

NFPA®

307

Standard for the
Construction and Fire Protection
of Marine Terminals, Piers,
and Wharves

2021



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NFPA® 307

Standard for the

Construction and Fire Protection of Marine Terminals, Piers, and Wharves

2021 Edition

This edition of NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*, was prepared by the Technical Committee on Marine Terminals. It was issued by the Standards Council on October 11, 2019, with an effective date of October 31, 2019, and supersedes all previous editions.

This edition of NFPA 307 was approved as an American National Standard on October 31, 2019.

Origin and Development of NFPA 307

This document originated in 1980 from the combination of the 1967 edition of NFPA 307, *Recommendations for the Operation of Marine Terminals*, and the 1975 edition of NFPA 87, *Standard for the Construction and Protection of Piers and Wharves*.

NFPA 87 was withdrawn by the Standards Council in October 1980, and the 1980 edition of NFPA 307 was retitled *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*.

NFPA 87 was first initiated by the Committee on Piers and Wharves from 1915 to 1925, and was adopted by NFPA in 1925. Revised editions were adopted in 1931, 1935, 1954, 1963, 1968, 1971, and 1975.

NFPA 307 was first adopted by NFPA in 1951. Revised editions were adopted in 1961, 1967, 1980 (when NFPA 87 was incorporated), 1985, 1990, and 1995.

The 2000 edition of NFPA 307 consisted of amendments to the 1995 edition. The Technical Committee identified a need for the standard to reflect current marine terminal operating procedures and updated methods of material handling and storage.

In 2005, the entire standard was revised in accordance with the *Manual of Style for NFPA Technical Committee Documents*. Under design criteria for sprinkler systems, the Technical Committee changed “Extra Hazard (Group 1)” to “Group A Plastics.” The committee amended fire protection requirements for marine terminal buildings where specific cargoes other than Group A plastics, or hazardous materials, are handled or stored.

The 2011 edition revised the definition of *hazardous material* and the requirements for wood and unprotected substructures and for piles and stiffening members of piers and wharves. The standard permitted the use of corrosion-resistant types of pipes, fitting, hangers, or listed protective corrosion resistant coatings on fixed extinguishing system components that are subject to corrosion in a marine environment. The standard also recommended consideration of alternative hydrant spacing in locations where standard spacing is impractical due to container-handling equipment.

In the 2016 edition, the Technical Committee referenced *NFPA 5000, Building Construction and Safety Code*, wherever possible, particularly for requirements related to the design, materials, and workmanship of pier and wharf construction and other structures within the facility. However, the standard lets the AHJ consider other codes or standards when approving marine terminal construction plans. Previous editions of the standard only addressed cargo-handling facilities. The 2016 edition also included construction requirements that apply to marine terminals designed for passenger vessels.

During the first draft meeting for the 2021 edition, the committee heard a presentation from the U.S. Coast Guard that emphasized a need to increase awareness throughout the public sector and private industry about federal requirements that pertain to firefighting on commercial vessels in U.S. ports. The committee developed a new annex to inform municipal and industrial firefighters about marine firefighting (MFF) requirements that vessel owners or operators (plan holders) must meet in

their respective vessel response plans (VRPs). The intent of the new annex is to familiarize municipal and industrial firefighters on plan holder actions in the event of fire onboard commercial vessels at marine terminals, piers, and wharves. The annex also provides details on specific responsibilities of plan holders and their contracted MFF service providers.

The 2021 edition also directs users to NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, for requirements relating to standpipes and hose systems for marine terminals. NFPA 307 now requires that fire protection water supplies be inspected, tested, and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, to ensure that water supply systems are operational when needed in the event of a fire or other emergency.

Because marine terminal structures have specific fire safety challenges, a fire risk assessment should be performed in the design phase of construction. The 2021 edition now provides a list of resources to facilitate this assessment process.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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 relating, generally, to the fire safe construction and fire protection of piers and wharves and of structures thereon. It shall also be responsible for documents relating to the fire safety that is unique to marine terminal facilities and operations but avoiding duplicating and overlapping the scopes of other NFPA Committees that may have primary jurisdiction.

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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 Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall provide general principles for the construction and fire protection of marine terminals, piers, and wharves.

