



HELI-DECKS & HELI-PORTS

GENERAL FOAM INFORMATION

DESCRIPTION

Helicopters provide a level of convenience that is probably unequaled by other forms of transport. While helicopters can land in the middle of built-up areas on the top of a high-rise building, they can also land and take off from areas inaccessible to other forms of transport. This means that the protection of these facilities is critical to saving lives and property. In particular there has been an increase in the use of helicopters for transportation in the business, pleasure and medical fields. This increase in use by helicopters has generated increasing concerns for the safety of crew and passengers as well as minimizing loss to the heliport landing pad and the helicopter. Although the extent of fire protection required is determined by the authority having jurisdiction, most heliports today are protected by application of foam using hose lines, oscillating monitors or fixed nozzles.

The National Fire Protection Association (NFPA) has developed and adopted NFPA 418, Standard for Heliports to provide a guideline for minimum safety standards. Heliports can be land based, on marine vessels and on offshore drilling rigs and platforms. The requirements for marine vessels and offshore drill rigs are determined by USCG and ABS rules and differ slightly from the requirements for land based applications. (See CFR (Code of Federal Regulations) section at the end of this bulletin).

PROTECTION FOR HELIPORTS

The level of fire protection required is based on the classification of the heliport. Fire protection for land-based heliports is derived from the largest helicopter that will use the facility. Heliports have been divided into three classifications

based on the size of the largest helicopters that the facility will accommodate. Before designing fire protection systems for heliports, it is important to know some of the common terminology.

DEFINITIONS

Heliport: A facility designed to accommodate operation of helicopters. This includes the landing area and all related facilities.

Landing Pad: Minimum load bearing area designed for touchdown of a helicopter.

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.

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

Practical Critical Fire Area: (PCFA) The area for foam discharge purposes calculated as one half of the fuselage length multiplied by three times the fuselage width.

HELIPORT CLASSIFICATIONS

NFPA 418 provides groups for heliport protection based on the Practical Critical Fire Area (PCFA). The PCFA is based on many factors that include; the size of helicopters, fuel capacities, actual fire experience and fire tests. The following terms cover the three current heliport classifications.



H-1: Helicopter overall length up to but not including 50 ft (15.2 m), with a practical critical fire area of 375 sq. ft. (34.8 sq. m.).

H-2: Helicopter overall length from 50 ft (15.2 m) up to but not including 80 ft (24.4 m) with a practical critical fire area of 840 sq. ft. (78.0 sq. m.).

H-3: Helicopter overall length from 80 ft (24.4) up to but not including 120 ft (36.6) with a practical critical fire area of 1,440 sq. ft. (133.8 sq. m.).

FOAM FIRE PROTECTION SYSTEMS

NFPA 418 requires a low expansion foam fire fighting system be installed for all roof top heliports. In addition to extinguishment of fires, the foam system can be used to prevent the ignition of fuel spills by covering the spill with a foam blanket. NFPA recognizes two types of protection for heliports.

- The first is foam hose lines, which can be either portable, using an eductor and nozzle or pick-up nozzle with hose and a supply of foam concentrate in pails all stored in a cabinet. It may also be a permanently installed proportioning system piped to fixed hose reels or racks.
- The second method is a fixed proportioning system permanently piped to monitors or fixed spray nozzles strategically located around the periphery of the landing pad.

Exception:

1. Heliports on parking garages, unoccupied buildings or other similar unoccupied structures do not require the installation of a low expansion foam system.
2. For H-1 heliports, two portable foam fire extinguishers each having a rating of 20-

A-160-B shall be permitted to satisfy the requirement.

In addition to the foam system, portable fire extinguishers are also required. A minimum of two means of access to the landing pad shall be provided for firefighters. The means of access may be the same as the means of egress. Hose lines are the preferred method of protection when personnel trained in the operation of the equipment are available. The use of hose lines provides better direction of foam to the fire and faster control of the fire.

