NFPA®

418

Standard for Heliports

2021

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NFPA® 418

Standard for

Heliports

2021 Edition

This edition of NFPA 418, *Standard for Heliports*, was prepared by the Technical Committee on Helicopter Facilities. It was issued by the Standards Council on October 5, 2020, with an effective date of October 25, 2020, and supersedes all previous editions.

This edition of NFPA 418 was approved as an American National Standard on October 25, 2020.

Origin and Development of NFPA 418

The development of NFPA 418 began in 1965 after the NFPA Sectional Committee on Aircraft Hangars and Airport Facilities was asked to provide guidance on the construction and protection of elevated heliports. Earlier work had been done by the NFPA Sectional Committee on Aircraft Rescue and Fire Fighting with regard to fire protection in the event of accidents during flight operations, and the NFPA Sectional Committee on Aircraft Fuel Servicing developed the safeguards needed for the prevention of fire accidents during fueling operations at such locations.

In 1967, a *Tentative Standard on Elevated Heliport Construction and Protection* was approved at the NFPA Annual Meeting. The 1968 edition was a revision of the tentative standard, including a change in title, and the 1973 edition was a complete revision of the 1968 edition. The 1979 edition contained further amendments. The 1990 edition added chapters for land-based facilities and offshore heliports, and the title was changed from *Standard on Rooftop Heliport Construction and Protection* to *Standard for Heliports*.

The standard was revised for the 1995 edition, and criteria for rooftop helicopter hangars were added for the 2001 edition. The 2006 edition was a partial revision.

The 2011 edition revised the requirements for means of egress, fuel equipment locations, and suppression system design and testing, and a requirement for emergency response planning was added. Those changes were intended to address problems that had contributed to recent helipad fires.

For the 2016 edition, the committee wanted to build on the improvements in the previous edition. A retroactivity clause was added to provide a means for ensuring the safety of existing heliports without requiring full compliance. New criteria for determining noncombustibility of helipad materials were incorporated. The authority having jurisdiction was required to approve the emergency response plan, to ensure that the plan is coordinated with first responders.

The committee also reorganized the section on fire protection for rooftop heliports for clarity while addressing the following technical issues:

(1) The foam discharge duration was increased from 5 minutes to 10 minutes to better align with other standards and to allow additional time for first responders to reach the rooftop heliport.
(2) Signs to identify the foam system activation stations were required to ensure that personnel are able to locate and identify the correct pull station in an emergency.
(3) The foam system shutoff controls were required to be located where they would be accessible during a fire on the helipad.

In addition, the committee assigned two task groups: the first to further study the implications of requiring compliance with the latest edition of FAA AC 150/5390, and the second to review the requirements for portable extinguishers. Following the task groups' reports, the committee reaffirmed the existing requirements.

For the 2021 edition, the technical committee made three significant revisions. First, several foam requirements were changed in Chapter 5, including the duration of foam discharge for hose line systems from 2 minutes to 10 minutes. In addition, a new requirement in Chapter 5 allows for manual firefighting equipment, as approved by the authority having jurisdiction. Finally, a new reserved Chapter 11, Vertiports and Vertistops, has been added. The technical committee will request public input and public comments during the next revision cycle to help create the specific requirements for electric/hybrid aircraft.

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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 on the fire protection criteria for the design and construction of elevated and ground level heliports, helistops, and helipads; fire protection requirements for heliports, helistops, and helipads; and requirements for rescue and firefighting operations at heliports, helistops, and helipads.

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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 D.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard specifies the minimum requirements for fire protection for heliports, vertiports, vertistops, and rooftop hangars.

1.1.2 This standard does not apply to ground-level helicopter hangars.

1.1.3 All hangars not covered by this standard are required to comply with NFPA 409.

1.1.4 Temporary landing sites and emergency evacuation facilities are outside the scope of this standard.

1.2 Purpose. The purpose of this standard is to establish minimum fire safety requirements for operation at heliports for the protection of persons, aircraft, and other property. *(See Annex B, Heliport Emergency Planning and Training for Safety Personnel.)*

1.3 New Technology.

1.3.1 Nothing in this standard shall be intended to restrict new technologies or alternative arrangements, provided the level of safety prescribed by this standard is not lowered.

1.3.2 Materials or devices not specifically designated by this standard shall be utilized in complete accord with all conditions, requirements, and limitations of their listings.

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

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.

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

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

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2021 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 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2020 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2021 edition.

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

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 99, *Health Care Facilities Code,* 2021 edition.

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

NFPA 220, *Standard on Types of Building Construction,* 2021 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing,* 2017 edition.

NFPA 409, *Standard on Aircraft Hangars,* 2021 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 2020 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 E108, *Standard Test Methods for Fire Tests of Roof Coverings*, 2020a.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2019a.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018.

2.3.2 FAA Publications. Federal Aviation Administration, US Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590.

FAA AC 150/5390-2C, *Heliport Design Advisory Circular*, April 24, 2012.

2.3.3 FM Approvals LLC. FM Approvals LLC, 1151 Boston-Providence Turnpike, P.O. Box 9102, Norwood, MA 02062.

FM 4470, *Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction*, 2016.

FM 5130, *Approval Standard for Foam Extinguishing Systems*, 2018.

Δ **2.3.4 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 162, *Foam Equipment and Liquid Concentrates*, 2018.

UL 790, *Test Methods for Fire Tests of Roof Covering*, 2004, revised 2018.

2.3.5 U.S. Government Publications. US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Military Specification, MIL-F-24385 (Navy), "Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, For Fresh and Sea Water," 21 November, 1969 (and all revisions and amendments thereto).

2.3.6 Other Publications.

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

Δ **2.4 References for Extracts in Mandatory Sections. (Reserved)**

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 Area.

3.3.1.1* *Critical Area.* The area calculated to be one-half the overall length of the helicopter multiplied by three times the width of the widest portion of the fuselage.

3.3.1.2 *Helicopter Storage and Servicing Area.* That part of a rooftop hangar normally used for the storage and servicing of one or more helicopters, not including any adjacent or contiguous areas or structures, such as shops, storage areas, and offices.