1.1.2 Nothing in this standard shall supersede any of the regulations of governmental or other regulatory authority.

1.1.3 The provisions of this standard shall reflect situations and state-of-the-art techniques at the time the standard was issued.

1.2 Purpose. The provisions of this standard shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion in marine terminals, piers, and wharves.

1.3 Application. This standard shall apply to marine terminals as defined herein.

1.3.1 In addition to the requirements of this standard, special use piers and wharf structures that are not marine terminals, such as public assembly, residential, business, or recreational occupancies, that differ in design and construction from cargo handling piers and wharves, shall require special consideration.

1.3.2* This standard shall not apply to marinas and boatyards.

1.3.3 This standard shall not apply to the handling of the following:

- (1)* Flammable or combustible liquids in bulk
- (2)* Liquefied gases in bulk

1.4 Retroactivity. Unless otherwise noted, it shall not be intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document, except in those cases in which it shall be determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or property.

1.5 Units.

1.5.1 All weights and measures used in this standard shall be in accordance with the modernized metric system known as the International System of Units (SI), followed by approximate conversions in U.S. customary units.

1.5.2 The liter unit, which is outside of but recognized by SI, shall commonly be used in international fire protection.

1.5.3 Although some rounded SI values are slightly more stringent than existing values, this change shall not be intended to apply to existing installations.

1.5.4 In addition, actual numerical values obtained directly from referenced documents, such as NFPA 70, shall not be changed or rounded, although the SI equivalent is placed first in the text.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

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

NFPA 1, *Fire Code*, 2018 edition.

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

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

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

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

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

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

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

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2020 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2014 edition.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

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

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, 2019 edition.

NFPA 101®, *Life Safety Code*®, 2021 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2019 edition.

NFPA 495, *Explosive Materials Code*, 2018 edition.

NFPA 498, *Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives*, 2018 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

2.3 Other Publications.

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

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2018b.

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

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

2.3.3 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 1006, *Standard for Technical Rescuer Professional Qualifications*, 2017 edition.

Chapter 3 Definitions

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

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of

production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

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

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

3.3 General Definitions.

3.3.1 Approach Way. A structure used to gain access to a pier or wharf but not used to moor barges or vessels.

3.3.2* Bent. A main supporting framework consisting of a transverse row of piling with interconnecting pile cap and bracing.

3.3.3 Berth. The waterside area adjacent to a pier, wharf, or bulkhead where vessels are moored.

3.3.4 Bulkhead Building. A structure generally having a solid-fill-type substructure and forming the land end of one or more piers.

3.3.5 Bulkhead Wall. A retaining wall of timber, stone, concrete, steel, or other material built along, or parallel to, navigable waters.

3.3.6 Cargo. Commodities in transit.

3.3.6.1 Breakbulk Cargo. Commodities packaged in bags, drums, cartons, crates, and so forth, commonly, but not always, palletized and conventionally stevedored and stowed.

3.3.6.2 Bulk Cargo. Unpackaged commodities carried in the holds or tanks of cargo vessels and tankers and generally transferred by such means as conveyors, clamshells, and pipeline.

3.3.6.3 Containerized Cargo. Commodities stowed and transported in an intermodal freight container.

3.3.7 Chassis. Special trailer or wheeled undercarriage on which containers or roll-on/roll-off (RO/RO) cargoes are moved.

3.3.8 Container. A reusable, intermodal boxlike structure of rigid construction fitted with devices to permit lifting and handling particularly transfer from one mode of transportation to another mode of transportation.

3.3.9* Container Freight Station (CFS). A transload facility used primarily for loading and unloading cargo from containers.

N 3.3.10* External Firefighting Systems. Firefighting resources (i.e., personnel and equipment), from other than aboard the vessel, capable of combating a fire.

N 3.3.11 External Firefighting Teams. Trained firefighting personnel, aside from the crew, with the capability of boarding and combating a fire on a vessel.

3.3.12* Hazardous Material. A substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. [1006, 2017]

3.3.13* Low Water Level. A tidal datum that is a long-term arithmetic mean of the named tidal levels as promulgated for a given location in the tables and charts of the National Ocean Survey of the National Oceanic and Atmospheric Administration.

3.3.14 Marine Terminal. A facility comprised of one or more berths, piers, wharves, loading and unloading areas, warehouses, and storage yards and used for transfer of people and/or cargo between waterborne and land transportation modes.

