NFPA® 418

Standard for Heliports and Vertiports

2024 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA® 418

Standard for

Heliports and Vertiports

2024 Edition

This edition of NFPA 418, *Standard for Heliports and Vertiports*, was prepared by the Technical Committee on Helicopter Facilities. It was issued by the Standards Council on December 1, 2023, with an effective date of December 21, 2023, and supersedes all previous editions.

This edition of NFPA 418 was approved as an American National Standard on December 21, 2023.

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 allowed for manual firefighting equipment, as approved by the authority having jurisdiction. Finally, a new reserved Chapter 11, "Vertiports and Vertistops," was added. The technical committee requested public input and public comments to help create the specific requirements for electric/hybrid aircraft.

The 2024 edition has been revised to include both new provisions and updates to existing requirements.

In Chapter 1, new application and equivalency sections have been added for further clarification.

In Chapter 3, several definitions have been either added or updated, including *critical fire area*, which has been updated to simplify its use across the document.

A new Chapter 4, “Fire Protection Approaches,” has been introduced to allow for an evaluation of the fire risks and hazards as found on a specific site. Complementing Chapter 4 is a new Chapter 5, “Performance-Based Design Approach.” This chapter permits the use of a performance-based design for heliports, helistops, vertiports, and vertistops, based on specified criteria and final approval by the authority having jurisdiction.

For Chapter 6, the committee has provided references to recently updated documents from the Federal Aviation Administration (FAA) and updates to fueling and charging systems to address new technologies, such as electric and hydrogen vehicles.

In Chapter 7, the requirements for fire protection have been updated. A new requirement to permit the use of the new Chapter 4 for alternative arrangements has been added.

Chapter 11 fire extinguisher requirements have been updated to reflect changes made in NFPA 10.

A new Annex D, “Electric Aircraft Safety Precautions for Heliports and Vertiports,” and Annex E, “Hydrogen Aircraft Safety Precautions for Heliports and Vertiports,” have been added.

Finally, changes to other existing requirements, as well as updates pertaining to general organization and reference publications, have been provided.

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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, vertiports and vertistops; fire protection requirements for heliports, helistops, vertiports and vertistops; and requirements for rescue and firefighting operations at heliports, helistops, vertiports and vertistops.

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Standard for

Heliports and Vertiports

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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.

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

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

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

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

Δ **1.2* Purpose.** The purpose of this standard shall be to establish minimum fire safety requirements for operations at heliports, helistops, vertiports, and vertistops for the protection of persons, aircraft, and other property.

N **1.3 Application.**

N **1.3.1** The application of this standard shall be permitted to be based on the risk considerations outlined in Chapter 4.

N **1.3.2** A documented risk assessment shall be permitted to be the basis for implementation of this standard.

1.4 New Technology.

Δ **1.4.1** 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.

Δ **1.4.2** Materials or devices not specifically designated by this standard shall be utilized in complete accord with all conditions, requirements, and limitations of their listings.

1.5 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.

Δ **1.5.1** 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.

Δ **1.5.2** 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.

Δ **1.5.3** 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.

N **1.6 Equivalency.** Nothing in this standard shall be intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

N **1.6.1** Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

N **1.6.2** The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

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 2, *Hydrogen Technologies Code,* 2023 edition.

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

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2021 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2023 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2023 edition.

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

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

NFPA 72®, National Fire Alarm and Signaling Code®, 2022 edition.

NFPA 99, *Health Care Facilities Code,* 2024 edition.

NFPA *101®, Life Safety Code®,* 2024 edition.

NFPA 220, *Standard on Types of Building Construction,* 2024 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing,* 2022 edition.

NFPA 409, *Standard on Aircraft Hangars,* 2022 edition.

NFPA 410, *Standard on Aircraft Maintenance,* 2020 edition.

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

NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems,* 2023 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*, 2022.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2022.

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

FAA AC 150/5390-2D, *Heliport Design Advisory Circular*, January 5, 2023.

FAA Engineering Brief No. 105 for Vertiports, September 21, 2022.

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

FM 4470, *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*, April 2022.

FM 5130, *Foam Extinguishing Systems*, May 2021.

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

UL 162, *Foam Equipment and Liquid Concentrates*, 2018, revised 2022.

UL 790, *Standard Test Methods for Fire Tests of Roof Coverings*, 2022.

2.3.5 US 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, 2020.

Δ **2.4 References for Extracts in Mandatory Sections.**

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

NFPA *101®, Life Safety Code®,* 2024 edition.

NFPA 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders,* 2022 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2023 edition.

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments,* 2020 edition.

NFPA 5000®, Building Construction and Safety Code®, 2024 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 phrases "standards development process" or "standards development activities," the term "standards" includes all NFPA standards, including codes, standards, recommended practices, and guides.

3.3 General Definitions.

3.3.1 Area.

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

3.3.1.2* ***Critical Fire Area.*** The area of application of the fire protection system.

N **3.3.2 Controlling Dimension.** The greatest distance between two outermost points on an aircraft that are opposite one another, with any adjustable or articulated components at their maximum outboard deflection.

N **3.3.3* Deck Integrated Firefighting System (DIFFS).** A system consisting of a series of flush-mounted nozzles positioned to protect the landing pad.

3.3.4 Electric Vertical Takeoff and Landing (eVTOL) Aircraft. (Reserved)

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

N **3.3.6 Extinguishment.** To cause to cease burning. [**470,** 2022]

N **3.3.7 Final Approach and Takeoff Area (FATO).** A defined area over which the aircraft completes the final phase of the approach to a hover or a landing and from which the aircraft initiates takeoff.

