NFPA 418
Standard for Heliports

1995 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Standard for

Heliports

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This edition of NFPA 418, *Standard for Heliports*, was prepared by the Technical Committee on Helicopter Facilities and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 22-25, 1995, in Denver, CO. It was issued by the Standards Council on July 21, 1995, with an effective date of August 11, 1995, and supersedes all previous editions.

This edition of NFPA 418 was approved as an American National Standard on August 11, 1995.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

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 text was a revision of the tentative standard (including a change in title). The 1973 edition was a complete revision of the 1968 edition. Further amendments were made in 1979. The title of the 1990 edition of this standard was changed from Standard on Roof-top Heliport Construction and Protection. The 1990 edition added chapters for land-based facilities and offshore heliports.

The standard was revised for 1995.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in membership may have occurred. A key to classifications is found at the back of this 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 fire-fighting operations at heliports, helistops, and helipads.

Contents

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

Information on referenced publications can be found in Chapter 6 and Appendix B.

Chapter 1 Administration

1-1 Scope.

1-1.1 This standard specifies the minimum requirements for fire protection for heliports.

1-1.2 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.

1-3 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

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

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. (*See A-3-6.1 for additional information.*)

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

Foam Fire Extinguishing System. A low-expansion foam fire extinguishing system designed and installed in accordance with NFPA 11, *Standard for Low-Expansion Foam.* It 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.

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

Listed.* Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

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.

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

Practical Critical Fire Area. The area, for foam discharge purposes, calculated as one-half the fuselage length multiplied by three times the fuselage width. (*See also A-3-6.1.*)

Rooftop Landing Pad. The entire load-bearing surface intended for the landing, takeoff, and parking of helicopters.

Shall. Indicates a mandatory requirement.

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

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.

Chapter 2 General Requirements—Land-Based Facilities

2-1* Plans. Plans for construction and protection of heliports shall be approved by the authority having jurisdiction.

2-2 Tank Locations. Aboveground flammable liquid storage tanks, compressed gas storage tanks, and liquefied gas storage tanks shall be laterally located at least 50 ft (15.2 m) from the edge of takeoff and landing areas as defined in FAA A/C 150/5390-2, *Heliport Design Advisory Circular.*

2-3 Fire-Fighting Access.

2-3.1 The heliport shall have at least one access point for fire-fighting/rescue personnel. Where practical, a second access point shall be available and located as remotely as possible from the other.

2-3.2 Fences shall not prevent rapid access by fire-fighting/rescue personnel.

2-4 Landing Pad Pitch. The heliport shall be pitched or sloped so that drainage flows away from access points and passenger holding areas.

2-5 No Smoking. No smoking shall be permitted within 50 ft (15.2 m) of the landing pad edge. No smoking signs shall be erected at access/egress points to the heliport.

2-6 Fueling System. Fueling systems shall be designed in accordance with NFPA 407, *Standard for Aircraft Fuel Servicing.*

Chapter 3 Rooftop Landing Facilities—Additional Protection

3-1 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.

3-2 Landing Pad Pitch. The rooftop landing pad shall be pitched to provide drainage that flows away from passenger holding areas, access points, stairways, elevator shafts, ramps, hatches, and other openings.

3-3 Landing Pad Construction Materials. The rooftop landing pad surface shall be constructed of noncombustible, nonporous materials that are approved. The contiguous building roof covering within 50 ft (15.2 m) of the landing pad edge shall have a Class A rating.

3-4* Means of Egress. At least two approved means of egress from the rooftop landing pad edge shall be provided and shall be remotely located from each other to the extent practical.

3-4.1 For heliports occupied by 50 or more people, two approved means of egress from the roof shall be provided and shall be remotely located from each other to the extent practical but shall not be located less than 30 ft (9.1 m) from each other. For heliports occupied by fewer than 50 people, one approved means of egress from the roof shall be provided.

3-4.2 Means of egress from the rooftop landing pad and roof shall not obstruct flight operations.

3-5 Fire-Fighting Access. The helicopter rooftop landing pad shall have at least two access points for fire-fighting purposes. Access for fire-fighting personnel through the landing pad egress shall be permitted.

3-6 Fire Protection. A foam fire extinguishing system shall be designed and installed to protect the rooftop landing pad.