N 3.3.15 On-Site Fire Assessment. A marine firefighting professional on scene, at a safe distance from the vessel or on the vessel, who can determine the steps needed to control and extinguish a marine fire in accordance with a vessel's stability and structural integrity assessment, if necessary.

3.3.16* Pier. A structure, usually of greater length than width and projecting from the shore into a body of water with direct access from land, that can be either open deck or provided with a superstructure.

3.3.17 Protected Steel. Structural steel protected by the application of a material such as concrete to maintain the stability of the steel under fire conditions for a specified period of time.

N 3.3.18* Remote Assessment and Consultation. Contacting the salvage and marine firefighting (SMFF) resource providers by phone or other means of communications to discuss and assess the situation.

3.3.19 Roll-On/Roll-Off (RO/RO). A form of cargo handling utilizing a vessel designed to load or unload cargo by using wheeled vehicles that roll on or roll off.

3.3.20 Substructure. The portion of the construction of a pier or wharf below, and including, the deck. (See Annex B.)

3.3.21 Superstructure. The portion of the construction of a pier or wharf above the deck.

3.3.22 Terminal Operator. The owner or other person, such as the leasee, who is responsible for the operation of the facility.

3.3.23* Terminal Yard. Open areas at a marine terminal site that are provided for the temporary storage of cargo, containers, and cargo-handling equipment.

3.3.24 Tidal Range. The difference in height between mean lower low water and mean higher high water or, in places having only one tide daily, between mean low water and mean high water.

3.3.25 Transit Shed. A transload facility for cargoes usually located on a pier or wharf and primarily used for transfer of breakbulk-type cargo.

3.3.26 Transload Facility. A building or structure used for loading and unloading cargo from containers, trucks, railcars, and vessels; the classification and consolidation of commodities; and the temporary storage of commodities, such as a transit shed or container freight station.

3.3.27 Warehouse. A building used for long-term storage of commodities in contrast to temporary storage in container freight stations and transit sheds.

3.3.28* Wharf. A structure at the shoreline that has a platform built along and parallel to a body of water with either an open deck or a superstructure.

Chapter 4 Piers and Wharves

4.1* General. Design, materials, and workmanship of pier and wharf construction shall conform to *NFPA 5000*.

4.2 Substructure Construction.

4.2.1* General. Construction and protection standards for the three basic pier substructure construction types — fire resistive, noncombustible, and combustible — and also any combination of these materials in a fourth construction type defined herein as composite construction shall conform to the requirements outlined in this chapter. [See also Figure B.1(a) through Figure B.1(c).]

4.2.2 Protection Against Physical Damage.

4.2.2.1 Concrete or other portions of pier or wharf structures that are exposed to impact or abrasion by vessels, or that are subject to damage by floating ice or debris, shall be protected by an open-fender system constructed of wood or other material approved by the authority having jurisdiction.

4.2.2.2 Provisions shall be made to reduce the impact force exerted on the pier or wharf structures with details of construction that prevent excessive damage from ordinary operations.

4.2.3 Support for Walls. When piers or wharves are located in soft or yielding bottoms where unequal loading results in unequal settlement, the substructure for supporting division walls and walls enclosing stairs, elevators, escalators, and chutes shall be separate and distinct from the structure of the pier or wharf.

4.2.4 Fire-Resistive Substructures.

4.2.4.1 General.

N 4.2.4.1.1 A fire-resistive substructure shall be one having a fire resistance rating in all of its parts of not less than 4 hours.

N 4.2.4.1.2* If a performance-based design is used, the analysis design process shall be acceptable to the AHJ.

4.2.4.2 Wood and Unprotected Substructures. If piles or cribwork are constructed of wood or other material acceptable to the AHJ, or unprotected steel piles are used, they shall not extend above low water.

4.2.4.3 Pier Deck. Pier decks shall be reinforced concrete or equivalent construction to provide a 4-hour fire resistance rating.

4.2.4.3.1 Where railroad tracks extend onto the pier deck at a lower level than the deck, the sides and bottom of the

depressed section shall be of the same construction as the pier deck or of an equivalent fire resistance rating.