FOAM HAND-LINE REQUIREMENTS

The foam system design is based on protection of the Practical Critical Fire Area of the largest helicopter that uses the heliport. NFPA 418 has established the size of the practical critical fire area for each heliport category based on the largest helicopter that may use that category heliport. The size of the practical critical fire area is as follows:

Heliport Category Practical Critical Fire Area:

H-1	375 sq. ft.	(34.8 sq. m.)
H-2	840 sq. ft.	(78.0 sq. m.)
H-3	1,440 sq. ft.	(133.8 sq. m.)

The type of foam concentrate used determines the application rate required for the practical critical fire area. Application rates are as follows:

Type of Foam Concentrate Application Rate:

A.F.F.F.:	0.10 gpm/sq. ft. (4.1 lpm/sq. m.)
Fluoroprotein:	0.16 gpm/sq. ft. (6.5 lpm/sq. m.)
Protein:	0.20 gpm/sq. ft. (8.1 lpm/sq. m.)

The quantity of foam concentrate required is based on two minutes operation at the above application rate. The 2-minute discharge is based on control of the practical critical fire area



within one minute plus a 100% reserve quantity for extinguishment. The water supply shall be from a reliable source and shall be adequate to supply the system at the design rate for the minimum discharge time.

Note: If the actual flow rate exceeds the design requirements, NFPA 418 does not allow for a reduction in run time of foam concentrate. The quantity of foam concentrate shall be based on the actual discharge rate for the specified time. The number of hose lines required has not been defined in NFPA 418. The size and quantity of nozzles for the hose lines is based on the discharge rate required to apply foam to the practical critical area at the specified application rate. After the required flow rate has been determined, select standard nozzles, with available flows that can be handled by one operator. Typical nozzle flows available are 60 gpm (227 lpm), 95 gpm (360 lpm) or 125 gpm (227 lpm).

Design a System

Criteria for designing a fire protection system for a heliport using hose lines is as follows:

1. Identify the Helicopter Category.
2. Determine the best type of foam concentrate to use.
3. Determine the application rate required. This is based on the type of foam concentrate.
4. Determine the method or application.
5. Determine the foam solution requirements for protection of the heliport. This is derived by multiplying the Practical Critical Fire Area by the required application rate.
6. Determine the quantity and size of discharge devices required.
7. Determine the required discharge time for operation to heliport.
8. Determine the quantity of foam concentrate required.
9. Select the proper type of proportioning equipment to meet the needs of the system.

Design Example

Hazard Information:

Type Hazard: Helipad

Largest Helicopter: 110 ft (33.5 m) overall length

Size of Pad: 120 ft x 120 ft (36.6 m x 36.6 m)

Foam Concentrate type: A.F.F.F.

Type of Protection: Hose lines

Proportioning System: To be determined

1. Identify the Helicopter Category.

The largest helicopter has an overall length 110 ft (33.4m). Based on NFPA 418, this would be an H-3 category heliport.

2. Determine the best type of foam concentrate to use.

The foam specified is A.F.F.F. This would be the foam of choice as it has the lowest application rate and is best suited to this type of fire.

3. Determine the application rate required.

NFPA 418 recommends a minimum application rate of is 0.10-gpm/sq. ft. (4.1 lpm/sq. m.).

4. Determine the method or application.

Hose line protection has been specified.

5. Determine the solution requirement.

The area required to be protected is the practical critical fire area. The practical critical fire area for the H-3 category heliport is 1,440 sq. ft. (133.8 sq. m.). The required application rate is 0.10-gpm/sq. ft. (4.1 lpm/sq. m.) as defined previously.

1,440 sq. ft. (133.8 sq. m.) X 0.10-gpm/sq. ft. (4.1 lpm/sq. m.) = 144 gpm (545 lpm) of solution required.



6. Determine the quantity and size discharge devices required.

Based on the required flow of 144 gpm (545 lpm), two standard nozzles with a flow of 95 gpm (360 lpm) would be used.

Total solution flow using two nozzles at 95 gpm each = 190 gpm (720 lpm).

7. Determine required discharge time for operation to heliport.

Based on hose line protection, the required discharge time is 2 minutes.