3.3.1.3* *Practical Critical Fire Area (PCA).* The area, for foam discharge purposes, calculated as one-half the fuselage length multiplied by three times the fuselage width.

3.3.2 Emergency Evacuation Facility. A designated and clear area at rooftop or ground level intended exclusively for emergency/rescue operations by helicopters.

3.3.3* Foam Fire-Extinguishing System. A low-expansion foam fire-extinguishing system.

3.3.4 Helipad Support Structure. A structure used for helipad and/or helicopter maintenance or storage that is not classified as a rooftop hangar.

3.3.5* Heliport. An identifiable area located on land, on water, or on a structure that also includes any existing buildings or facilities thereon, used or intended to be used for landing and takeoff of helicopters.

3.3.5.1 *Offshore Landing Heliport.* A heliport located on fixed or mobile structures and vessels in a marine environ-

ment that do not have means of entry and egress connected directly to shore.

3.3.6* Overall Length. The length of a helicopter from the main rotor fully extended to the tail rotor fully extended.

3.3.7 Rooftop Hangar. A structure on top of a building where helicopters are housed, stored, or maintained.

3.3.8 Rooftop Landing Pad. The entire load-bearing surface intended for the touchdown and liftoff (TLOF) of helicopters.

3.3.9 Temporary Landing Site. A site intended to be used for a period of less than 30 consecutive days, and for no more than 10 operations per day.

N **3.3.10 Vertiport.** A generic reference to the area of land, water, or structure used or intended to be used, for the landing and takeoff of vertical takeoff and landing (VTOL) aircraft, together with associated buildings and facilities.

N **3.3.10.1** ***Electric Takeoff and Landing (eVTOL). (Reserved)***

N **3.3.10.2** ***Vertical Takeoff and Landing (VTOL). (Reserved)***

N **3.3.11 Vertistop.** An area similar to vertiports, except that no fueling, defueling, maintenance, repairs, or storage of aircraft are permitted.

Chapter 4 General Requirements — Land-Based Facilities

4.1 General. The requirements in this chapter shall apply to all land-based facilities, except those exempted through the provisions in 1.4.1. *(See Chapter 8 for requirements applying to offshore heliports.)*

4.1.1* Listing. This chapter shall provide requirements for the correct use of heliport firefighting system components.

4.1.1.1 All components shall be listed for their intended use.

4.1.1.2 Where listings for components do not exist, components shall be approved.

4.2* Plans.

4.2.1 The design drawings for the construction and protection of the heliport shall be approved by the authority having jurisdiction.

4.2.2 The design of the heliport, including all the aeronautical components, shall be in accordance with FAA AC 150/5390-2C, *Heliport Design Advisory Circular.*

4.2.3 The final approach and takeoff (FATO) area, the approach/departure path, and the touchdown and liftoff (TLOF) area shall be designated on the design drawings.

4.3 Tank and Equipment Locations.

4.3.1 Storage, handling, and use of flammable and combustible liquids shall be in accordance with NFPA 30.

4.3.2 Oxygen and other medical gases shall be stored and used in accordance with NFPA 99.

4.3.3 Aboveground flammable liquid storage tanks, compressed gas storage tanks, fuel storage tanks, and liquefied gas storage tanks shall be laterally located at least 50 ft (15.2 m) from the edge of the FATO area as defined in FAA AC 150/5390-2C, *Heliport Design Advisory Circular.*

4.4 Firefighting Access.

4.4.1 The heliport shall have at least two access points for firefighting/rescue personnel. The access points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF).

4.4.2 Fences shall not prevent access by firefighting/rescue personnel.

4.5 Fuel Spill Control. The landing pad shall be designed so that fuel spills are directed away from access/egress points and passenger holding areas.

4.6 No Smoking.

4.6.1 No smoking shall be permitted within 50 ft (15.2 m) of the landing pad edge.

4.6.2 NO SMOKING signs shall be erected at access/egress points to the heliport.

4.7 Fueling System. Fueling systems shall be designed in accordance with NFPA 407.

4.7.1 Fueling equipment shall not hinder or obstruct access to exits or firefighting equipment.

4.7.2 Fueling equipment shall be located a minimum of 25 ft (7.6 m) from hangars and fixed fire protection equipment.

4.7.3 Fuel servicing equipment shall be designed to not penetrate the FATO and safety area obstruction clearance requirements in FAA AC 150/5390-2C, *Heliport Design Advisory Circular.*

4.8* Means of Egress. At least two means of egress that lead to a public way shall be provided from the landing pad.

4.8.1* The egress points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF).

4.8.2 The egress points shall be located remotely from each other, not less than 30 ft (9.1 m) apart.

4.8.3 No two egress points shall be located on the same side of the landing pad.

Chapter 5 Rooftop Landing Facilities

5.1 General. The requirements in Chapters 4 and 5 shall apply to all rooftop landing facilities, except those exempted through 1.4.1.

5.2* Structural Support. Main structural support members that could be exposed to a fuel spill shall be made fire resistant using listed materials and methods to provide a fire-resistance rating of not less than 2 hours.

5.3 Landing Pad Pitch. The rooftop landing pad shall be pitched to provide drainage at a slope of 0.5 percent to 2 percent.

5.3.1 The pitch of the pad shall be designed to protect, at a minimum, the primary egress path, passenger holding area, rooftop hangar, and fire protection activation systems.

5.3.2 Drainage flow shall not penetrate alternate egress points, stairways, ramps, hatches, and other openings not designed for drainage.

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5.4 Landing Pad Construction Materials.

5.4.1 The rooftop landing pad surface shall be constructed of approved noncombustible, nonporous materials.

Δ **5.4.1.1*** A material that complies with at least one of the following shall be considered a noncombustible material:

(1)* A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat

(2) A material that is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*

(3) A material that is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*

Δ **5.4.2** The contiguous building roof covering within 50 ft (15.2 m) of the landing pad edge shall have a Class A fire rating for exterior fire exposure, and shall be listed according to FM 4470, *Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction*; UL 790, *Test Methods for Fire Tests of Roof Covering*; or ASTM E108, *Standard Test Methods for Fire Tests of Roof Coverings*.

