection.

A-5-2.6 An exit passageway serves as a horizontal means of exit travel that is protected from fire in a manner similar to an enclosed interior exit stair. Where it is desired to offset exit stairs in a vessel with multiple decks, an exit passageway can be used to preserve the continuity of the protected exit by connecting the bottom of one stair to the top of another stair. One possible use of an exit passageway is to satisfy the requirement of 5-7.2.

A-5-2.9 Alternating tread devices are illustrated in Figure A-5-2.9.

A-5-2.10.4 Reliable two-way communication systems are intended to include the following:

- Two-way telephone communication systems as described in NFPA 72
- Sound-powered phones
- Two-way public address systems
- Hand-held radios suitable for the intended shipboard application

Where handheld radios require repeaters, the repeaters should be powered from the emergency power source.

A-5-2.10.6.4 The option in 5-2.10.6.4 would require 75 liters per minute per meter width of glazing, and is based on ordinary glass which is assumed to have no integrity. The option in 5-2.10.6.3 recognizes that the windows have inherent integrity, so the sprinklers could be spaced in accordance with their listing.

A-5-5.1.4 Figure A-5-5.1.4 illustrates various arrangements of means of egress.

A-5-5.1.5 Figure A-5-5.1.5 illustrates scissor stairs.

Two entwined stairways sharing the same enclosing bulkheads are called scissor stairs. To be considered separate exits the stairs must be completely separated from each other. In effect, each stair's enclosure must consist of a fire resistance rated tube entwined around the other much like the form of a helix. This results in space and cost savings by permitting the stairs to share the common enclosing bulkheads between

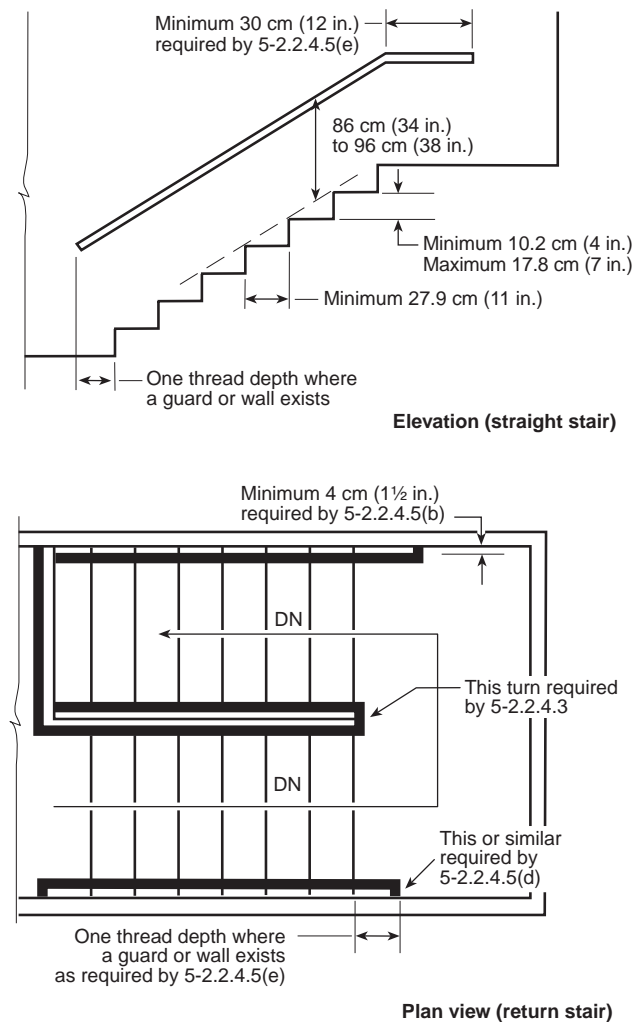


Figure A-5-2.2.4.5 Handrail details.

them and the remainder of the vessel. With this arrangement, two independent escape paths are created, similar to that provided by two independent stair enclosures positioned some distance from each other. Note the continuity of all bulkheads, providing a complete separation at all points. The arrows designate the direction of egress travel.