N **3.3.8 Fire Protection.** Methods of providing fire detection, control, and extinguishment. [**1710,** 2020]

N **3.3.9 Fire Suppression.** The sharp reduction of the rate of heat release of a fire and the prevention of regrowth. [**750,** 2023]

3.3.10* Foam Fire Protection System. A low-expansion foam fire protection system.

3.3.11* 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.

3.3.11.1 ***Offshore Landing Heliport.*** A heliport located on fixed or mobile structures and vessels in a marine environment that do not have means of entry and egress connected directly to shore.

N **3.3.12 Heliport or Vertiport Category.** A category based on the controlling dimension of the largest designed aircraft intended to use the facility and designated as A-1, A-2, or A-3 *(see Annex C).*

N **3.3.12.1** ***A-1.*** A classification where the aircraft's controlling dimension is less than 50 ft (15.2 m).

N **3.3.12.2** ***A-2.*** A classification where the aircraft's controlling dimension is between 50 ft (15.2 m), and up to, but not including, 80 ft (24.4 m).

N **3.3.12.3** ***A-3.*** A classification where the aircraft's controlling dimension is between 80 ft (24.4 m), and up to, but not including, 120 ft (36.6 m).

N **3.3.13* Helistop.** A heliport where no refueling, maintenance, repair, or storage of helicopters is permitted, except for unscheduled maintenance.

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

N **3.3.15 Professional Engineer.** A person registered or licensed to practice engineering in a jurisdiction, subject to all laws and limitations imposed by the jurisdiction. (SAF-FUN) [***101,*** 2024]

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

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

N **3.3.18 Safety Area.** A defined area surrounding the FATO intended to reduce the risk of damage to aircraft accidentally diverging from the FATO.

3.3.19 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 **3.3.20 Touchdown and Liftoff Area (TLOF).** A dynamic load-bearing area, normally centered in the FATO, on which the aircraft lands or takes off.

N **3.3.21 Travel Distance.** The actual walking distance from a point to the nearest fire extinguisher fulfilling hazard requirements. [**10,** 2022]

3.3.22 Vertical Takeoff and Landing (VTOL) Aircraft. (Reserved)

3.3.23 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.

3.3.24 Vertistop. A vertiport, where no refueling, recharging, maintenance, repairs, or storage of aircraft is permitted, except for unscheduled maintenance.

N Chapter 4 Fire Protection Approaches

N 4.1 Fire Protection Approach. The fire protection approach for heliports, helistops, vertiports, and vertistops shall be permitted to be determined based on an evaluation of fire risks and hazards associated with the site and services provided and the business continuity planning and disaster restoration capabilities of the heliport, helistop, vertiport, or vertistop specific to the site.

N 4.1.1 The fire protection approach shall be established with consideration given to the following factors:

(1) The exposure threat to facility occupants, the public, emergency responders, and exposed property from a fire occurring at the heliport, helistop, vertiport, or vertistop.
(2) The importance of the continuity of the operations performed at the heliport, helistop, vertiport, or vertistop; the value of the facility where the heliport, helistop, vertiport, or vertistop is located and its contents; and the potential for environmental impact.
(3) Methods and equipment employed as part of a risk management or business continuity strategy that allow the heliport, helistop, vertiport, vertistop, or aircraft to remain operable during and after an event or to be replaced or restored.
(4) The potential for a given protection strategy to result in a service or business interruption or inhibit the ability of the heliport, helistop, vertiport, or vertistop to operate in a timely manner post event.

N 4.1.2 The overall fire protection approach shall be developed in conjunction with the considerations in 4.2.3 resulting in the use of one or both of the following strategies for heliports, helistops, vertiports, and vertistops:

(1) Prescriptive-based approaches in accordance with this standard
(2) A fire-risk-based approach in accordance with 4.1.3 and Section 4.2

N 4.1.3 A fire-risk-based approach shall be permitted to be used to determine the construction, fire suppression, fire detection, and utility requirements for heliports, helistops, vertiports, and vertistops only where specifically permitted by this standard and necessary to achieve the purpose of this standard. *(See Section 1.2.)*

N 4.2 Fire Risk Assessment.

N 4.2.1 The fire risk assessment permitted by 4.1.2 shall be documented and acceptable to the authority having jurisdiction (AHJ).

N 4.2.2 The fire risk assessment shall include an evaluation of the risk management considerations outlined in 4.2.3, and all heliport, helistop, vertiport, and vertistop stakeholders, including a registered professional engineer with experience in fire protection engineering, fire hazards, risk assessments, and fire and life safety system design.

N 4.2.3* The following risk management elements shall be considered to determine the level of acceptable fire risk documented as part of the fire risk assessment:

(1) The type and quantity of fuel or energy stored in the aircraft
(2) The type of operations and activities performed at the heliport, helistop, vertiport, or vertistop
(3) The risk of flammable or combustible liquid spills and equipment or process for containment and control
(4) Life safety aspects of an emergency event at the heliport, helistop, vertiport, or vertistop
(5) Fire threat to the heliport, helistop, vertiport, or vertistop occupants, and exposed property or operations
(6) Fire threat from an incident at the heliport, helistop, vertiport, or vertistop to the adjacent structures or properties
(7) Continuity of service, operation, and the effects of business interruption, including the business or operational impact of a loss of aircraft (specifically military and unique aircraft)
(8) Quantity, size, and value of the aircraft at the heliport, helistop, vertiport, or vertistop
(9) Economic loss from loss of function or business interruption
(10) Economic loss from value of equipment other than the aircraft or the heliport, helistop, vertiport, or vertistop
(11) Regulatory and reputation impact
(12) Potential economic impact
(13) Construction and compartmentation of the heliport, helistop, vertiport, or vertistop from adjacent areas
(14) Fire suppression and detection features provided for the heliport, helistop, vertiport, or vertistop
(15) Response time by emergency forces to an alarm or an incident at the heliport, helistop, vertiport, or vertistop
(16) Local firefighting capabilities and resources for an incident at the heliport, helistop, vertiport, or vertistop
(17) Evaluation and acknowledgement of insurance representatives
(18) Redundant infrastructure, including an off-site heliport, helistop, vertiport, or vertistop to continue to support aircraft operations and the mission of the heliport, helistop, vertiport, or vertistop
(19) Redundant equipment, including replacement aircraft and other equipment at the heliport, helistop, vertiport, or vertistop
(20) Life safety of emergency responders, the public, and occupants of the heliport, helistop, vertiport, or vertistop and adjacent spaces or structures
(21) Life cycle costs

N 4.2.4 The fire risk assessment shall cover and address the entire heliport, helistop, vertiport, or vertistop, including all adjacent support areas and exposed structures.

N 4.2.5 An approved performance-based approach, in accordance with Chapter 5, shall be permitted to be applied selectively to specifically identified areas, hazards, or equipment or to specific fire protection requirements for the heliport, helistop, vertiport, or vertistop.

N 4.2.6 The AHJ shall be permitted to require an approved, independent third party to review the proposed design brief based on the documented fire risk assessment accepted by the AHJ to provide an evaluation and approval of the fire risk assessment or the fire protection approach.

N Chapter 5 Performance-Based Design Approach

N 5.1 General.

N 5.1.1 The requirements of Chapter 5 shall apply to recognized performance-based practices.

N 5.1.2 A performance-based approach shall be permitted to determine the construction, fire suppression, fire detection, and utility requirements for heliports, helistops, vertiports, and vertistops to achieve the purpose of this standard. *(See Section 1.2.)*

N 5.2 Goals and Objectives. The performance-based design shall meet the following goals and objectives:

(1) Include allowances for alternative means to be utilized for elements of the heliport, helistop, vertiport, or vertistop
(2) Develop the risk assessment, design criteria, design brief, system performance, and testing criteria in accordance with this chapter
(3) Meet the scope and purpose of the standard as detailed in Sections 1.1 and 1.2
(4) Provide equivalent performance to the prescriptive requirements of this standard

N 5.3* Qualifications. The performance-based design documents shall be both of the following:

(1) Prepared by a licensed professional engineer with experience in fire protection engineering, fire hazards, and risk assessments
(2) Acceptable to the AHJ

N 5.4 Independent Review. The AHJ shall be permitted to require an approved, independent third party to review the proposed design brief based on the documented performance-based design approach accepted by the AHJ to provide an evaluation of the design approach.

N 5.5 Final Determination. The AHJ shall make the final determination as to whether the performance objectives have been met.

N 5.6 Maintenance of Design Feature. The design features required for the heliport, helistop, vertiport, or vertistop to continue to meet the performance goals and objectives of this standard shall be maintained for the life of the building.

N 5.7 Performance Criteria.

N 5.7.1 General. All designs shall meet the goals and objectives specified in Section 5.2—provided that the performance criterion of 5.7.2 has been met and the stakeholders concur with the design and risk management considerations in 4.2.3.

N 5.7.2 Performance Criterion. The performance criterion shall include the protection of the heliport, helistop, vertiport, or vertistop from damage by fire or its associated effects, including smoke, corrosion, heat, and water.

N 5.7.3 Stakeholders. The stakeholders shall comprise the registered professional engineer experienced in fire and life safety system design and risk assessments; the owner or owner's representative; aircraft and heliport, helistop, vertiport, or vertistop insurance representatives; representatives of the AHJ; and representatives of the emergency response entities.

N 5.7.4 Design Brief. The design of the heliport, helistop, vertiport, or vertistop shall include the preparation of a design brief that is prepared utilizing recognized performance-based design practices.

N 5.7.4.1 Any deviation from a prescriptive requirement outlined in NFPA 418 shall be detailed in the design brief.

N 5.7.4.2 Design specifications and briefs used in the performance-based design shall be stated and shown to be realistic and sustainable.

N 5.7.4.3 Specific inspection, testing, or maintenance requirements that are necessary to maintain reliable performance of the fire safety features of the information technology area shall be stated in the design brief.

Chapter 6 General Requirements — Land-Based Facilities

6.1 General. The requirements in this chapter shall apply to all land-based facilities, except those exempted through the provisions in 1.5.1. *(See Chapter 9 for requirements applying to offshore heliports.)*

N 6.1.1 Risk Assessment and Summary. Where a fire risk assessment or a performance-based design approach is utilized as permitted in Chapters 4 and 5 of this standard, the design brief and summary of the fire risk assessment shall be captured in the heliport, helistop, vertiport, or vertistop plans and specifications and be maintained for the life of the heliport, helistop, vertiport, or vertistop.

6.1.2* Listing. This chapter shall provide requirements for the correct use of heliport, helistop, vertiport, and vertistop firefighting system components.

6.1.2.1 All components shall be listed for their intended use.

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

6.2* Plans.

6.2.1 The design drawings for the construction and protection of the heliport, helistop, vertiport, or vertistop shall be approved by the authority having jurisdiction.

6.2.2 The design of the heliport or helistop, including all the aeronautical components, shall be in accordance with FAA AC 150/5390-2D, *Heliport Design Advisory Circular*, or equivalent criteria.