5.5* Means of Egress. Two means of egress from the rooftop landing pad to the building's egress system shall be provided.

5.5.1* The egress points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF).

5.5.2 The egress points shall be remotely located from each other, not less than 30 ft (9.1 m) apart.

5.5.3 No two egress points shall be located on the same side of the rooftop landing pad.

5.5.4* Means of egress from the landing pad shall not obstruct flight operations.

5.6 Firefighting Access. (Reserved)

5.7 Fire Protection.

5.7.1 General. A foam fire-extinguishing system with either a fixed discharge outlet(s) in accordance with 5.7.2 or a hose line(s) in accordance with 5.7.3 shall be designed and installed to protect the rooftop landing pad, unless otherwise permitted by the following:

(1) A foam fire-extinguishing system shall not be required for heliports located on open parking structures or buildings that are not normally occupied.

(2) For H-1 heliports, two portable foam extinguishers, each having a rating of 20-A:160-B, shall be permitted to be used to satisfy the requirement of 5.7.1.

5.7.1.1 Where trained personnel are not available, fixed fire protection outlet(s) shall be provided.

N **5.7.1.2** Where manual firefighting equipment is the primary means of fire suppression, the AHJ shall approve the installation of equipment and verify the availability of appropriately trained personnel.

5.7.1.3* The foam discharge rate for the fire-extinguishing system shall be 0.10 gpm/ft^2 (4.1 L/min·m^2) for aqueous film forming foam (AFFF).

5.7.1.4 Where freezing is possible, freeze protection shall be provided.

5.7.1.5 The foam components shall be installed in an area of the heliport and shall not penetrate, when not in use, the approach departure surface, transitional surfaces, TLOF, FATO, and safety areas as defined in FAA AC 150/5390-2C, *Heliport Design Advisory Circular*.

5.7.2 Fixed Foam Fire-Extinguishing Systems.

Δ **5.7.2.1** Fixed foam fire-extinguishing systems shall be designed and installed in accordance with NFPA 11 or an equivalent standard, as appropriate, except as modified by this chapter.

5.7.2.2* The design area of application of foam discharge for fixed discharge outlet systems shall be the entire rooftop landing pad.

5.7.2.3 The duration of foam discharge for the fixed discharge outlet system shall be 10 minutes.

5.7.2.4 A fixed nozzle discharge outlet system shall be one of the following: fixed stationary nozzles around the perimeter, two or more oscillating monitors/nozzles, or in-deck (deck-integrated firefighting system) nozzles within the perimeter of the deck.

5.7.2.5 Where fixed foam systems utilizing fixed deck nozzles or oscillating foam turrets, or both, are installed, system components shall be listed or approved.

5.7.2.6 Activation of Systems.

5.7.2.6.1* The fixed discharge outlet system shall be activated manually.

5.7.2.6.2* Manual actuation stations shall be located at each egress point from the rooftop landing pad and at an approved location inside the building from which the rooftop landing pad can be viewed.

5.7.2.6.3 Manual foam activation stations shall be clearly labeled or identified as to the purpose and hazard protected.

5.7.2.6.4 Where buildings are provided with a fire alarm system, the activation of the foam system shall be monitored by the building fire alarm system in accordance with *NFPA 72*.

5.7.2.6.5 An approved manual control for foam system shutdown shall be accessible at all times, including the time of fire and system operation.

5.7.3 Manual Firefighting Equipment.

5.7.3.1* The area of application of foam discharge for hose line systems shall be the practical critical fire area for the category of the helicopter landing facility in accordance with Table 5.7.3.1.

5.7.3.2 The duration of foam discharge for the hose line systems shall be 10 minutes.

5.7.4 Supplementary Protection. Standpipes and hose stations, if used, shall be installed in accordance with NFPA 14.

Δ Table 5.7.3.1 Practical Critical Fire Areas for Hose Line Systems Only

Heliport Category	Helicopter Overall Length*/D-Value	Practical Critical Fire Area	
		ft^2	m^2
H-1	Less than 50 ft (15.2 m)	375	34.8
H-2	50 ft (15.2 m) up to but not including 80 ft (24.4 m)	840	78.0
H-3	80 ft (24.4 m) up to but not including 120 ft (36.6 m)	1440	133.8

*Helicopter length, including the tail boom and the rotors.

5.7.5 Water Supply.

5.7.5.1 The water supply for the foam system shall be from a source approved by the AHJ.

Δ 5.7.5.2 Fire pumps, if used, shall be installed in accordance with NFPA 20.

5.7.6 Foam Concentrate Supply.

5.7.6.1 The supply of foam concentrate shall be sufficient to supply the largest system.

Δ 5.7.6.2 The foam concentrate for the fixed system or manual firefighting equipment shall be listed in accordance with UL 162, *Foam Equipment and Liquid Concentrates*, or FM 5130, *Approval Standard for Foam Extinguishing Systems*, and shall be on the qualified products list for MIL-F-24385, or equivalent.

5.7.7 Fire Alarm.

5.7.7.1 A means of communication shall be provided from the roof area to notify the fire department of emergencies.

5.7.7.2 Where buildings are provided with a fire alarm system, a manual pull station shall be provided for each designated means of egress from the roof. *(See 5.5.1.)*

5.7.8 Acceptance Testing.

Δ 5.7.8.1 Fixed Foam Fire-Extinguishing Systems. The fixed foam discharge outlet system shall be tested to determine coverage of the rooftop landing pad using water, foam, or an alternative test fluid acceptable to the AHJ.

5.7.8.1.1 The system shall cover 95 percent of the rooftop landing pad during the test.

5.7.8.1.2 The access points for firefighting and for egress located on the landing pad shall be covered.

5.7.8.2 Manual Firefighting Equipment. The hose hand-lines shall be flow tested to demonstrate that the design objectives are met.

5.7.9 Inspection, Testing, and Maintenance.

5.7.9.1 Fire protection systems installed in accordance with NFPA 11 or NFPA 14 shall be inspected, tested, and maintained in accordance with NFPA 25.