A-5-6.4 The intent of this paragraph is that where an exterior stair is unprotected, it is to be considered part of the exit access.

A-5-8.1.3 This illumination criterion applies to unobscured (i.e., smokefree) environments.

A-6-2.4.2.3(b) To maintain the smoketight qualities of the division, all penetrations should be protected as with penetrations of A-Class divisions. The penetrations need not be rated as A or B Class, but should be sealed. In most cases, C'-Class construction will involve bolting or overlapping parts or the addition of fire-stop sealants around fittings and penetrations.

A-6-2.4.6 An example of an acceptable protective device can be a steel shutter operated by a fusible link.

A-6-2.5.4 Figure A-6-2.5.4 illustrates shafts of various heights.

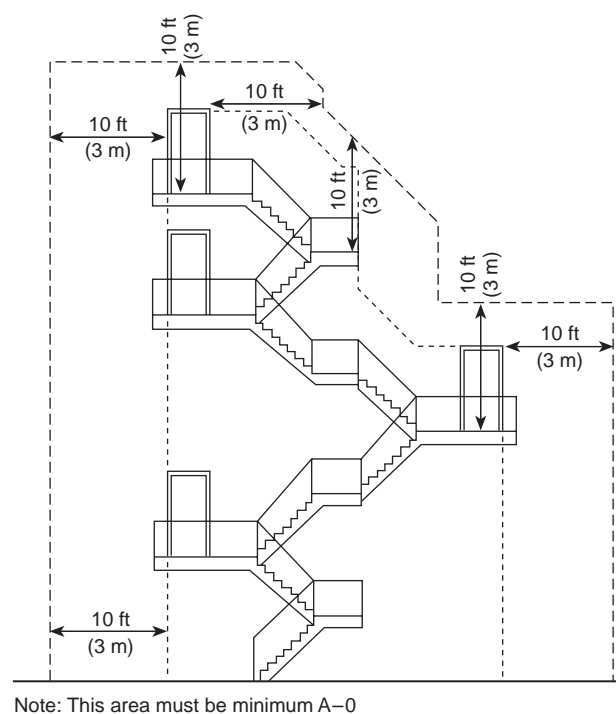


Figure A-5-2.2.6.2 Protection of outside stairs—Fire-resistance rating for the bulkhead of the 10-ft (3-m) extension is a minimum of 1 hour.

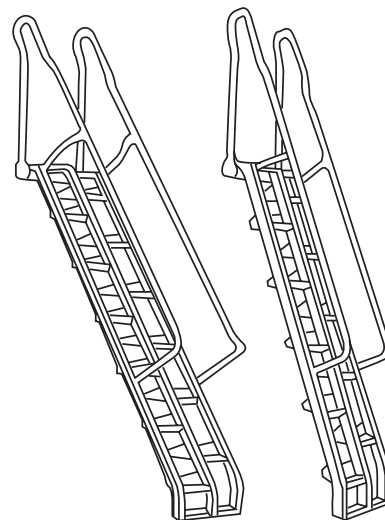


Figure A-5-2.9 Alternating tread devices.

A-6-2.7.1(b) The 14 m (45.9 ft) separation requirement applies in both the longitudinal and transverse directions.

A-6-3.3 Paint meeting the requirements of 6-3.3.1 or 6-3.3.2 is considered an acceptable interior finish.

A-6-3.4 Figure A-6-3.4 illustrates the deck overlay requirement.

A-6-4.3 This requirement does not apply to textiles that are used as interior finish.