4.2.4.3.2 When used on the underside of the pier deck, vapor barriers, moisture shields, coatings, or finishes shall conform to the definition of noncombustible or limited-combustible as defined in *NFPA 5000*.

4.2.4.4 Aprons. Pier aprons or platforms built along the sides or ends of the pier shall have the substructure and deck constructed to have a 4-hour fire resistance rating.

4.2.5 Noncombustible Substructures.

4.2.5.1 General. A noncombustible substructure shall be one that does not meet the requirements for fire-resistive substructures in accordance with 4.2.4, such as structural steel and steel piles that are not provided with fireproofing equivalent to a 4-hour fire resistance rating, or one of reinforced concrete for which a 4-hour fire resistance rating has not been established by standard testing.

4.2.5.2 Pier Deck. Pier decks shall conform to the requirements of 4.2.4.3, except that the fire resistance rating requirement of fire-resistive substructures shall not apply to noncombustible pier decks.

4.2.5.3 Aprons. Pier aprons or platforms built along the sides or ends of the pier shall have the substructure and deck constructed so as to have a fire resistance rating equal to that of the pier substructure and deck.

4.2.6 Combustible Substructures.

4.2.6.1 Piles and Stiffening Members. The substructure shall be constructed of wood piles or other material acceptable to the AHJ extending to the pier deck.

4.2.6.1.1 Construction material other than wood shall maintain its structural integrity under fire exposure and have heat, flame, and smoke characteristics that are equivalent to wood pilings.

4.2.6.1.2 Stiffening of the piling shall be by the use of inclined bracing piles or cross braces of timber of not less than 100 mm (4 in.) nominal minimum dimension and 20,000 mm² (32 in.²) minimum cross-sectional area.

4.2.6.1.3 The cross bracing shall be designed to offer a minimal surface exposed to fire and the smallest possible obstruction to the distribution of water in fighting fires under the pier deck.

4.2.6.1.4* Deep narrow spaces between timbers shall be fire-stopped over each bent or at least once in each timber length.

4.2.6.2 Pier Deck and Supports.

4.2.6.2.1 Pile caps shall consist of sawed timber not less than 200 mm (8 in.) nominal minimum dimension and 62,000 mm² (96 in.²) minimum cross-sectional area, and the deck stringers of not less than 150 mm (6 in.) nominal minimum dimension and 46,000 mm² (72 in.²) minimum cross-sectional area.

4.2.6.2.2 Deck planking on stringers shall be not less than 100 mm (4 in.) in thickness, and on this planking shall be laid a wearing surface of 50 mm (2 in.) of wood sheathing or a layer of concrete, asphalt, or other material of equivalent durability.

4.2.6.2.3 The sheathing and deck planks shall be laid at right angles, except that in the driveways the sheathing shall be permitted to be laid diagonally.

4.2.6.2.4 Joists 100 mm (4 in.) or less in thickness shall not be used in this type of construction.

4.2.6.2.5 Pier decks without superstructures shall have deck planking not less than 76 mm (3 in.) thick.

4.2.6.2.6 Pier decks of composite laminated timber and concrete construction shall be acceptable, provided that timbers used shall be not less than 50 mm (2 in.) in nominal thickness and shall be treated for protection against decay, termites, or attack by marine life. [See Figure B.1(a) and Figure B.1(c) in Annex B.]

4.2.6.2.7 Any openings in pier decks, such as spaces between bull rail and pier deck, alongside railroad or crane tracks, and others made necessary for operations or equipment, shall be closed to prevent debris from falling through and accumulating on substructure members. [See Figure B.1(a) and Figure B.1(c) in Annex B.]

4.2.6.2.8 Steel angle iron, steel plate, or equivalent noncombustible material of a thickness that resists damage and fire spread shall be used for closures and shall be permanently installed in such a manner as to accommodate operations and accomplish these objectives.

4.2.6.2.9 Where railroad tracks extend onto a pier at a lower level than the deck, the sides and bottom of the depressed section shall be of the same construction as the pier deck or of equal or greater fire resistance than the pier deck.

4.2.6.2.10 Side hatches shall be permitted in the walls of the depressed sections in 4.2.6.2.9 for fire-fighting purposes, with openings normally closed by hatch covers having a fire resistance rating equivalent to the walls.