Exception No. 1: A foam fire extinguishing system shall not be required for heliports located on parking garages, unoccupied buildings, or other similar unoccupied structures.

Exception No. 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 this requirement.

3-6.1* The foam discharge rate shall be as follows:

AFFF	0.10 gpm/ft^2 [4.1 (L/min)/m^2]
Fluoroprotein	0.16 gpm/ft^2 [6.5 (L/min)/m^2]
Protein	0.20 gpm/ft^2 [8.1 (L/min)/m^2]

3-6.2 The area of application of foam discharge for fixed discharge outlet systems shall be the entire rooftop landing pad. The duration shall be 5 minutes.

3-6.3* 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. The duration shall be 2 minutes.

Table 3-6.3 Practical Critical Fire Areas

Category	Helicopter Overall Length[1]	Practical Critical Fire Area
H-1	Up to but not including 50 ft (15.2)	375 ft^2 (34.8 m^2)
H-2	From 50 ft (15.2 m) up to but not including 80 ft (24.4)	840 ft^2 (78.0 m^2)
H-3	From 80 ft (24.4 m) up to but not including 120 ft (36.6)	1440 ft^2 (133.8 m^2)

[1]Helicopter length, including the tail boom and the rotors.

3-6.4 The water supply for the foam system shall be from a reliable source, approved by the authority having jurisdiction.

3-6.4.1 Fire pumps, if used, shall be installed in accordance with NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps.*

3-6.4.2 Standpipes and hose stations, if used, shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

3-6.4.3 Where freezing is possible, adequate freeze protection shall be provided.

3-6.5 The foam components shall be installed in a readily accessible area of the heliport and shall not penetrate the primary, approach, departure, and transitional surfaces defined in paragraphs 3J, 3K, 3L, 13, and 21 of FAA A/C 150/5390-2, *Heliport Design Advisory Circular.*

3-6.6 At facilities where there is more than one rooftop landing pad, the supply of foam available shall be sufficient to cover an incident on at least one of the pads.

3-6.7 Where fixed foam systems utilizing fixed deck nozzles or oscillating foam turrets, or both, are installed, system components shall be listed or approved.

3-7 Standpipes. If a building with a rooftop heliport is supplied with a standpipe system, a Class II standpipe shall be extended to the roof level on which the rooftop heliport is located. Such standpipe systems shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

3-8 Fire Alarm. 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 3-4.1.*)

Chapter 4 Offshore Heliports

4-1* Plans. Plans for construction and protection of heliports located on fixed and mobile offshore installations shall be approved by the authority having jurisdiction.

4-2 Fire-Fighting Access. The heliport shall have at least one access point for fire-fighting/rescue personnel. Where practical, a second access point shall be available and shall be located as remotely as possible from the other.

4-3 Landing Pad Pitch. Heliports shall be designed to prevent the standing collection of liquids and to prevent liquids from spreading to or spilling on accommodation spaces or working spaces.

Chapter 5 Portable Fire Extinguishers

5-1 Quantity and Rating. At least one portable fire extinguisher as specified in Table 5-1 shall be provided for each takeoff and landing area, parking area, and fuel storage area.

Exception: This requirement shall not apply to unattended ground level heliports.

Table 5-1 Minimum Ratings of Portable Fire Extinguishers for Heliport Categories

Category	Helicopter Overall Length[1]	Minimum Rating
H-1	Up to but not including 50 ft (15.2)	4-A:80-B
H-2	From 50 ft (15.2) up to, but not including, 80 ft (24.4)	10-A:120-B
H-3	From 80 ft (24.4) up to, but not including, 120 ft (36.6)	30-A:240-B

[1]Helicopter length, including the tail boom and the rotors.

5-2 Servicing. Portable fire extinguishers shall comply with NFPA 10, *Standard for Portable Fire Extinguishers*, Chapters 1, 4, 5, and 6.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

6-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1994 edition.

NFPA 11, *Standard for Low-Expansion Foam*, 1994 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 1993 edition.

NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*, 1993 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing*, 1990 edition.

6-1.2 Other Publication.

6-1.2.1 FAA Publication. Federal Aviation Administration, Department of Transportation, Distribution Unit, M-494.3, Washington, DC 20590.