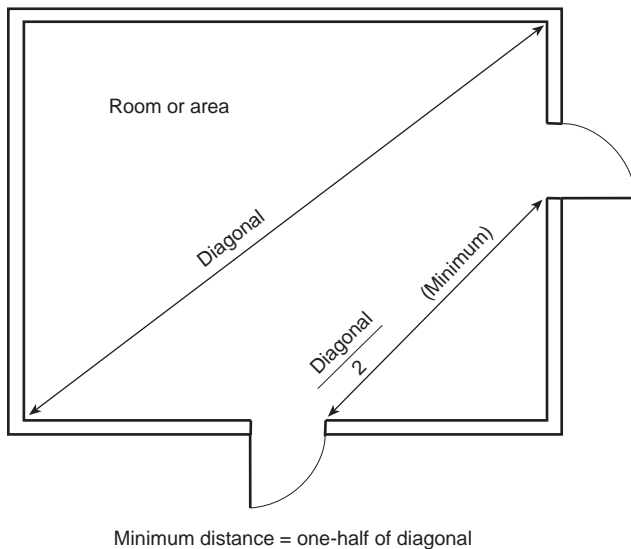


Figure A-5-5.1.4(a) Remoteness and half diagonal rule.

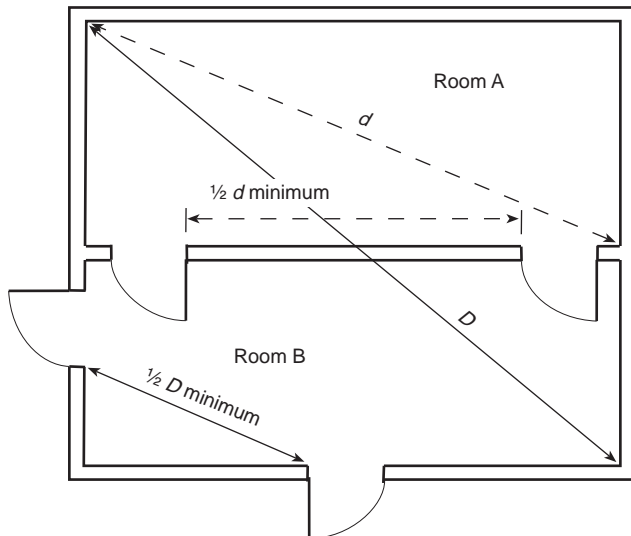


Figure A-5-5.1.4(b) Communicating openings, whether protected or not, between the stair enclosures.

A-7-1 Chapter 7 specifies fire-detection, alarm, and communication systems, as well as fire-protection systems and equipment required for merchant vessels. Wherever possible, reference has been made to the appropriate NFPA codes and standards provided they address marine applications. Otherwise, reference has been made to the appropriate SOLAS or CFR regulation. When the appropriate NFPA code or standard is revised to address the specific marine application, it is planned to delete references to SOLAS and CFR regulations.

A-7-2.2 Guidance for the installation of automatic foam-water sprinkler systems can be found by using the marine chapters of NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 11, *Standard for Low-Expansion Foam*, in combination with NFPA 16A, *Standard for the Installation of Closed-Head Foam-Water Sprinkler Systems*.

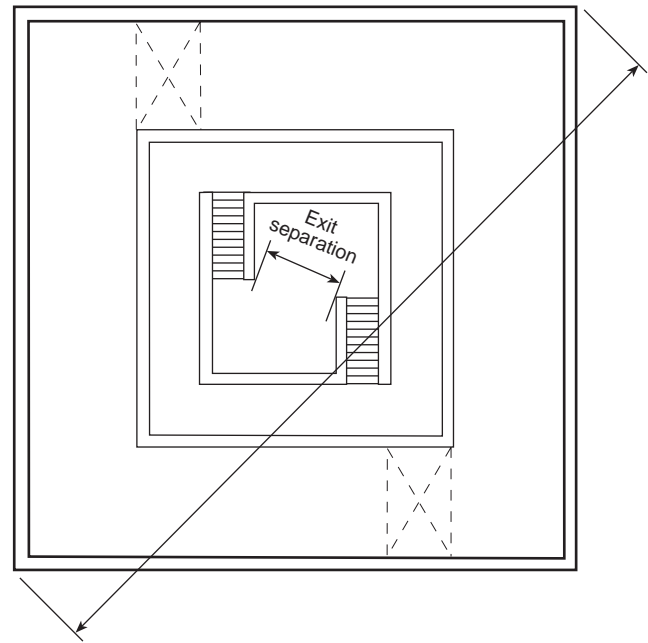


Figure A-5-5.1.4(c) Half-diagonal rule.