4.2.6.3 Aprons.

4.2.6.3.1 Pier aprons or platforms built along the sides or ends of the pier shall have the substructure and deck constructed to have fire-resistive qualities equal to that of the pier substructure and deck, except that at every fire wall of the substructure and superstructure, a section of the apron or platform and its substructure shall be of fire-resistive construction as defined in 4.2.4.

4.2.6.3.2 The fire-resistive section shall extend for a distance of at least 3 m (10 ft) on each side of the fire wall.

4.2.7 Composite Substructures.

4.2.7.1 General. Composite construction shall be any combination of combustible and noncombustible materials (with or without fire resistance rating), described in 4.2.4, 4.2.5, and 4.2.6, not meeting the limitations in 4.2.4.2.

4.2.7.2 Pier Decks, Supports, Bracings, and Aprons. Pier decks, supports, bracings, and aprons shall conform to the construction requirements of 4.2.4, 4.2.5, and 4.2.6 for the type of construction used for the various portions of substructure.

4.3 Substructure Protection and Subdivision.

4.3.1 Noncombustible Substructures. The provision of fire walls, firestops, automatic sprinklers, and other fire-extinguishing facilities under the pier deck shall depend upon the amount of exposed steel, the fire resistance ratings of rein-

forced concrete construction or assemblies, and the fire hazard as determined by the authority having jurisdiction.

4.3.2* Composite Substructures.

4.3.2.1 The provision of fire walls and firestops, automatic sprinklers, and other fire-extinguishing facilities shall conform to the requirements for combustible substructures as provided in 4.3.3 except as stated in 4.3.2.2.

4.3.2.2 Where exposed combustible structural materials are limited to piling and intrabent bracing, and the height from low water to the top of combustible construction does not exceed the typical distance between bents, the provision of fire walls and firestops and the installation of automatic sprinklers or other fire-extinguishing facilities under the pier deck shall depend upon the amount and concentrations of all exposed combustible materials, fire resistance rating of the pier deck, configuration of and access to the substructure, and the fire hazard.

4.3.3 Combustible Substructures.

4.3.3.1* Automatic Sprinklers. A complete system of automatic sprinklers shall be installed for the protection of all combustible substructures.

4.3.3.1.1 Exemption. Requiring the installation of a complete automatic sprinkler system shall be permitted to be waived for those existing substructures specified in 4.3.3.2.5 and for piers and wharves that have all of the following characteristics:

- (1) Solid decking that is 7.5 m (25 ft) or less in width
- (2) Area that is 465 m² (5000 ft²) or smaller, exclusive of approach ways that are 7.5 m (25 ft) or less in width
- (3) Separation distance of at least 9 m (30 ft) from other structures
- (4) Superstructures that do not exceed 46.5 m² (500 ft²) in individual area or 140 m² (1500 ft²) in aggregate area
- (5) Superstructures that are not less than 9 m (30 ft) apart

4.3.3.1.2 Installation of Sprinklers.

4.3.3.1.2.1 Installation of sprinkler equipment shall be in accordance with the applicable provisions of NFPA 13.

4.3.3.1.2.2 Where there is danger of damage to sprinkler equipment by floating objects, physical barriers shall be provided to exclude such objects.

4.3.3.1.3 Installation Requirements in Addition to NFPA 13.

4.3.3.1.3.1* Upward Projecting Sprinklers. Where narrow horizontal channels or spaces are caused by caps, stringers, ties, and other structural members and where the standard upright sprinkler does not project sufficient water upward to extinguish or control fires on the underside of the pier or wharf deck, a sprinkler that projects water upward to wet the overhead shall be used.

(A) Location, spacing, and deflector position shall be governed by the discharge pattern of the sprinkler and the structure being protected.

Δ (B) The following design and installation guides shall apply where pendent sprinklers in the upright position or old-style sprinklers are to be utilized:

- (1) The maximum coverage per sprinkler shall be limited to 7.5 m² (80 ft²).

- (2) Where spacing or arrangement of stringers constitutes typical open-joist construction directly supporting the deck, sprinkler branch lines shall meet the following requirements:

- (a) Sprinkler branch lines shall be installed between the bents at right angles to the stringers.
- (b) Spacing between branch lines shall not exceed 3 m (10 ft).
- (c) Sprinklers on branch lines shall be staggered and spaced not to exceed 2.5 m (8 ft) on center.