5.7.9.2 Foam systems installed in accordance with NFPA 11 shall be maintained in accordance with NFPA 11.

Chapter 6 Rooftop Hangars

6.1 Construction.

6.1.1 Building construction of the rooftop hangar shall be as a minimum Type II (111) construction in accordance with NFPA 220 except for the floor, which shall have a minimum 2-hour fire resistance rating.

6.1.2 Other helicopter support operations within the rooftop hangar, such as offices, medical supplies, gas storage, and fire protection equipment, shall meet the following criteria:

(1) They shall be separated by walls and ceilings having a minimum fire resistance rating of 1 hour.
(2) They shall have openings protected by listed fire doors or shutters having a minimum fire resistance rating of 45 minutes.

6.1.3 Partitions and ceilings separating rooftop hangars from other building occupancies shall have a minimum fire resistance rating of 2 hours, and doors shall have a minimum fire resistance rating of 1½ hours.

6.1.4 Means of egress shall be in accordance with NFPA *101*.

6.1.4.1 Egress doors that do not require the opening of doors accommodating aircraft shall be provided in each partitioned space.

6.1.4.2 Intervals between doors shall not exceed 150 ft (45 m) on all exterior walls or 100 ft (30 m) along interior walls.

6.1.4.3 Egress/access points to and from the roof shall be marked.

6.2 Rooftop Hangar Floor Drainage.

6.2.1 Floor drainage systems shall be provided to restrict the spread of fuel in order to reduce fire and explosion hazards from fuel spillage.

6.2.2 Drainage systems shall use metallic pipe drained to a safe location, meeting one of the following criteria:

(1) The system shall be designed with traps.
(2) The system shall be provided with ventilation to prevent vapor mixtures from forming within the underground drainage system.

6.2.3 Drainage systems in helicopter storage and servicing areas shall be designed and constructed so that they have capacity to prevent buildup of flammable liquids and water over the drain inlet when fire protection systems and hose streams are discharging at the design rate.

6.2.4 The pitch of the rooftop hangar floor shall be a minimum of ½ of 1 percent.

6.2.5 The floor pitch provided shall be calculated taking into consideration the towing requirements, helicopter weight, maintenance, and so forth.

6.2.6 Curbs, ramps, or drains shall be provided at all openings from helicopter storage and servicing areas, or the slope of the floor shall be such as to prevent the flow of liquids through the openings.

6.2.7 Pits for service facilities, such as for compressed air and electrical outlets, shall drain into the floor drainage system.

6.2.8 Grates and drain covers shall be of sufficient strength to support the point loading of the heaviest type of helicopter or equipment that the rooftop hangar serves.

6.2.9 Grates and covers shall be removable to facilitate cleaning and flushing.

6.3 Suspended or Elevated Heaters. In helicopter storage and servicing areas, listed electric, gas, or oil heaters shall be permitted and shall be installed at least 10 ft (3 m) away from the helicopter engines.

6.4 Lighting and Electrical Systems.

6.4.1 Artificial lighting shall be restricted to electrical lighting.

6.4.2 Installations of electrical equipment shall be in compliance with the provisions for aircraft hangars contained in Article 513 of *NFPA 70*.

6.5 Lightning Protection. Where provided, lightning protection shall be installed in accordance with NFPA 780.

6.6 Protection of Helicopter Rooftop Hangars.

6.6.1 Helicopter storage and servicing areas shall be protected in accordance with NFPA 409.

Δ **6.6.2** Foam concentrate shall be listed in accordance with UL 162, *Foam Equipment and Liquid Concentrates*, or FM 5130, *Approval Standard for Foam Extinguishing Systems*.

6.6.3 All other areas of the rooftop hangar shall be protected by water sprinkler systems designed, installed, and tested in accordance with NFPA 13.

6.7 Portable Fire Extinguishers for Rooftop Hangars.

6.7.1 Portable fire extinguishers for rooftop hangars shall be provided in accordance with NFPA 10.

6.7.2 In helicopter storage and service areas, the distribution of fire extinguishers shall be in accordance with the extra hazard classification of NFPA 10.

Chapter 7 Water Supply

7.1* Calculation of Water Supply for Foam Systems. Where foam systems are provided for the rooftop landing pad area and rooftop hangar, the water supply shall be calculated based on the demand for the largest system.

Chapter 8 Offshore Heliports

8.1* Plans. Plans for construction and protection of heliports located on fixed and mobile offshore installations shall be approved by the AHJ.

8.2 Firefighting Access.

8.2.1 The heliport shall have at least one access point for firefighting/rescue personnel.

8.2.2 Where practical, a second access point shall be available and shall be located remotely from the first.

8.3 Landing Pad Pitch. Heliports shall be designed to prevent the standing collection of liquids and to prevent liquids from spreading to or spilling onto accommodation spaces or working spaces.

Chapter 9 Portable Fire Extinguishers

9.1 General. The selection, installation, and maintenance of portable fire extinguishers shall comply with NFPA 10.

9.2 Minimum Requirement. At least one portable fire extinguisher as specified in Table 9.2 shall be provided for each takeoff and landing area, parking area, and fuel storage area.

Δ **Table 9.2 Minimum Ratings of Portable Fire Extinguishers for Heliport Categories**

Heliport Category	Helicopter Overall Length/D-value*	Minimum Rating (UL)
H-1	Less than 50 ft (15.2 m)	4-A:80-B
H-2	50 ft (15.2 m) up to but not including 80 ft (24.4 m)	10-A:120-B
H-3	80 ft (24.4 m) up to but not including 120 ft (36.6 m)	30-A:240-B

*Helicopter length, including the tail boom and the rotors.

9.3 Extinguishers Subject to Damage, Theft, or Tampering. Where the portable extinguisher cannot be maintained and safeguarded against damage, theft, or tampering, the portable fire extinguisher shall be omitted with the approval of the AHJ.