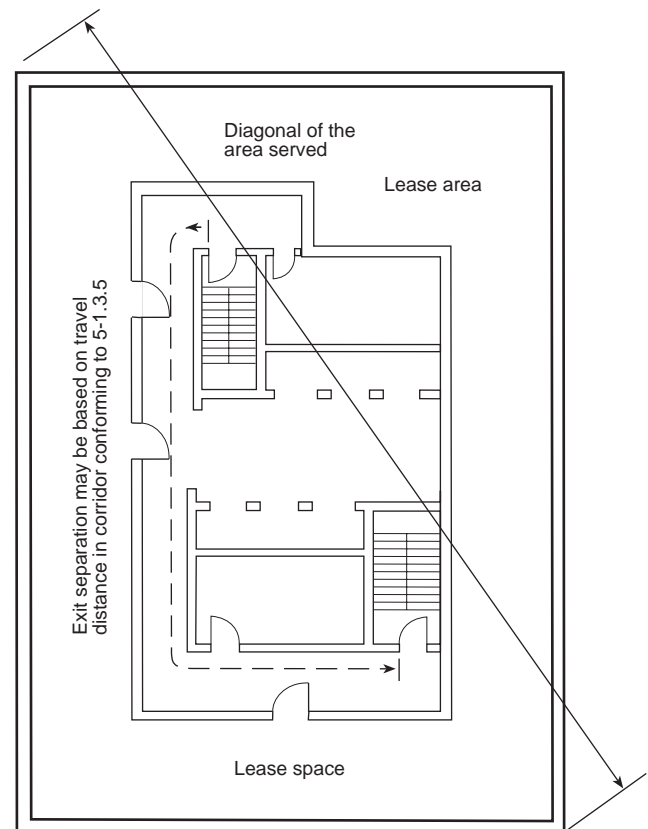


Figure A-5-5.1.4(d) Half-diagonal rule.