- (3)* Where crisscross construction is involved, closer spacing of sprinklers shall be permitted as necessary to provide wetting of the entire structure.

- (4) The deflectors of sprinklers on lines under stringers shall be located not less than 100 mm (4 in.) nor more than 250 mm (10 in.) below the bottom plane of the stringer, and not more than 450 mm (18 in.) below the underside of the pier or wharf deck.

- (5)* The sprinkler system shall meet the following requirements:

- (a) Sprinkler system shall be hydraulically designed in accordance with the requirements of NFPA 13.
- (b) Sprinkler orifice shall be 12.7 mm (½ in.).
- (c) Sprinkler orifice shall discharge at a minimum pressure of 85 kPa (12.5 psi).

- (d) Design area shall be based upon the largest area between firestops plus an additional area embracing at least two branch lines on opposite sides of the firestop.

- (e) Minimum design area shall be not less than 465 m² (5000 ft²).

- (6) The temperature rating of the sprinkler shall not exceed 74°C (165°F).

- (7) The maximum area to be protected by any one system shall be limited to 2325 m² (25,000 ft²).

4.3.3.1.3.2 Combustible Substructures. Sprinklers designed and approved specifically for protection of combustible substructures shall be installed in conformity with their listing.

4.3.3.1.3.3 Pipe Hangers.

(A) The pipe hangers shall be placed in a location where they will be in the wetting pattern of the sprinkler to prevent the lag screws from burning or charring out, dropping sprinkler piping, and bleeding the system.

(B) The distance from the sprinkler to the hanger shall not exceed 460 mm (18 in.).

4.3.3.1.3.4 Bracing. Horizontal and vertical bracing shall be provided at not more than 6 m (20 ft) intervals on all sprinkler piping 76 mm (3 in.) or larger that is parallel to and within 15 m (50 ft) of the face of the pier or wharf and where bracing has the possibility of being subjected to heavy fireboat nozzle streams.

4.3.3.1.3.5 Underdeck Areas. Sprinkler systems, including hanger assemblies and bracing, in underdeck areas shall be protected against corrosion throughout the structure.

(A) Sprinklers shall be of corrosion-resistant type.

(B) Detector elements and wiring systems of smoke or heat detectors or other electrical equipment used for fire protection of substructures shall be moisture- and corrosion-proof to

protect against unfavorable atmospheric conditions that exist beneath these structures.

(C) Frequent inspection and testing of these systems shall be conducted in accordance with applicable NFPA standards.

4.3.3.1.3.6 Protection Against Physical Damage. Water supply systems, hydrants, fire hose valves, and sprinkler systems shall be installed with protection against freezing and physical damage.

4.3.3.2 Other Extinguishing Facilities.

4.3.3.2.1 Deck Openings. Deck openings to permit the use of revolving nozzles and other fire-fighting devices shall be provided for all combustible substructures in accordance with the specifications of 4.3.3.2.1.1 through 4.3.3.2.1.6.

4.3.3.2.1.1 Openings in the pier deck shall be provided at intervals not exceeding 7.5 m (25 ft) on center to enable the fire department to place in operation, with the least possible delay, devices for extinguishing underdeck fires.

4.3.3.2.1.2 Openings in the pier deck shall be over clear spaces to avoid interference by the substructure with effective operation of extinguishing devices.

4.3.3.2.1.3 The effective arrangement of openings in the pier deck shall not exceed 64,500 mm² (100 in.²) and shall be not less than 230 mm (9 in.) in the smallest dimension, so as to pass the appliances for which they are intended.

4.3.3.2.1.4 Openings in the pier deck shall be provided with covers that can be removed.

4.3.3.2.1.5 Covers for openings in the pier deck shall be constructed of, or be insulated with, material that resists the passage of heat and fire in a manner equivalent to that of the pier deck.

4.3.3.2.1.6 The location of openings in the pier deck shall be conspicuously indicated.

4.3.3.2.2 Deck. All parts of the deck, including aprons, where firefighters shall be expected to work, shall be solid and continuous, have no uncovered openings, and be smoketight.

4.3.3.2.3 Extinguishing Equipment.

4.3.3.2.3.1 A sufficient number of revolving nozzles, cellar pipes, and other devices of appropriate type shall be maintained on the pier or wharf, preferably at the land end, in readily accessible locations, with the necessary supply of hose to permit establishing two complete water curtains across the pier or wharf and at least two additional nozzles for extinguishing purposes.