Chapter 10 Emergency Operations

10.1 Emergency Response Plan. An approved emergency response plan shall be developed for each heliport.

10.2 Training. Annual training for the emergency response plan shall be conducted for facility personnel involved with heliport emergency operations. *(See Annex B for guidance on training of facility personnel.)*

N **Chapter 11 Vertiports and Vertistops (Reserved)**

N **11.1* General. (Reserved)**

N **11.2 Electric Storage Systems. (Reserved)**

N **11.3 Charging Stations. (Reserved)**

N **11.4 Emergency Electrical Shutoff System. (Reserved)**

N **11.5 Electrical Testing. (Reserved)**

N **11.6 Aircraft Batteries. (Reserved)**

N **11.7 Battery Storage Facilities. (Reserved)**

N **11.8 Electrical Safety. (Reserved)**

N **11.9 Battery Fire Containment. (Reserved)**

N **11.10 Hybrid/Electric Aircraft. (Reserved)**

N **11.11 Hydrogen Fuel Cells. (Reserved)**

N **11.12 Hydrogen Fueling. (Reserved)**

N 11.13 Fire Protection. (Reserved)

N 11.14 Firefighting Equipment. (Reserved)

N 11.15 Portable Fire Extinguishers. (Reserved)

N 11.16 Mixed Case Power/Fuel. (Reserved)

N 11.17 Other Considerations. (Reserved)

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.3.2.1 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.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, 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.3.2.3 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.3.3.1.1 Critical Area. See Annex C for additional information.

A.3.3.1.3 Practical Critical Fire Area (PCA). See also Annex C.

A.3.3.3 Foam Fire-Extinguishing System. A foam fire-extinguishing system can be a fixed discharge outlet system utilizing fixed storage and piping connected to fixed outlets or monitor nozzles and manually activated by pushing a button on a console or a pull station. It also can be a hose line system connected to fixed storage.

A.3.3.5 Heliport. The term *heliport* applies to all sites used or intended to be used for the landing and takeoff of helicopters.

N A.3.3.6 Overall Length. The overall length of a helicopter is also referred to by some authorities as D or the D-value.

A.4.1.1 A foam system consists of a water supply, a foam concentrate supply, proportioning equipment, a piping system, foam makers, and discharge devices designed to distribute foam effectively over the hazard. Some systems include detection devices.

A.4.2 FAA AC 150/5390-2C, *Heliport Design Advisory Circular*, contains design and construction information on heliports. This advisory circular provides for adequate clearance between operating aircraft and buildings or structures located at the heliport. The FAA advisory circular should be consulted to ensure that adequate safe practice and facilities are maintained.

A.4.8 The two means of egress can also be used for access to the landing pad for firefighting and/or rescue operations. Where doors accessing the interior of the building are locked, an approved means should be provided for entry of emergency responders.

Δ A.4.8.1 Figures A.4.8.1(a) and A.4.8.1(b) are examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.4.8.1(b) is such that it has no sides and does not comply with 4.8.3; however, it does comply with the 90-degree rule in 4.8.1. Figure A.4.8.1(c) is an example of an unacceptable configuration, due to both egress points being on the same side of the landing pad.

A.5.2 Where the landing pad is nonporous, fuel-tight, and provided with a proper drainage system, and where fuel cannot flow to support members, the main structural support members would not need to be fire rated.

Δ A.5.4.1.1 The provisions of 5.4.1.1 do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials.

A.5.4.1.1(1) Examples of such materials include steel, concrete, masonry, glass, and some aluminum alloys.

A.5.5 Design of the means of egress from a rooftop landing pad might involve a compromise among several different code requirements. Rooftop landing pads bring with them an inherent risk. The means of egress must be provided for safety to human life. Strict compliance with a code's requirement for rated stairways off the landing pad is not the intent of this standard. The intent of this standard is to provide a minimum safeguard to provide a reasonable degree of safety to all persons on the roof. The building's egress system is dictated by the adopted building code. Once those persons enter the building's egress system, they are away from the FATO area.

A.5.5.1 See Figure A.4.8.1(a) through Figure A.4.8.1(c) for examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.4.8.1(b) is such that it has no sides and cannot comply with 5.5.3; however, it does comply with the 90-degree rule in 5.5.1. Figure A.4.8.1(c) is not an acceptable configuration due to both egress points being on the same side of the landing pad.

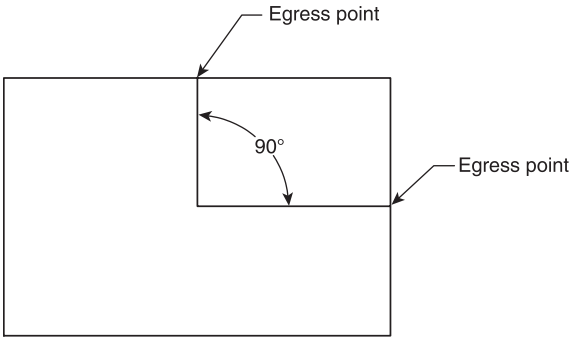

FIGURE A.4.8.1(a) Example of an Acceptable Configuration of Egress Points on a Landing Pad.

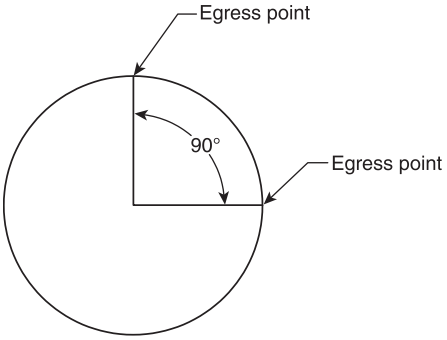

FIGURE A.4.8.1(b) Example of an Acceptable Configuration of Egress Points on a Landing Pad with No Sides.

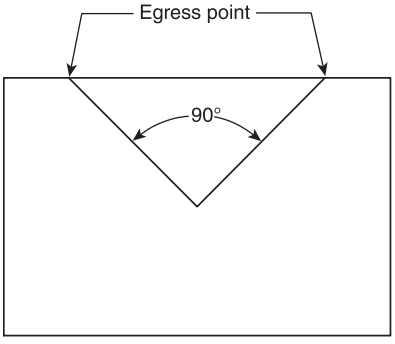

FIGURE A.4.8.1(c) Example of an Unacceptable Configuration of Egress Points on a Landing Pad.

A.5.5.4 When considering the means of egress from the landing pad and for the rooftop, obstructions to the FATO need to be avoided since they can create unsafe flight conditions that have been shown to cause aircraft accidents. Exterior, open stairways leading to the building's egress system should not encroach into the FATO.