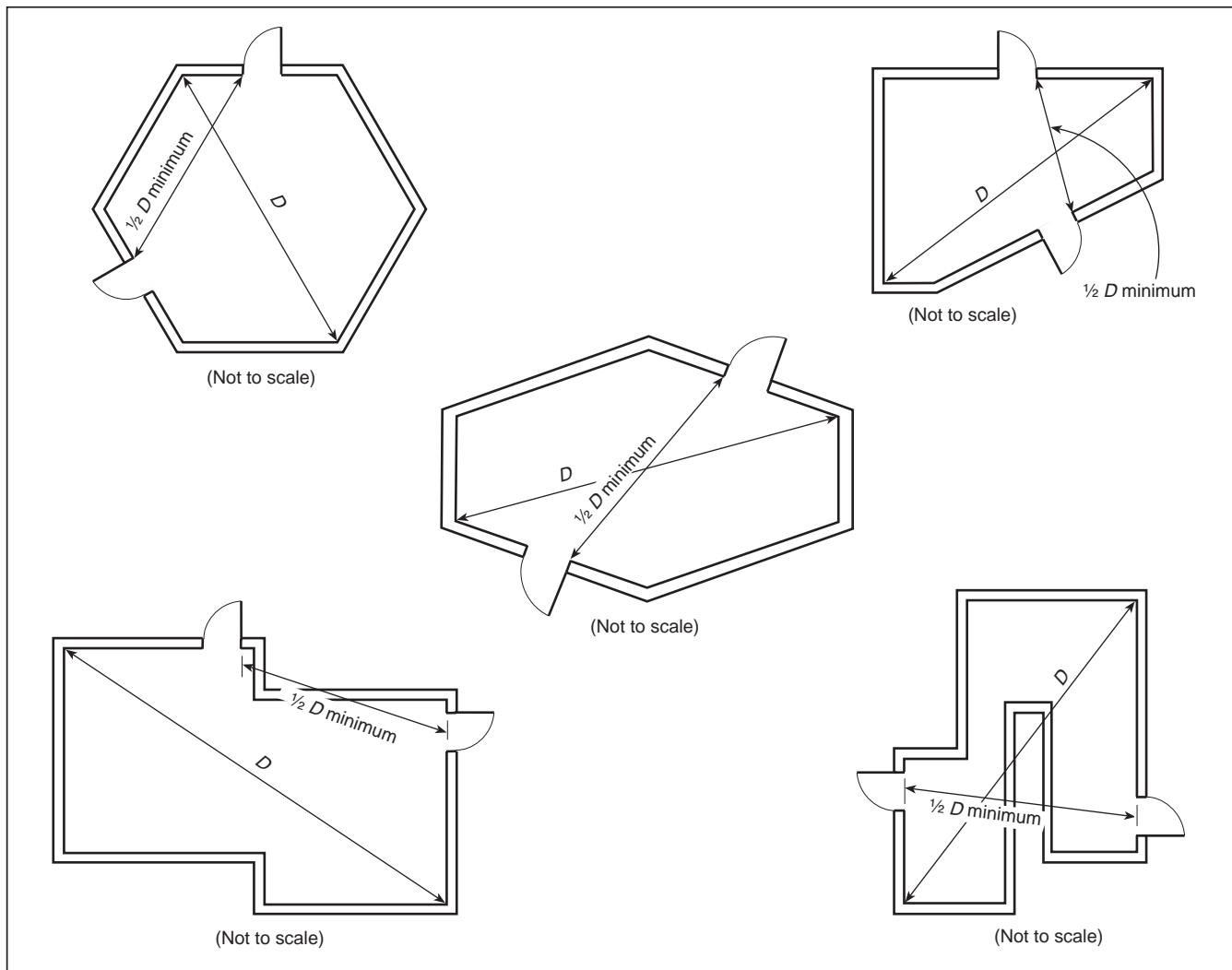


Figure A-5-5.1.4(e) Half-diagonal rule.

A-7-2.16.2 The fire-fighting equipment contemplated by this requirement includes nozzles, eductors, fog applicators, and so forth.

A-7-2.16.7 This can be accomplished either by remote starting of one of the main fire pumps from the navigating bridge, engineering operating station, or fire control station, if any, or permanent pressurization of the fire main system by one of the main fire pumps, except where machinery space is continuously attended.

A-7-3.2.5.1 Self-Contained Breathing Apparatus (SCBA) Compressor and Refill Station. High-pressure (4500 psi) SCBA provide additional breathing time over the low-pressure units and/or afford the user weight savings. On larger vessels, the operator might very likely need high-pressure units to meet the entrance/exit time demands placed upon the fire fighters.

Where SCBA recharge systems are installed onboard a vessel or where SCBAs can be readily recharged at a suitable recharge facility shoreside, shipboard fire-fighting evaluations should emphasize the actual donning and use of SCBAs, consumption of SCBA air, and recharging of the cylinders. During training,

to prevent exhausting all readily accessible and fully charged breathing apparatus, thereby reducing a ship's actual fire-fighting readiness, a ship should maintain at least 75 percent of the ship's total units in a fully charged and ready state. Following completion of the training, priority should be placed on getting the ship back to 100 percent breathing apparatus capability.