4.3.3.2.3.2 In determining the number of devices that are required, consideration shall be given to the amount of such equipment carried on fire apparatus due to respond.

4.3.3.2.4 Water Supply. To supply water for the devices covered by 4.3.3.2.3, a water supply system with hydrants or hose connections shall be installed that meets the requirements of the authority having jurisdiction.

4.3.3.2.5* Existing Substructures.

4.3.3.2.5.1 In existing substructures where, in the opinion of the authority having jurisdiction, it is clearly impractical to install and maintain an automatic sprinkler system, deck open-

ings, and revolving nozzles, as specified in 4.3.3.2 in conjunction with the required structural barriers of 4.3.3.3 through 4.3.3.6, shall be permitted to be provided as alternate protection.

4.3.3.2.5.2 Partial automatic sprinkler equipment, manual sprinkler equipment, or any built-in extinguishing equipment that is practical to install and maintain shall be capable of preserving the integrity of the required structural barriers under fire conditions.

4.3.3.3 Subdivision of Combustible Substructures. All substructures of combustible construction shall have the under-deck area subdivided by transverse fire walls in accordance with 4.3.3.3.1, transverse firestops in accordance with 4.3.3.3.2, or other protection in accordance with 4.3.3.3.3.

4.3.3.3.1 Transverse Fire Walls. Transverse fire walls shall extend to low water and the full width of the pier, including aprons or platforms, at intervals not exceeding 137 m (450 ft).

4.3.3.3.1.1 A section of the entire pier deck over the fire wall, including any aprons or platforms, shall be of fire-resistive construction, as defined in 4.2.4, to preserve the effectiveness of the fire wall.

4.3.3.3.1.2 The fire-resistive section shall extend for a distance of at least 3 m (10 ft) on each side of the fire wall.

4.3.3.3.1.3 The 6 m (20 ft) fire-resistive cap that is 3 m (10 ft) on each side of the fire wall is not required when the fire walls constitute a continuation of the fire walls in a superstructure.

4.3.3.3.2 Transverse Firestops. Transverse firestops shall be located between fire walls.

4.3.3.3.2.1 Spacing between fire walls and firestops or between firestops shall not exceed 46 m (150 ft).

4.3.3.3.2.2 Firestops shall fit tightly against the pier deck and around any structural members or pipes that pass through the firestop so that an effective barrier to fire and draft is maintained.

4.3.3.3.2.3 Firestops shall extend to the low water line.

4.3.3.3.2.4 Where aprons or platforms are built along the sides of the pier, firestops shall extend to the outside edge of such platforms.

4.3.3.3.3 Other Protection. The requirements set forth in 4.3.3.3.1 and 4.3.3.3.2 shall be permitted to be modified where floods, tidal action, or wave action render such fire walls or firestops structurally impracticable, provided equivalent protection is obtained by other means.

4.3.3.4 Types of Fire Walls.

4.3.3.4.1 Substructure fire walls shall have a fire resistance rating of at least 4 hours and shall be constructed of reinforced concrete or of other materials that are equivalent in stability and fire resistance rating.

4.3.3.4.2 Walls shall be free of holes and shall extend to low water.

4.3.3.5* Types of Firestops. Firestops shall have a fire resistance rating of not less than 1 hour and shall be constructed of 150 mm (6 in.) of reinforced concrete or other materials that are equivalent in stability and resistance to physical damage.

4.3.3.6 Existing Substructures. For existing substructures where, in the opinion of the authority having jurisdiction, the standard fire walls required in 4.3.3.4 are impractical, approved firestops installed every 46 m (150 ft) and constructed as specified in 4.3.3.5, shall be permitted to be used as alternate protection.

4.4 Superstructure Construction.

4.4.1* Material Requirements. The type of material or combination of materials used in superstructure construction shall meet the general construction provisions of Section 4.1 and, when protected in accordance with this standard, shall be of any of the types of construction described in *NFPA 5000*.

4.4.2 Exterior Wall Requirements.

4.4.2.1 Exterior walls that are less than 9 m (30 ft) from other buildings or from property lines shall be constructed of not less than 4-hour fire-resistive construction, and openings in such walls shall be protected by labeled protective devices in accordance with NFPA 80.