A.5.7.1.3 The design density is for synthetic foam concentrates, not fluoroprotein or protein foam products.

A.5.7.2.2 Consideration should be given to the environmental conditions of the rooftop landing pad in the design of the system, including wind, exhaust fans, and other factors that affect the distribution of the foam on the rooftop landing pad.

A.5.7.2.6.1 Training on the operation of the fire protection system should be in accordance with Annex B.

A.5.7.2.6.2 It is acceptable for the rooftop landing pad to be viewed using video or other acceptable means.

A.5.7.3.1 The area of application and the duration where using a hose line system is reduced because foam is applied efficiently and directly on the fire by trained personnel.

A.7.1 The water supply is not intended to be based on simultaneous operation of both systems.

A.8.1 The design of heliports located on fixed or mobile offshore installations generally is based on landing sites of aluminum or steel construction. However, in no way should this be construed as a recommendation of aluminum or steel over other suitable building materials.

N **A.11.1** This new chapter is reserved for vertiport and vertistop requirements that will provide electric and hybrid electric vertical takeoff and landing (VTOL) aircraft fire safety criteria and standards. *(See 3.3.10 and 3.3.11 for definitions of these terms.)* The technical committee encourages public input and public comment during the next revision cycle of this standard to assist in the development of the specific requirements.

Annex B Heliport Emergency Planning and Training for Safety Personnel

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General. If safety personnel are provided at a heliport, the heliport operator should provide initial and recurrent training aimed at providing the safety personnel with the knowledge and skills necessary to deal effectively with an emergency at the heliport.

B.1.1 The training should address, at least, the following subjects:

(1) Operation of the heliport
(2) Safety procedures around helicopters during ground operations
(3) Communication systems at the heliport
(4) Heliport emergency plan
(5) Operation of the fire protection system

B.1.2 Heliport emergency planning is the process of preparing a heliport to cope with an emergency that takes place at the heliport or in its vicinity. The following are examples of heliport emergencies:

(1) Aircraft emergencies, such as crashes on or off the heliport
(2) Medical emergencies
(3) Dangerous goods occurrences
(4) Fires
(5) Natural disasters

B.1.3 The purpose of heliport emergency planning is to minimize the impact of an emergency by saving lives and maintaining aircraft operations.

B.1.4 The heliport emergency plan sets out the procedures for coordinating the response of heliport agencies or services (e.g., air traffic services unit, firefighting services, heliport administration, medical and ambulance services, aircraft operators, security services, and police) and the response of agencies in the surrounding community (fire departments, police, medical and ambulance services, hospitals, military, and harbor patrol or Coast Guard) that could be of assistance in responding to the emergency.

B.1.4.1 A heliport emergency response plan should be established at a heliport.

B.1.4.2 The plan should identify agencies that, in the opinion of the heliport operator, could be of assistance in responding to an emergency at the heliport or in its vicinity.

B.1.4.3 The plan should specify the procedures for at least the following emergencies:

(1) Aircraft crash or other accident within the heliport perimeter
(2) Aircraft crash outside the heliport perimeter
(3) Trauma injury to personnel
(4) Medical emergencies
(5) Fire in the heliport, including firefighting access points and system
(6) Evacuation of the heliport, including the heliport egress system

B.1.4.4 Where an approach/departure path at a heliport is located over water, the plan should identify which agency is responsible for coordinating rescue in the event of an aircraft ditching and indicate how to contact that agency.

B.1.4.5 The plan should include, at a minimum, the following information:

(1) Types of emergencies planned for
(2) How to initiate the plan for each emergency specified
(3) Names of agencies on and off the heliport to contact for each type of emergency, with telephone numbers or other contact information
(4) Role of each agency responding to each type of emergency
(5) List of pertinent and available on-heliport services with telephone numbers or other contact information
(6) Copies of any agreements with other agencies for mutual aid and the provision of emergency services
(7) Grid map of the heliport and its immediate vicinity
(8) Use of any of the following equipment, if that equipment is provided at the heliport:
    (a) Portable extinguishers
    (b) Fire hoses, nozzles, and other similar appliances
    (c) Extinguishing agents

B.1.4.6 A heliport operator should consult all agencies identified in the plan about their role in the plan.

B.1.4.7 The plan should be reviewed and the information in it updated yearly by the heliport operator.

B.1.4.8 A test of the emergency response plan should be carried out at least once every 3 years at a heliport that provides a scheduled service for the transport of passengers.

B.1.4.9 At a rooftop heliport, at least one person who has received the training described in this annex should be available during aircraft operations.

Annex C Establishing Extinguishing Agent Quantities and Discharge Rates

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Introduction. The calculations used to develop the minimum extinguishing agent quantities and discharge rates presented in Table C.1(a) and Table C.1(b) for rooftop heliports include the factors specified in C.1.1 through C.1.4.

C.1.1 Aircraft Size. This factor reflects the potential level of risk (e.g., passenger load), the potential fire load (e.g., fuel capacity), and the dimensions (i.e., fuselage length and width) that allow the identification of a meaningful operational objective [i.e., the area to be rendered fire-free (controlled or extinguished)].

C.1.2 Relative Effectiveness of Agent Selected. This factor is represented by the specific application rate identified for each of the common generic foam concentrate types.

C.1.3 Time Required to Achieve Control. Large-scale fire tests, empirical data, and field experience indicate that 1 minute is both a reasonable and a necessary operational objective.

C.1.4 Time Required to Maintain Controlled Area Fire-Free. This factor is an operational objective that provides a safety factor for the initial fire attack while waiting for the arrival of backup support.

Table C.1(a) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System

Heliport Category	(ft)		(ft)	½ O.L. of Largest Helicopter (ft)		Fuselage Width Tripled (ft)		Practical Critical Fire Area (ft)		Application Rate (gpm/ft²)		Q_1 (gal)		Q_2		Q (gal)
H-1	0	<	50	25	×	15	=	375	×	0.10	=	37.5	+	100%	=	75
H-2	50	<	80	40	×	21	=	840	×	0.10	=	84	+	100%	=	168
H-3	80	<	120	60	×	24	=	1440	×	0.10	=	144	+	100%	=	288

O.L.: Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended. Fuselage width: Actual fuselage width (does not include landing gear) measured from outside of cabin. Q_1: Water to control within 1 minute. Q_2: Reserve to extinguish. Q: Total water to extinguish.