NFPA, ANSI, OSHA, and the Compressed Gas Association (CGA) provide additional maintenance, sizing, quality standards, and air-test criteria for breathing air quality—recharge equipment. Although the CGA requires a minimum air quality of Grade D for such equipment, SCBA recharge systems should meet at least CGA Grade-E air quality with less than 25-ppm water vapor. Grade-D air is acceptable, but requiring Grade-E air will provide an air quality margin for the operator. The water vapor limit is required to eliminate water vapor condensing and freezing in the SCBA regulator when the SCBA is used in cold weather. Compressor air samples should be taken on a quarterly basis in accordance with manufacturers' procedures and should be provided to a qualified air test laboratory to check for proper air quality. Additional air analysis is re-

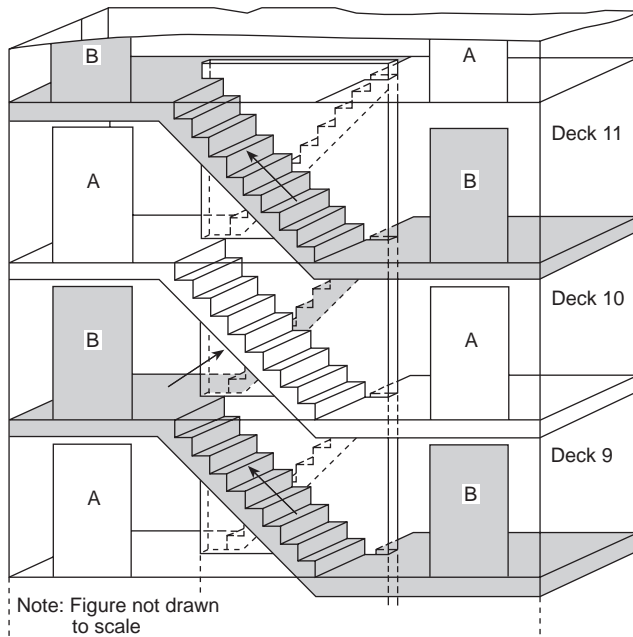


Figure A-5-5.1.5 Scissor stairs.

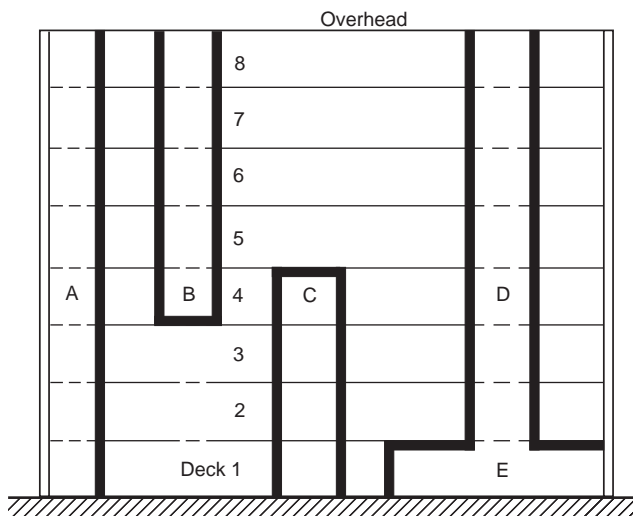


Figure A-6-2.5.4 Shafts that do not run full height of the vessel must be capped by decks or overheads.

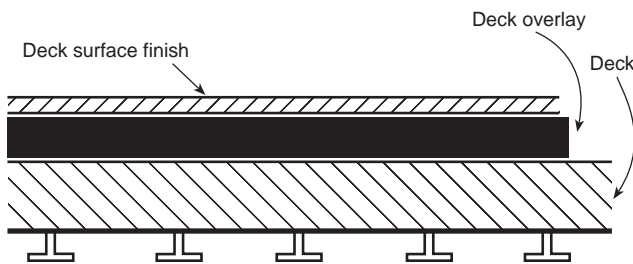


Figure A-6-3.4 Deck overlay details.

quired following major overhaul modifications or extensive repairs to the breathing air system.

Routine maintenance of the SCBA compressor recharge system is essential to ensure proper operation of the equipment and to ensure proper air quality is maintained. Special attention should be given to the condition, level, and type of lubricating oil; purification cartridge shelf/usable life; condition of air quality monitoring equipment; and drainage of the condensate reservoir. Only lubrication oils specifically approved for the compressor should be used. Operation of the compressor in high-ambient air conditions 32.2°C (90°F) decreases performance and accelerates wear and should be avoided. Consult the manufacturer's technical manual for maintenance and overhaul practices and periodicity. An active servicing program should be implemented to prevent excessive oil carry-over and carbon dioxide (CO₂) generation.