FAA A/C 150/5390-2, *Heliport Design Advisory Circular*, January 4, 1988.

Appendix A Explanatory Material

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

A-1-3 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 concerned with product evaluations that is in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-1-3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which 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-2-1 FAA A/C 150/5390-2, *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-3-4 For further information on exit principles, see NFPA *101®, Life Safety Code®*.

A-3-6.1 Where personnel trained in the operations of the equipment are in attendance, a hose line system is preferred.

The calculations used to develop the minimum extinguishing agent quantities and discharge rates presented in Table A-3-6.1 for rooftop heliports include the following factors:

(a) *Aircraft Size.* 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).

(b) *Relative Effectiveness of Agent Selected.* Represented by the specific application rate identified for each of the common generic foam concentrate types.

(c) *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.

(d) *Time Required to Maintain Controlled Area Fire-Free.* An operational objective that provides a safety factor for the initial fire attack while waiting for the arrival of backup support.

The calculation method is supported by research and experimental work done mainly at the U.S. FAA's 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, Montreal Canada, circa 1970.

The RFFP II initially focused on the "Theoretical Critical Fire Area," 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's working definition of the Theoretical Critical Fire Area (TC) is "the area adjacent to an aircraft in which fire must be controlled." This definition implies control of the fire within a specific area. In order to achieve this, dimensions need to be determined. Formulas 1 and 2, which follow, were developed from that earlier work.

Using these formulas, the size of the area of interest can be calculated. For example:

1. Where L<65 ft: TC = L × (40 ft + W)
   or
   1a. L<20 m: TC = L × (12 m + W)
   and
2 Where L>65 ft: TC = L × (100 ft + W)
   or
   2a. L>20 m: TC = L × (30 m + W)

Where: L = average aircraft length
W = average width of aircraft served at the airport of interest.

Conceptually, the TC 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 TC area for different sizes of aircraft. They are widely accepted throughout the aircraft fire service community and are applied as described in the following paragraphs.

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's work 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 theoretical critical fire area calculations.

As a result, RFFP II developed material recommending that the practical area be approximately two-thirds the theoretical area [*see Figure A-3-6.1(a)*]. This principle has been adopted by the ICAO, the 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 (PC) for fixed-wing aircraft is commonly expressed as follows:

3. (practical critical fire area) =
(0.67) × (theoretical critical fire area)
or
3a. PC = (0.67) (TC)

In adapting the fixed-wing fire protection methodology to helicopters, the committee considered the following additional factors that make the fire protection problem of helicopters (rotary-wing aircraft) unique:

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

(b) *Fuel Quantities and Location.* Fuel tanks are not located in the "wings" or rotor blades, and relatively small quantities of fuel are involved.

(c) *Impact Energy.* Relative to the fixed-wing counterpart, a helicopter accident generally occurs at slow ground speeds.

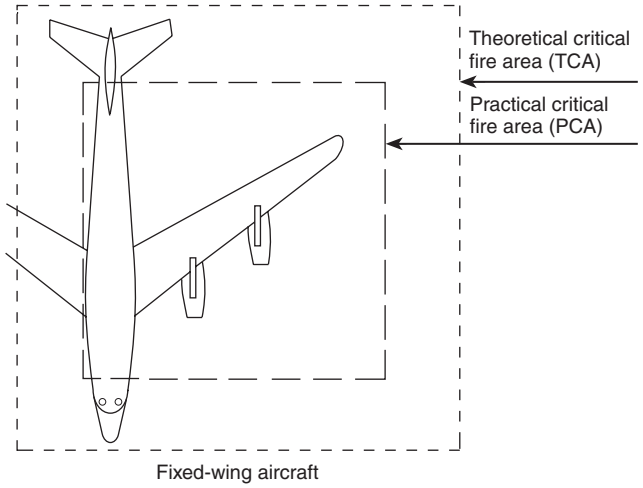

Figure A-3-6.1(a) Practical critical fire area relative to theoretical critical fire area.