Table C.1(b) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System (SI units)

Heliport Category (m)				½ O.L. of Largest Helicopter (m)		Fuselage Width Tripled (m)		Practical Critical Fire Area (m^2)		Application Rate (mm/min)		Q_1 (L)		Q_2		Q (L)
H-1	0	<	15.2	7.6	×	4.6	=	35.0	×	4.1	=	143.5	+	100%	=	287.0
H-2	15.2	<	24.4	12.2	×	6.4	=	78.0	×	4.1	=	319.8	+	100%	=	639.6
H-3	24.4	<	36.6	18.3	×	7.3	=	133.6	×	4.1	=	547.8	+	100%	=	1095.6

O.L.: Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended. Fuselage width: Actual fuselage width (does not include landing gear) measured from outside of cabin. Q_1: Water to control within 1 minute. Q_2: Reserve to extinguish. Q: Total water to extinguish.

C.2 Calculation Method History.

C.2.1 The calculation method is supported by research and experimental work done mainly at the United States Federal Aviation Administration (FAA) Technical Center. It was developed by the Rescue and Firefighting Panel II (RFFP II), a group of international experts in the field, convened by the International Civil Aviation Organization, in Montreal, Canada, in 1972.

C.2.2 The RFFP II initially focused on the concept of the theoretical critical fire area (TCA), which was identified in the FAA's large-scale fire tests as ". . . the area adjacent to the fuselage extending outward in all directions to a limit beyond which a large fuel fire would not melt an aluminum fuselage, regardless of the fire exposure time." For this concept to be useful, specific information about the size of the area was needed. Again, using the FAA Technical Center's work as a basis, the RFFP II defined the TCA as "the area adjacent to an aircraft in which fire must be controlled."

C.3 Formulas. The definition of TCA implies control of the fire within a specific area. In order to achieve this, dimensions need to be determined. The formulas that follow were developed from that earlier FAA Technical Center work. Using these formulas, the size of the area of interest can be calculated. For example,

If L is less than 65 ft (20 m),

[C.3a]

$$TCA = L \times (40\ \text{ft} + W)$$

or

$$TCA = L \times (12\ \text{m} + W)$$

If L is greater than 65 ft (20 m),

[C.3b]

$$TCA = L \times (100\ \text{ft} + W)$$

or

$$TCA = L \times (30\ \text{m} + W)$$

where:
TCA = theoretical critical fire area
L = average aircraft length
W = average width of aircraft served at the airport of interest

C.3.1 Conceptually, the TCA serves as a means for assessing the magnitude of the potential fire hazard of the aircraft accident environment. It *does not represent* the average, maximum, or minimum spill fire size associated with a particular aircraft. However, it does represent a starting point for determining realistic fire-extinguishing agent requirements. The formulas allow for the calculation of the TCA for different sizes of aircraft. The formulas are widely accepted throughout the aircraft fire service community and are applied as described in C.3.2 through C.3.12.

C.3.2 A 1970 study concluded that in survivable aircraft crashes a practical fire area should be considered that was smaller than the theoretical area. Detailed criteria for the practical fire area and the related quantities of extinguishing agents were formulated during the second meeting of the RFFP II. In developing its material, the panel included a study of the quantities of agents used on actual fires. In 99 out of 106 such fires, the quantities of agents used were less than those recommended by the TCA calculations.

C.3.3 As a result of the study, the RFFP II developed material recommending that the practical area be approximately two-thirds the theoretical area *(see Figure C.3.3)*. This principle has been adopted by the International Civil Aviation Organization (ICAO), NFPA, and the U.S. FAA in the development of tables that show extinguishing agent volumes for their respective standards and recommended practices. The practical critical fire area (PCA) for fixed-wing aircraft is commonly expressed as follows:

[C.3.3]

$$PCA = (0.67)(TCA)$$

where:
PCA = practical critical fire area
TCA = theoretical critical fire area

C.3.4 In adapting the fixed-wing fire protection methodology to helicopters (rotary-wing aircraft), the committee considered the additional factors described in C.3.4.1 through C.3.4.4 that make the fire protection problem of helicopters unique.

C.3.4.1 Occupied Space. Relative to its fixed-wing counterpart, a smaller portion of the overall aircraft length is occupied.

C.3.4.2 Fuel Quantities and Location. Fuel tanks are not located in the "wings" or rotor blades, and relatively small quantities of fuel are involved.

C.3.4.3 Impact Energy. Relative to the fixed-wing counterpart, a helicopter accident generally occurs at slow ground speeds.

C.3.4.4 Expected Aircraft Size. In general, heliports are designed for the largest helicopter expected to utilize the facility, not the median size for the category. *(See Table 5.7.3.1.)*

C.3.5 After considering the factors involved in the fixed-wing methodology and those factors that are unique to helicopters, the committee arrived at a theoretical critical area for helicopters that includes a longitudinal dimension of one-half the overall length of the helicopter and a width equal to three times the fuselage width. In addition, in the absence of any data that suggested a more appropriate alternative, the practical critical fire area has been determined to be 100 percent of the theoretical critical area. *(See Figure C.3.5.)*

C.3.6 Another established principle is the distinction between control and extinguishment of a fire. Test data and a wide range of field experience indicate that the quantities of foam agent needed to control and extinguish an aircraft fire should be determined separately. This principle is expressed in the following calculation method, which provides the minimum agent volume for effective fire service operations:

[C.3.6]

$$Q = Q_1 + Q_2$$

where:
Q = minimum agent volume for effective fire service operations
Q_1 = volume of agent needed for 1-minute control of PCA
Q_2 = volume of agent needed for continued control or complete extinguishment of fire related to PCA, or both