A-7.4 The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) design guidelines and The Society of Naval Architects and Marine Engineers (SNAME) Technical and Research Bulletin No. 4-16 should be used as a guide when designing vessel heating, ventilation, and air conditioning (HVAC) systems in terms of heating, cooling, dehumidification, and other design requirements. ASTM F 1005, *Standard Practice for HVAC Duct Shapes; Identification and Description of Design Configuration*, should be used as guidance when determining HVAC duct shapes, identification, description, and related criteria.

The following is ventilation guidance for various spaces.

(a) *Spaces with Dedicated Exhaust.* Independent exhaust-duct runs are generally required for spaces containing toxic, noxious, or potentially explosive fumes—such as battery rooms, paint lockers, film rooms, and toilets—or where a high fire hazard exists such as the galley. Where dedicated exhaust runs are required, they should lead directly to the weather. Weather exhaust terminals for this ducting should be located to prevent the possibility of recirculating exhausted air back into the vessel. Where common exhaust ducting is considered, the design of the exhaust system should consider the spaces being served and the possibility of contaminated air migrating back into those spaces due to failure of any required exhaust fans.

(b) *Medical Spaces.* Ventilating systems servicing medical spaces should be installed in accordance with NFPA 99, *Standard for Health Care Facilities*.

(c) *Incinerator Space.* The ventilation system for an incinerator space should be a permanent, positive-pressure type and the pressure in the space should be kept greater than the operating pressure of the incinerator. The ventilation system for an incinerator blower space should be permanent, positive-pressure type and be independent of all other ventilation systems. It should provide a pressure greater than the pressure within the incinerator and provide at least 20 air changes per hour based on the gross volume of the incinerator blower space.

(d) *Battery Storage Areas.* Battery rooms are to be ventilated to avoid accumulation of flammable gas. Natural ventilation can be employed if ducts are run directly from the top of the battery room to weather. If natural ventilation is impractical, mechanical exhaust ventilation is to be provided with fan intake at the top of the room. Openings for air intake are to be provided near the floor. Fans are to be of the nonsparking type and capable of completely changing the air in the battery room in not more than 2 minutes. The fan should be inter-

locked with the charging system and always operate during charging.

Where battery lockers are installed, they are to be ventilated, if practical, similar to a battery room, by a duct leading from the top of the locker to open air or to an exhaust ventilation duct leading to the weather. The duct should terminate not less than 0.9 m (3 ft) above the top of the locker in machinery spaces and similar well-ventilated compartments. Louvers or their equivalent are to be provided near the bottom of the room or locker for entrance of air. Deck boxes are to be provided with a duct from the top of the box terminating at least 1.2 m (4 ft) above in a goose neck or other device to prevent entrance of water. Holes for air inlet are to be provided on at least two opposite sides of the box. The entire deck box, including openings, is to be weathertight. Small battery boxes require only openings near the top to permit escape of gas.

(e) *Compartments Containing Gasoline, [or fuel having a flash point of 43.3°C (110°F) or lower] Machinery, or Fuel Tanks.* Such spaces should maintain a negative pressure by means of a natural supply and mechanical exhaust ventilation system. Where mechanical exhaust systems are required, design of the system should assure that adequate air changes are provided per minimum requirements per Table A-7-4(e).