(d) *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 3-6.3.*)

After considering both 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 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 A-3-6.1(b).*]

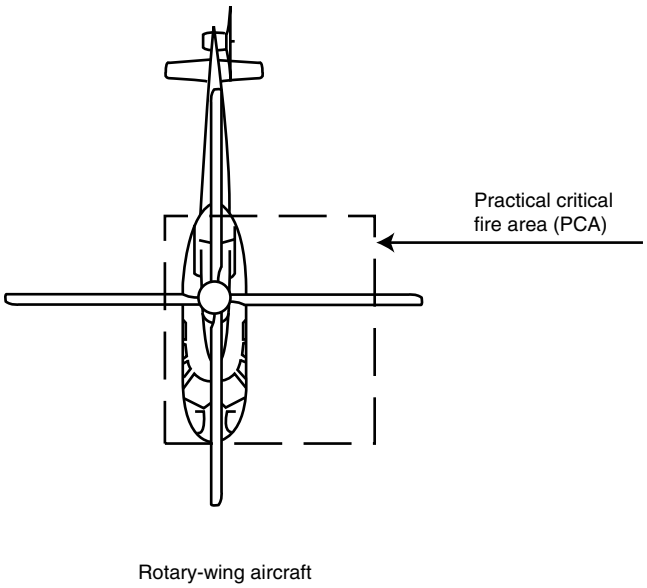

Figure A-3-6.1(b) Practical critical fire area for helicopters.

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 items 1 through 6 as follows:

1. Where Q_1 = Volume of agent needed for 1-minute control of PC
   and
2. Q_2 = Volume of agent needed for continued control or complete extinguishment of fire related to PC, or both.
3. Therefore: $Q = Q_1 + Q_2$ = Minimum agent volume for effective fire service operations.

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:

4. Q_1 = (application rate) × (practical critical area)
   or
   4a. $Q_1 = (AR)(PC)$ Where the "application rate" 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 lpm/m^2 depend on the units convention being used.
5. $Q_2 = f(Q_1)$ And it has been determined that, for all categories of heliports, f = 1.
6. Therefore: $Q = 2[(AR)(PC)]$

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 Tables A-3-6.1(a) and (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 Tables A-3-6.1(a) and (b) is substituted and the indicated calculations are performed to obtain the value of Q for the specific foam concentrate to be used.

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 fire-fighting 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.

It should therefore be clear that in order to extend an effective fire suppression and rescue operation beyond the initial 1-minute fire control period, an additional volume of foam agent, Q_2, needs to be available. 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. 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.

Table A-3-6.1(a) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System

NFPA/ICAO Heliport Category				½ × O.L. of Largest Helicopter[1]		Fuselage Width Tripled[2]		Practical Crital Fire Area		Application Rate (gpm/ft^2)		Q_1 Water to Control within 1 Min		Q_2 Reserve to Extinguish		Q Total Water to Extinguish
H-1	0 ft	<	50 ft	25 ft	×	15 ft	=	375 ft^2	×	0.10	=	37.5 U.S. gal	+	100%	=	75 U.S. gal
H-2	50 ft	<	80 ft	40 ft	×	21 ft	=	840 ft^2	×	0.10	=	84 U.S. gal	+	100%	=	168 U.S. gal
H-3	80 ft	<	120 ft	60 ft	×	24 ft	=	1440 ft^2	×	0.10	=	144 U.S. gal	+	100%	=	288 U.S. gal

[1]O.L.= Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended.
[2]Fuselage width = Actual fuselage width (does not include landing gear) measured from outside of cabin.

Table A-3-6.1(b) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System

NFPA/ICAO Heliport Category				½ × O.L. of Largest Helicopterx[1]		Fuselage Width Tripled[1]		Practical Crital Fire Area		Application Rate [(L/min)m^2]		Q_1 Water to Control within 1 Min		Q_2 Reserve to Extinguish		Q Total Water to Extinguish
H-1	0 m	<	15.2 m	7.6 m	×	4.6 m	=	34.8 m^2	×	4.1	=	141.9 L	+	100%	=	283.9 L
H-2	15.2 m	<	24.4 m	12.2 m	×	6.4 m	=	78.0 m^2	×	4.1	=	317.9 L	+	100%	=	635.9 L
H-3	24.4 m	<	36.6 m	18.3 m	×	7.3 m	=	133.8 m^2	×	4.1	=	545.0 L	+	100%	=	1090 L

[1]O.L. = Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended.
[2]Fuselage width = Actual fuselage width (does not include landing gear) measured from outside of cabin.