N 6.2.3 The design of the vertiport or vertistop, including all aeronautical components, shall be in accordance with FAA Engineering Brief No. 105 for Vertiports, or equivalent design criteria.

6.2.4 The design drawings shall designate the boundaries of the touchdown and liftoff (TLOF) area, the final approach and takeoff (FATO) area, the safety area, and the approach/departure paths.

6.3 Tank and Equipment Locations.

6.3.1 Storage, handling, and use of ignitible (flammable and combustible) liquids shall be in accordance with NFPA 30.

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

6.3.3 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 150/5390-2D, *Heliport Design Advisory Circular*.

6.4 Firefighting Access.

6.4.1 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).

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

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

6.6 No Smoking.

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

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

Δ **6.7 Fueling and Charging Systems.**

N **6.7.1** Fueling systems shall be designed in accordance with NFPA 407.

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

N **6.7.3** Other than aircraft fuel servicing vehicles, battery-powered vehicles, including battery-powered aircraft, that do not comply with the provisions of this standard shall not be operated within 10 ft (3 m) of fueling equipment or spills.

N **6.7.4** Charging systems shall be installed in accordance with *NFPA 70*.

N **6.7.5** Energy storage systems, including the storage of lithium-ion batteries, shall be designed and installed in accordance with NFPA 855.

N **6.7.6** Hydrogen storage and fueling facilities shall be designed and installed in accordance with NFPA 2.

N **6.7.7** Each charging system(s) shall comply with the following:

(1) Include an emergency power-off device to isolate the system
(2) Be readily accessible and located within sight of the load it is supporting
(3) Be clearly marked

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

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

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

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

Chapter 7 Rooftop Landing Facilities

7.1* General. The requirements in Chapters 6 and 7 shall apply to all rooftop landing facilities, except those exempted through 1.5.1.

7.2* 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.

N **7.2.1** The structural support requirements in Section 7.2 shall be permitted to be modified where a fire risk assessment, as outlined in Chapter 4, identifies that an alternative means of protection is acceptable as outlined in the fire risk assessment.

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

7.3.1 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.

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

7.4 Landing Pad Construction Materials.

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

7.4.1.1* 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*

[**5000:**7.1.4.1.1]

7.4.2 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, *Standard Test Methods for Fire Tests of Roof Covering*; or ASTM E108, *Standard Test Methods for Fire Tests of Roof Coverings*.

N **7.4.3** Rooftop landing area surfaces shall be designed to prevent electric shock hazards to personnel and passengers in accordance with *NFPA 70*.

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

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

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

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

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

7.6 Firefighting Access. (Reserved)

7.7 Fire Protection. The fire protection requirements in Section 7.7 shall be permitted to be modified where a fire risk assessment, as outlined in Chapter 4, identifies that an alternative means of protection is acceptable as outlined in the fire risk assessment.

7.7.1 General. A foam fire protection system with either a fixed discharge outlet(s) in accordance with 7.7.2 or a hose line(s) in accordance with 7.7.3 shall be designed and installed to protect the rooftop landing pad, unless otherwise permitted by the following:

(1) A foam fire protection system shall not be required for heliports, helistops, vertiports, or vertistops, located on open parking structures or buildings that are not normally occupied.
(2) For A-1 heliports, helistops, vertiports, and vertistops, two portable foam extinguishers, each having a rating of 20-A:160-B, shall be permitted to be used to satisfy the requirement of 7.7.1.
(3) Where foam extinguishers per 7.7.1(2) are not available, approved extinguishers with a 20-A:160B:C rating shall be permitted.
(4) Where approved, alternative fire protection systems shall be provided in accordance with Chapter 4.

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

7.7.1.2 Where manual firefighting equipment is the primary means of fire protection, the AHJ shall approve the installation of equipment and verify the availability of appropriately trained personnel.

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

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

7.7.1.5 Fire protection discharge devices, including extinguishers, shall comply with all of the following:

(1) Be installed in the area of the heliport, helistop, vertiport, and vertistop
(2) Section 11.1, where portable fire extinguishers are provided
(3) Not penetrate the approach/departure surfaces, transitional surfaces, TLOF, FATO, and safety areas as defined in FAA AC 150/5390-2D, *Heliport Design Advisory Circular*, or in approved aviation standards, when not in use

7.7.2 Fixed Foam Fire Protection Systems.

7.7.2.1 Fixed foam fire protection systems shall be designed and installed in accordance with NFPA 11 or an equivalent standard, as appropriate, except as modified by this chapter.

7.7.2.2* The critical fire area of foam coverage for fixed discharge outlet foam fire protection systems shall be the entire rooftop landing pad.

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

N **7.7.2.4** Where approved, the duration of foam discharge for DIFF systems shall be permitted to be modified where designed in accordance with Chapter 4.

Δ **7.7.2.5** A fixed nozzle discharge outlet system shall be one of the following:

(1) Fixed stationary nozzles around the perimeter
(2) Two or more oscillating monitors/nozzles
(3) Deck-integrated firefighting system (DIFFS) nozzles within the perimeter of the deck

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

7.7.2.7 Activation of Systems.

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

7.7.2.7.2* 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.

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

7.7.2.7.4 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*.

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

7.7.3 Manual Firefighting Equipment.

Δ **7.7.3.1*** The critical fire area for foam discharge for manual hose line systems shall be in accordance with Table 7.7.3.1.