Electrical equipment within such spaces should be explosionproof and nonsparking as appropriate for such equipment in accordance with 46 CFR, Part 111. Purged and pressurized systems in accordance with NFPA 496, *Standard for Purged and Pressurized Enclosures for Electric Equipment*, can also be used where explosionproof installations are required. (See Section 7-6 for *Electrical Power Systems*.) Exhaust blower motors should be installed exterior to the ducting. Exhaust blower switches should be located outside of such spaces and interlocked with engine ignition switches to allow a minimum of one complete space air change in the space prior to engine starting, where applicable. A red warning sign should be posted at the switch stating the same. Ventilation ducting should conform to the following minimum criteria:

1. Maintain air velocity in ducting less than 610 m/min (2000 ft/min)
2. Have dimensions not greater than twice that of any other system duct
3. Meet B-Class boundary construction requirements as a minimum
4. Be constructed of nonferrous or galvanized ferrous metal and be gastight from end to end
5. Be as direct as possible to prevent air pockets
6. Be securely supported
7. Be provided with cowls or scoops having a free area not less than twice the required duct size and, accounting for

any screens at the entrance, have no dampers and be open at all times

Where engines and fuel tanks are not in closed compartments, at least one ventilation duct should be installed in the fore part of the vessel and one in the aft part of the vessel whereby both ducts should have cowl or scoops. Supply and exhaust duct opening should not be located where the natural flow of air is unduly obstructed or adjacent to possible sources of vapor ignition, nor should they be so located that exhaust air might be taken into the supply vents.

(f) *Hazmat Stores.* Ventilation requirements for the stowage of hazardous materials (HAZMAT) stores is covered under 46 CFR, Part 147, Subchapter N.

(g) *Machinery Spaces.* Mechanical ventilating systems for machinery spaces should be in accordance with SOLAS II-2, Regulation 15.

(h) *Pump Rooms.* Cargo oil or liquefied flammable gas (LFG) pump rooms are to have a mechanical ventilating system capable of providing at least 20 air changes per hour based on the gross volume of the pump room. The system is to have mechanical exhaust, natural or mechanical supply, and ducting near the deck of the compartment as required to effectively purge all areas of the pump room. Where forced supply ventilation is fitted, the system should be installed so as to avoid turbulence in the pump room. Fan motors are to be located outside the pump room and exterior to the ventilation ducts. Fans are to be of nonsparking construction. Provision is to be made for immediate shutdown of the fan motors upon release of the fire-extinguishing systems. Refer to 46 CFR, Subchapter D, ABS, *Rules for Building and Classing Steel Vessels*, Section 4/ 5.149.6, and ABS Section 4/5.151.6 for additional requirements for cargo pump rooms.

(i) *Refrigeration Machinery Spaces.* Refrigeration machinery spaces are to be effectively ventilated. Ammonia refrigerating machines are to be placed in compartments clear of the propelling machinery and so arranged that any leakage of ammonia fumes can escape to the open air.

(j) *Cargo Spaces.* Cargo spaces can be broken down as follows:

1. *Break Bulk.* Those portions of the cargo hold suitable for carrying dry-cargo, including hatch trunks and dry cargo deep tanks, should be mechanically ventilated with independent systems for each cargo hold. The supply air should be distributed from one end of the hold and exhausted at the opposite, assuring uniform air distribution without dead air pockets.
2. *Refrigerated Cargo Spaces.* Refrigerated cargo spaces should be provided with a mechanical fresh air supply system and natural foul air exhaust system. The fan should have 50 percent speed reduction with local and remote manual control. Manual volume-control dampers should be provided for each system in accessible locations.
3. *RO/RO Cargo Spaces.* The vent system for enclosed spaces intended for the carriage of motor vehicles with fuel in their tanks for self-propulsion is to be independent from all other vent systems and is to be capable of being controlled from a position outside the space. Ten air changes per hour are required based on the empty volume of the space serviced unless the space is fitted with Class I, Division I equipment, then six air changes per hour should be sufficient. Fans are to be nonsparking; inlets for exhaust ducts are to be located within 450 mm (17.75 in.) above

Table A-7-4(e) Ventilation Requirements

Size of Spaces		Air Change per Minute
m ³	ft ³	
<14.2 m ³	<500 ft ³	2
14.2 m ³ –28.3 m ³	501 ft ³ –1000 ft ³	3
28.3 m ³ –42.5 m ³	1001 ft ³ –1500 ft ³	4
>42.5 m ³	>1500 ft ³	5