4.4.2.2 Exterior walls shall be provided with access to the building interior at intervals not exceeding 60 m (200 ft) for the use of firefighters, guards, and workers.

4.5 Superstructure Protection.

4.5.1 Automatic Sprinklers. See also A.4.3.3.1.

4.5.1.1 All superstructures shall be provided with a complete system of automatic sprinklers installed in accordance with NFPA 13.

4.5.1.2 Automatic sprinklers shall not be required in small superstructures located over unsprinklered fire-resistive substructures if the following criteria are met:

- (1) Superstructures do not exceed 46.5 m² (500 ft²) in individual area.
- (2) Total area of all structures does not exceed 139.4 m² (1500 ft²).
- (3) Separation between any two structures is not less than 9 m (30 ft).

4.5.2* First Aid Fire Appliances. Portable fire appliances and 38 mm (1½ in.) standpipe connections shall be installed and distributed, and their locations marked in accordance with NFPA 10, NFPA 13, and NFPA 14.

Chapter 5 Terminal Buildings

5.1 General. This chapter shall apply to buildings and structures located on marine terminal premises other than the piers and wharves and their superstructures described in Chapter 4.

5.2 Construction Requirements. The construction or modification of marine terminal buildings shall conform to the requirements of *NFPA 5000*.

5.3* Additional Requirements.

5.3.1* All terminal buildings shall be separated from other buildings as necessary to minimize the effects of fire exposure, giving consideration to the construction, protection, and separation distances of the respective buildings.

5.3.2 Outside storage of cargo shall not be within 6 m (20 ft) of the exterior of the building unless the containers, railroad

cars, and vehicles are parked for the purpose of loading or unloading cargo.

5.3.3 Containers, railroad cars, and vehicles shall only remain parked within 6 m (20 ft) of a building as long as is necessary to meet cargo loading, unloading, and handling requirements.

5.3.4 Passenger Terminals. Passenger terminals located on piers or wharves shall be considered assembly occupancies and shall meet all applicable requirements of Chapter 16 of *NFPA 5000*.

5.4 Automatic Sprinklers. See also A.4.3.3.1.

5.4.1 General. Buildings used for the handling or storage of combustible **cardoor** passenger terminals located on piers or wharves shall be protected in accordance with the requirements of NFPA 13.

5.4.2 Design Criteria.

5.4.2.1* Unless the requirements of 5.4.2.2 apply, automatic sprinkler systems shall be designed based upon the design criteria for the protection of Group A plastics.

5.4.2.2 With the approval of the authority having jurisdiction, the requirements of 5.4.2.1 shall not apply to buildings used exclusively for the handling or storage of specific cargoes and commodities that are defined as commodity classes less than Group A plastics by NFPA 13.

5.4.2.3 Buildings consistent with 5.4.2.2 shall be protected in accordance with the design criteria for the applicable commodity as required by NFPA 13.

5.4.2.4 Buildings used for the storage of hazardous materials shall be protected in accordance with NFPA 13 and the applicable codes and standards for the type of hazardous material being stored.

5.4.3 Installation Requirements. Automatic sprinkler systems shall be installed so that all drains and alarms of control valves are accessible to terminal personnel for inspection, testing, maintenance, and operation.

5.5 Temporary Storage of Explosives. Buildings used for the temporary storage of explosives or fireworks shall conform to the appropriate provisions of NFPA 495, NFPA 498, and regulations of the U.S. Bureau of Alcohol, Tobacco, and Firearms.

5.6 Miscellaneous Service Operations. Where miscellaneous service operations such as office operations, maintenance and repair, and vehicle service are conducted in buildings used for receiving, delivering, and storage of cargo, the requirements of NFPA 101 shall apply when they are appropriate and are not covered by this standard. (See also Chapter 9 and Chapter 10.)

5.7 Manufacturing and Processing Operations. Manufacturing and processing operations conducted on the premises of marine terminals shall be confined to separate buildings that are designed, constructed, and protected for that purpose.

5.8 Structures Located Inside Terminal Buildings. Structures, permanent or temporary, placed inside larger terminal buildings, such as those used for offices and tool sheds, shall be sprinklered.