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

N **7.7.4 Manual Firefighting Equipment for Electrical Aircraft. (Reserved)**

N **7.7.5 Manual Firefighting Equipment for Hydrogen Aircraft. (Reserved)**

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

7.7.7 Water Supply.

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

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

Δ Table 7.7.3.1 Critical Fire Area for Manual Firefighting

Aircraft Category	Aircraft Controlling Dimension/D-Value	Critical Fire Area	
		ft^2	m^2
A-1	Less than 50 ft (15.2 m)	375	34.8
A-2	50 ft (15.2 m) up to but not including 80 ft (24.4 m)	840	78.0
A-3	80 ft (24.4 m) up to but not including 120 ft (36.6 m)	1440	133.8

7.7.8 Foam Concentrate Supply.

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

7.7.8.2 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.

7.7.9 Fire Alarm.

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

7.7.9.2 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 7.5.1.)*

7.7.10 Acceptance Testing.

7.7.10.1 Fixed Foam Fire-Protection 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.

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

7.7.10.1.2 The test shall demonstrate coverage of all ingress/egress points on the landing pad, except for coverage on stairs and ramps, which is not required.

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

7.7.11 Inspection, Testing, and Maintenance.

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

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

***N* 7.8* Deck Integrated Firefighting System (DIFFS). (Reserved)**

***N* 7.9 Passive Fire-Retardant Deck with Water Deck Integrated Firefighting System (DIFFS). (Reserved)**

Chapter 8 Rooftop Hangars

8.1 Construction.

8.1.1 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.

8.1.2 Other aircraft 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.

8.1.3 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.

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

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

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

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

***N* 8.1.5** The construction requirements in Section 8.1 shall be permitted to be modified where a fire risk assessment, as outlined in Chapter 4, identifies that an alternative means of protection is acceptable as outlined in the fire risk assessment.

8.2 Rooftop Hangar Floor Drainage.

8.2.1 Where ignitible combustible or flammable liquids are utilized as fuels, floor drainage systems shall be provided to restrict the spread of fuel in order to reduce fire and explosion hazards from fuel spillage.

8.2.2 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.

8.2.3 Drainage systems in aircraft 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.

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

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

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

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

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

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

Δ **8.3 Suspended or Elevated Heaters.** In the aircraft storage and servicing areas, listed electric, gas, or oil heaters shall be permitted and installed at least 10 ft (3 m), vertically and horizontally, from all surfaces of the aircraft.

8.4 Lighting and Electrical Systems.

8.4.1 Artificial lighting shall be restricted to electrical lighting.

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

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

Δ **8.6 Protection of Rooftop Hangars.**

8.6.1 Aircraft storage and servicing areas shall be protected in accordance with NFPA 409.

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

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

8.7 Portable Fire Extinguishers for Rooftop Hangars.

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

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

N **8.7.3** The fire extinguisher requirements in Section 8.7 shall be permitted to be modified where a fire risk assessment, as outlined in Chapter 4, identifies that an alternative means of protection is acceptable as outlined in the fire risk assessment.

N **8.8 Aircraft Maintenance.** The provisions of both NFPA 410 and the aircraft manufacturer's specifications shall be followed where aircraft maintenance is performed in a rooftop hangar.

Chapter 9 Offshore Heliports and Vertiports

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

9.2 Firefighting Access.

Δ **9.2.1** All heliports and vertiports shall have at least one access point for firefighting/rescue personnel.

Δ **9.2.2** Where practical, a second access point shall be available and shall be located remotely from the first.

9.3 Landing Pad Pitch. Heliports and vertiports 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 10 Water Supply

10.1* 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 11 Portable Fire Extinguishers

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

Δ **11.2 Minimum Requirement.** At least one portable fire extinguisher as specified in Table 11.2 shall be provided for each takeoff and landing area, parking area, fuel storage area, and charging site.

Δ **Table 11.2 Minimum Ratings of Portable Fire Extinguishers for Aircraft Categories**

Aircraft Category	Overall Length or Controlling Dimension	Minimum Rating (UL)
A-1	Less than 50 ft (15.2 m)	4-A:80-B
A-2	50 ft (15.2 m) up to but not including 80 ft (24.4 m)	10-A:120-B
A-3	80 ft (24.4 m) up to but not including 120 ft (36.6 m)	30-A:240-B

11.3 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.

N **11.4* Extinguisher Travel Distance.** Extinguisher travel distance, as defined by NFPA 10, shall be measured from a designated location, approved by the AHJ, and not be located within the TLOF, FATO, safety area, or penetrate the approach surface.

N **11.5 Wheeled Fire Extinguishers.** Wheeled fire extinguishers shall be considered for hazard protection in areas in which a fire risk assessment has shown the following:

(1) High-hazard areas are present
(2) Limited available personnel are present, thereby requiring an extinguisher that has the following features:
    (a) High agent flow rate
    (b) Increased agent stream range
    (c) Increased agent capacity

[**10:** 5.3.2.7]

Chapter 12 Emergency Operations

12.1 Emergency Response Plan. An approved emergency response plan shall be developed for each heliport or vertiport.

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

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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.

N **A.1.2** For emergency planning and training of safety personnel at heliports, see Annex B.

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.3.3.1.2 Critical Fire Area. Annex C explains the development of the fire area for hose line systems protecting landing pads. Where the terms *theoretical area* and *practical critical fire area* are used, the term *critical fire area* should apply. *(See Annex C for additional information.)*

N **A.3.3.3 Deck Integrated Firefighting System (DIFFS).** Flush-mounted nozzles can be either stationary/fixed or "pop-up"; where the popping-up will only appear at discharge.