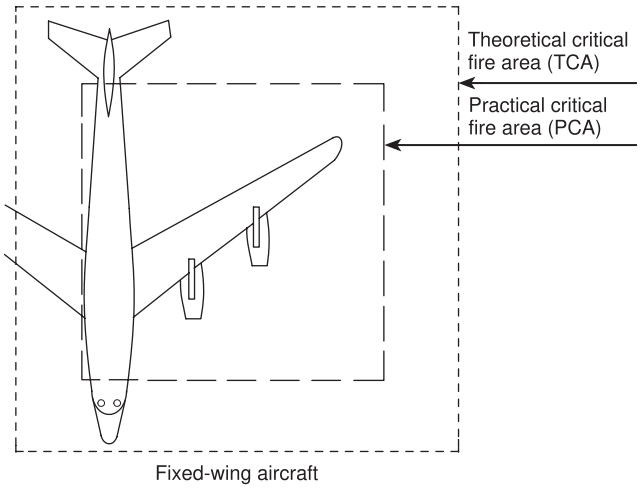

FIGURE C.3.3 Practical Critical Fire Area Relative to Theoretical Critical Fire Area.

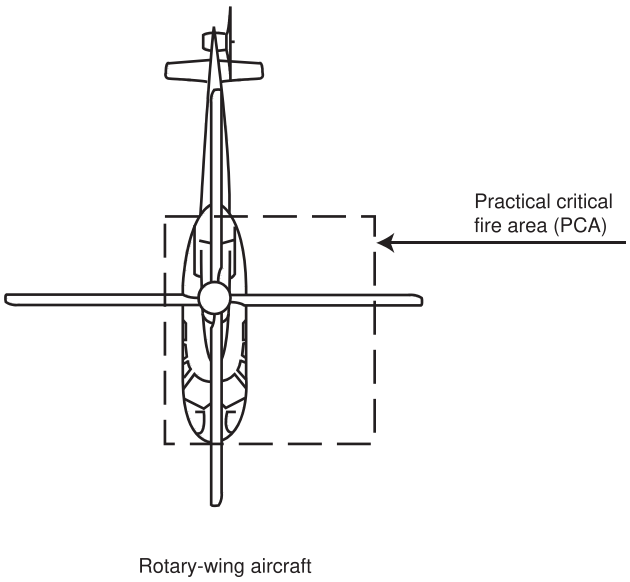

FIGURE C.3.5 Practical Critical Fire Area for Helicopters.

C.3.7 The relationship between Q_1 and Q_2 as they were developed by the committee that studied the fixed-wing fire protection problem is as follows:

[C.3.7]

$$Q_1 = (AR)(PCA)$$

where:
AR = application rate
PCA = practical critical area

C.3.8 Where the application rate (AR) is the unit volume of agent applied to a unit area of fire in a unit time (the exact units such as gpm/ft^2 or mm/min depend on the units convention being used), the volume of agent needed for continued control or complete extinguishment of fire is as follows:

[C.3.8a]

$$Q_2 = f(Q_1)$$

And, it has been determined that, for all categories of heliports, $f = 1$.

Therefore:

[C.3.8b]

$$Q = 2\left[(AR)(PCA)\right]$$

C.3.9 A sample calculation of the total water quantity, Q, needed where aqueous film-forming foam concentrate is to be used at each of the three categories of heliport is provided in Table C.1(a) and Table C.1(b). A similar set of water quantities can be calculated for any other foam concentrate for which an accepted application rate is known. The value for the AFFF application rate in column 5 of Table C.1(a) and Table C.1(b) is substituted, and the indicated calculations are performed to

obtain the value of Q for the specific foam concentrate to be used.

C.3.10 To fully appreciate the significance and simplicity of this methodology as a means of determining levels of fire protection, it should be clearly understood that Q_1 is only that minimum quantity of firefighting agent required for 1-minute fire control (90 percent extinguishment) of the anticipated practical critical fire area. Therefore, any fire and rescue service cannot be expected to perform an effective rescue effort where equipped with less than the quantity of primary extinguishing agent specified by the volume of Q_1 for the specific airport/heliport category. Furthermore, a fire suppression/rescue mission that is initiated using the required minimum application rate and is continued at that rate, while effectively extinguishing fire or securing unburned fuel within the practical area, ceases operations at the end of 1 minute. In other words, the agent specified by the volume Q_1 is depleted. There is no agent available for mop-up activities, foam blanket repair, or standby protection for continued rescue or salvage activities. Therefore, while the control volume Q_1 provides an operational significance that is critical to the rescue operation, it is, at the same time, limited.

C.3.11 It should be clear, therefore, that an additional volume of foam agent, Q_2, needs to be available to extend an effective fire suppression and rescue operation beyond the initial 1-minute fire control period. This volume of agent is used to repair foam blanket damage that might be caused by evacuees and rescue workers walking through the foamed areas or by hot surfaces created by the initial fire. Furthermore, Q_2 is needed to extinguish all fire in the practical critical fire area and those fires outside the practical critical area that initially are determined to pose no threat to life.

C.3.12 Agent quantity in accordance with Q_2 also provides standby protection before total extinguishment during interior aircraft search operations and for the removal of immobile survivors after fire control. It also is used for securing the fire area during initial aircraft salvage operations immediately after total fire extinguishment. Therefore, an aircraft fire service equipped with only the 1-minute fire control volume represented by Q_1 is expected to assume a significant level of risk. That risk cannot be considered a "calculated risk" unless the manager selecting the reduced agent volume knows the nature of the fire area and the potential hazard involved.

Annex D Informational References

D.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

D.1.1 NFPA Publications. (Reserved)

D.1.2 Other Publications.

D.1.2.1 FAA Publications. Federal Aviation Administration, US Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590.

FAA AC 150/5390-2C, *Heliport Design Advisory Circular*, April 24, 2012.

D.1.2.2 ICAO Publications. International Civil Aviation Organization, 999 Robert-Bourassa Boulevard, Montréal, Québec H3C 5H7 Canada.

"Rescue and Firefighting Panel, Report of the Second Meeting," Document 9036 RFFP II, Montreal, June 5–16, 1972.

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D.2 Informational References. (Reserved)

Δ **D.3 References for Extracts in Informational Sections. (Reserved)**

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