A.3.3.10 Foam Fire-Protection System. A foam fire-protection system can be a fixed discharge outlet system utilizing fixed storage and piping connected to fixed outlets, monitor nozzles, or DIFFS 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.3.3.11 Heliport. The term *heliport* applies to all sites used or intended to be used for the landing and takeoff of helicopters.

N **A.3.3.13 Helistop.** As unscheduled maintenance can take many forms, see the authority having jurisdiction for guidance and approval.

A.3.3.14 Overall Length. The overall length of a helicopter is also referred to by some authorities as D or the D-value.

N **A.4.2.3** The protection for heliports, helistops, vertiports, or vertistops should be specific to the nature and anticipated fire risks of each heliport, helistop, vertiport, or vertistop.

The risk analysis should consider the risk and hazards associated with the site and services provided for a given fire safety problem. Additional considerations can include the following:

(1) Availability of alternative or replacement aircraft or the heliport, helistop, vertiport, or vertistop that perform similar operations and activities
(2) Permitted downtime of the aircraft or the heliport, helistop, vertiport, or vertistop
(3) Presence of additional fire suppressions, alarm and detection equipment, or risk reduction features proximate to the heliport, helistop, vertiport, or vertistop
(4) Survivability of the aircraft or the heliport, helistop, vertiport, or vertistop
(5) Number and level of training of emergency response personnel
(6) Building construction, life safety, means of egress, and fire compartmentation

NFPA 551 can be used as a reference for conducting and evaluating fire risk assessments.

N **A.5.3** It is essential that the design professional recognize the possibility of fire at a heliport, helistop, vertiport, or vertistop. Licensed design professionals who develop performance-based design documents should be well versed in the science of fire; the effects of fire and operations at heliports, helistops, vertiports, or vertistops; and options for mitigation of the risk to persons, equipment, and operations presented by fire at the heliport, helistop, vertiport, or vertistop.

A.6.1.2 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 critical fire area. Some systems include detection devices.

A water-based system consists of a passive deck used in tandem with a water supply and piping system connecting through a deluge valve and associated controls to supply a network of a deck integrated firefighting system (DIFFS) nozzles to discharge over the critical fire area.

A.6.2 FAA AC 150/5390-2D, *Heliport Design Advisory Circular*, or equivalent, 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, or equivalents where alternative regulatory provisions apply, should be consulted to ensure that adequate safe practice and facilities are maintained.

Δ **A.6.8** The two means of egress can also be used for access to the landing pad for firefighting or rescue operations. In cases where the means of egress are associated with a barrier, such as a door or gate, are locked, an approved means should be provided for entry of emergency responders.

A.6.8.1 Figures A.6.8.1(a) and A.6.8.1(b) are examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.6.8.1(b) is such that it has no sides and does not comply with 6.8.3; however, it does comply with the 90-degree rule in 6.8.1. Figure A.6.8.1(c) is an example of an unacceptable configuration, due to both egress points being on the same side of the landing pad.

N **A.7.1** The *SFPE Engineering Guide, Fire Safety for Very Tall Buildings* provides design guidance related to rooftop landing facilities in very tall buildings.

A.7.2 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. It is noted that while the upper surface of helipads with a passive fire-extinguishing capability is not solid, the components creating the upper surface form an internal drainage system with the resultant helipad platform being nonporous and fuel tight with reference to the surrounding structural support members.

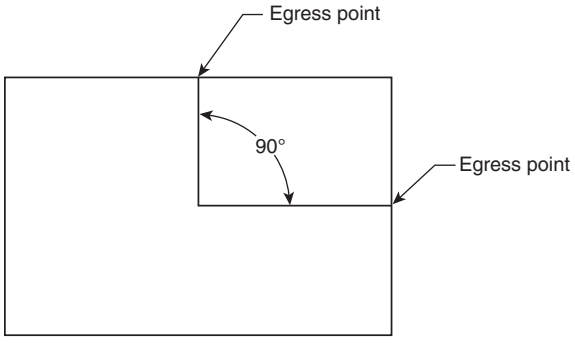

FIGURE A.6.8.1(a) Example of an Acceptable Configuration of Egress Points on a Landing Pad.

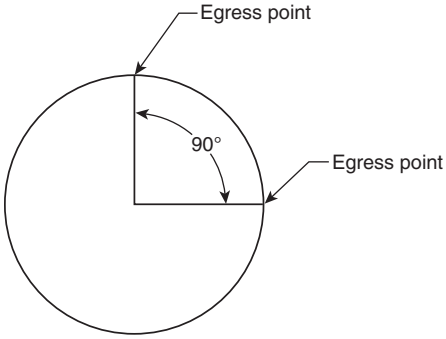

FIGURE A.6.8.1(b) Example of an Acceptable Configuration of Egress Points on a Landing Pad with No Sides.

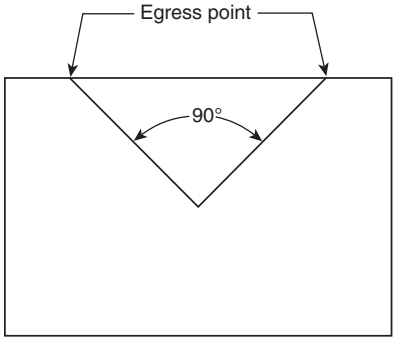

FIGURE A.6.8.1(c) Example of an Unacceptable Configuration of Egress Points on a Landing Pad.

A.7.4.1.1 The provisions of 7.4.1.1 do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials.

A.7.4.1.1(1) Examples of such materials include steel, concrete, masonry, glass, and some aluminum alloys.

A.7.5 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.7.5.1 See Figure A.6.8.1(a) through Figure A.6.8.1(c) for examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.6.8.1(b) is such that it has no sides and cannot comply with 7.5.3; however, it does comply with the 90-degree rule in 7.5.1. Figure A.6.8.1(c) is not an acceptable configuration due to both egress points being on the same side of the landing pad.

A.7.5.4 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. Where approved, collapsible handrails require special consideration. If these are not collapsed before aircraft operations, they will present significant obstacles to aircraft operations.

A.7.7.1.3 The design density is for synthetic foam concentrates, not fluoroprotein or protein foam products. Alternative designs to AFFF systems might require different application rates based on their listing, manufacturers' recommendations, and written instructions. These designs are subject to approval by the AHJ.

A.7.7.2.2 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.7.7.2.7.1 Training on the operation of the fire protection system should be in accordance with Annex B.

A.7.7.2.7.2 It is acceptable for the rooftop landing pad to be viewed using video or other acceptable means.

A.7.7.3.1 For hose line systems, the area and duration of application is reduced when compared to fixed outlet systems. It is expected that foam is applied efficiently and directly on the fire by trained personnel. *(See also 3.3.2, Controlling Dimension, and 3.3.14, Overall Length.)*

N **A.7.8** Both Sections 7.8 and 7.9 are reserved for possible requirements for two types of deck integrated firefighting systems (DIFFS) for the next edition of NFPA 418. 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.

A.9.1 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.

A.10.1 The water supply is not intended to be based on simultaneous operation of both systems.

N **A.11.4** See Figure 2-6, *TLOF/FATO/Safety Area Relationships and Minimum Dimension*, and Figure 3-4, *Hover Taxi Area*, of FAA AC 150/5390-2D, *Heliport Design Advisory Circular*, for further guidance.

Δ Annex B 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.

Δ **B.1 General.** If safety personnel are provided at a heliport, helistop, vertiport, or vertistop, the facility 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.

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

(1) Operation of the heliport, helistop, vertiport, or vertistop
(2) Safety procedures around aircraft during ground operations
(3) Communication systems at the heliport, helistop, vertiport, or vertistop
(4) Heliport, helistop, vertiport, or vertistop emergency plan
(5) Operation of the fire protection system
(6) Knowledge of the aircraft types and alternative energy sources used

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

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

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

Δ **B.1.4** The heliport, helistop, vertiport, or vertistop emergency plan sets out the procedures for coordinating the response of required agencies or services (e.g., air traffic services unit, firefighting services, 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 An emergency response plan should be established at the heliport, helistop, vertiport, or vertistop.

N **B.1.4.1.1** NFPA 855 should be utilized and considered where preparing for emergencies involving electrically powered aircraft and their support and housing facilities.

N **B.1.4.1.2** NFPA 2 should be utilized and considered where preparing for emergencies involving hydrogen-powered aircraft and their support and housing facilities.

B.1.4.2 The plan should identify agencies that, in the opinion of the heliport, helistop, vertiport, or vertistop operator, could be of assistance in responding to an emergency at the facility 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, helistop, vertiport, or vertistop perimeter
(2) Aircraft crash outside the heliport, helistop, vertiport, or vertistop perimeter
(3) Trauma injury to personnel
(4) Medical emergencies
(5) Fire in the heliport, helistop, vertiport, or vertistop, including firefighting access points and system
(6) Evacuation of the heliport, helistop, vertiport, or vertistop, including the heliport, helistop, vertiport, or vertistop egress system

B.1.4.4 Where an approach/departure path at a heliport, helistop, vertiport, or vertistop 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 All emergency and training plans 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 facility 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-site 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, helistop, vertiport, or vertistop and its immediate vicinity
(8) Use of any of the following equipment, if that equipment is provided at the heliport, helistop, vertiport, or vertistop:
    (a) Portable extinguishers
    (b) Fire hoses, nozzles, and other similar appliances
    (c) Extinguishing agents

N **B.1.4.5.1** The emergency operations plan for electric aircraft should include the following:

(1) Procedures for safe shutdown, de-energizing, or isolation of equipment and systems under emergency conditions to reduce the risk of fire, electric shock, and personal injuries, and for safe start up following cessation of emergency conditions
(2) Procedures for inspection and testing of associated alarms, interlocks, and controls
(3) Procedures to be followed in response to notifications from the energy storage management system (ESMS), where provided, that could signify potentially dangerous conditions, including shutting down equipment, summoning service and repair personnel, and providing agreed-upon notification to fire department personnel for off-normal potentially hazardous conditions
(4) Emergency procedures to be followed in case of fire, explosion, release of liquids or vapors, damage to critical moving parts, or other potentially dangerous conditions
(5) Response considerations similar to a safety data sheet (SDS) that will address response safety concerns and extinguishment where an SDS is not required
(6) Procedures for dealing with ESS equipment damaged in a fire or other emergency event, including contact information for personnel qualified to safely remove damaged ESS equipment from the facility

N **B.1.4.5.2** The plan for hydrogen-powered aircraft should be available for inspection by the AHJ and should include the following information:

(1) An indication that hazard identification labeling is provided for each storage area
(2) A safety data sheet (SDS) or equivalent for GH_2 or LH_2 stored or used on the site
(3) A list and map identifying the locations of the GH_2 and LH_2 stored or used on the site
(4) A list of the types and quantities of GH_2 and LH_2 found within the facility

N **B.1.4.5.2.1** An emergency plan should be prepared and updated wherever GH_2 or LH_2 are produced, handled, stored, or used in amounts exceeding the maximum allowable quantity (MAQ) per control area or where required by the AHJ.

N **B.1.4.5.2.2** All hydrogen refueling station sites should have a completed risk assessment prior to dispensing fuel.

B.1.4.6 A heliport, helistop, vertiport, or vertistop 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, helistop, vertiport, or vertistop 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, helistop, vertiport, or vertistop that provides a scheduled service for the transport of passengers.

B.1.4.9 At a rooftop heliport, helistop, vertiport, or vertistop 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 for AFFF Hose Line Systems

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

C.1 Introduction. The option exists where trained personnel are available to use hose line systems dispensing AFFF as a fire protection system. The calculations used to develop the minimum extinguishing agent quantities and discharge for such systems as rates presented in Table C.1(a) and Table C.1(b) for rooftop heliports, helistops, vertiports, or vertistops 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.

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

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

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.

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

Aircraft Category				Controlling Dimension of Largest Aircraft (m)		Fuselage Width Tripled (m)		Critical Fire Area (m²)		Application Rate (mm/min)		Q_1 (L)		Q_2		Q (L)
A-1	0	<	15.2	7.6	×	4.6	=	35.0	×	4.1	=	143.5	+	100%	=	287.0
A-2	15.2	<	24.4	12.2	×	6.4	=	78.0	×	4.1	=	319.8	+	100%	=	639.6
A-3	24.4	<	36.6	18.3	×	7.3	=	133.6	×	4.1	=	547.8	+	100%	=	1095.6

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 US 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.

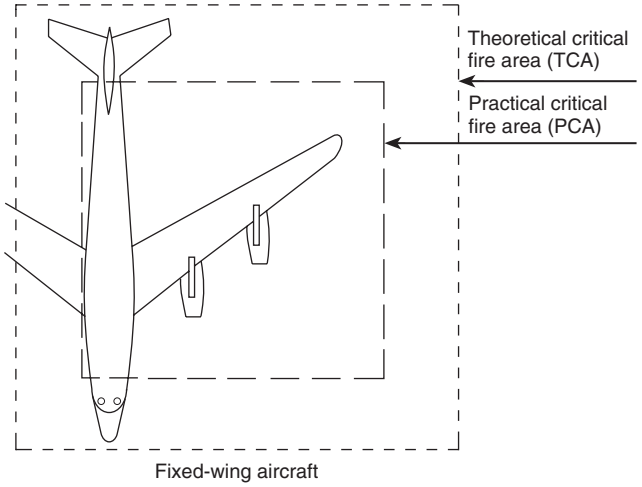

FIGURE C.3.3 Practical Critical Fire Area Relative to Theoretical Critical Fire Area.

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 7.7.3.1.)*

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

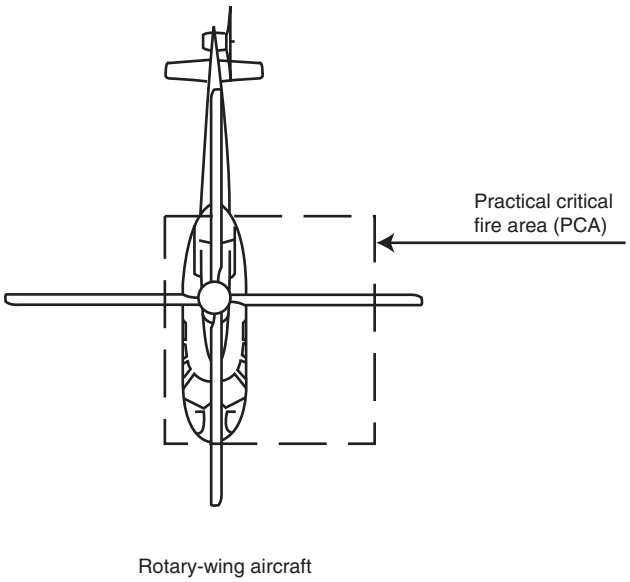

FIGURE C.3.5 Practical Critical Fire Area for Helicopters.

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.

N Annex D Electric Aircraft Safety Precautions

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

N **D.1 General.** Rapid advances in technology are changing the aviation landscape. These advancements are most evident in the fuels and energy sources being utilized for new and modern aircraft. These new fuel sources include electric, hydrogen, and hybrid configurations. This annex serves as guidance for aircraft rescue and firefighting (ARFF) personnel in preparing a response to these new technologies. The guidance found here can serve as a framework for future innovations that might not yet have been identified, but could appear within your area of operations.

N **D.2 Electric Power and Energy Storage Systems (ESS).** NFPA 855 should be utilized and considered when preparing for emergencies involving electrically powered aircraft and their support and housing facilities.

N **D.2.1 Knowledge of Facilities.** ARFF personnel should be knowledgeable of the types of work and technology that are being utilized within their response area. NFPA 855 requires specific documents to be presented to the AHJ when these facilities are constructed. ARFF personnel should know that these exist and are available.

N **D.2.1.1** The plans and specifications associated with an energy storage system (ESS) and its intended installation, replacement or renewal, commissioning, and use should be submitted to the AHJ for approval and include the following:

(1) Location and layout diagram of the room or area in which the ESS is to be installed
(2) Details on hourly fire-resistant-rated assemblies provided or relied upon in relation to the ESS
(3) The quantities and types of ESS units
(4) Manufacturer's specifications, ratings, and listings of ESS
(5) Description of energy storage management systems and their operation
(6) Location and content of required signage
(7) Details on fire suppression, smoke or fire detection, gas detection, thermal management, ventilation, exhaust, and deflagration venting systems, if provided