8. Determine the quantity of foam concentrate.

Since the actual application flow is higher than the design rate, the actual flow would be used to calculate the quantity of foam concentrate required:

Solution rate X % of injection X time = foam concentrate required.

190 gpm (720 lpm) solution X 0.03 X 2 minutes = 12 gallons (46 liters).

Select the proper type of proportioning equipment to meet the needs of the system. Correct proportioning of the foam concentrate is essential to provide the foam solution flow required to protect the hazard. Due to the small size of the proportioning system requirements, line proportioners (assuming enough pressure is available) or small bladder tank would be the best choice.

FIXED SYSTEMS

A fixed foam fire protection system has the foam proportioning equipment permanently piped to fixed application devices. The authority having

jurisdiction (AHJ) or the lack of trained personnel to operate hose lines may require the installation of a fixed system. The application rate for fixed systems would be the same as with hose streams. However, the area of application would be the entire landing pad not just the practical critical area. In addition, the discharge time increases to 5 minutes.

Note: NFPA 418 does not allow for a reduction in time of operation when the actual discharge exceeds the design requirements. The quantity of foam shall be based on the actual discharge rate for the specified time. The fixed installation may use fixed monitors, oscillating monitors or fixed spray nozzles to protect the area. The system design has not been defined by NFPA other than the application rate, area and discharge time. The size, number and location of the discharge devices are left to the discretion of the designer. In addition to the size of the helicopter, other conditions such as wind conditions, points of egress, approach and departure patterns should be considered. Also, the system discharge must cover all sides of the helicopter, as there is no way to determine the origin of a fire. The number of discharge devices required is dependent on the flow of the device, range, and spray pattern.

Design of System

Criteria for designing a fire protection system for a heliport using fixed discharge devices is as follows:

1. Identify the Helicopter Category.
2. Determine the best type of foam concentrate to use.
3. Determine the application rate required. This is based on the type of foam concentrate.
4. Determine the method or application.
5. Determine the solution requirement for protection of the heliport. This is derived at by multiplying the total landing pad area by the application rate.



6. Determine the quantity and size of discharge devices required.
7. Determine the required discharge time for operation to heliport.
8. Determine the quantity of foam concentrate required.
9. Select the proper type of proportioning equipment to meet the needs of the system.

Design Example

Hazard Information:

Type of Hazard: Helipad

Largest Helicopter: 110 ft (33.5 m) overall length

Size of Pad: 140 ft x 160 ft (42.6 m x 48.7 m)

Foam Concentrate: A.F.F.F.

Type of Protection: Oscillating monitors

Proportioning System To be determined

1. Identify the Helicopter Category.

The largest helicopter has an overall length 110 ft (33.4m). This would be an H-3 category heliport.

2. Determine the best type of foam concentrate to use.

The foam concentrate specified is A.F.F.F. This would be the foam of choice as it has the lowest application rate and is best suited to this type of risk.

3. Determine the application rate required.

Based on NFPA 418, the application rate for A.F.F.F. concentrate is 0.10-gpm/sq. ft. (4.1 lpm/sq. m.)

4. Determine the method or application.

Oscillating monitors have been specified.

5. Determine the solution requirement.

The area required to be protected is the total landing pad area. Based on a 140 ft x 160 ft (42.6 m x 48.7 m) landing pad, the area to be protected is 22,400 sq. ft. (6,827 sq. m.). The required application rate is 0.10-gpm/ sq. ft. (4.1 lpm/sq. m.) as defined previously.

22,400 sq. ft. (6,827 sq. m.) fire area X 0.10 gpm/ sq. ft. (4.1 lpm/ sq. m.) = 2,240 gpm (8,478 lpm) of solution required.

6. Determine the quantity and size discharge devices required.

Based on the required flow of 2,240 gpm (8,478 lpm), four standard oscillating monitors with a flow of 600 gpm (2,271 lpm) would be used.

Total solution flow to the hazard = 600 gpm (2,271 lpm) Solution flow x 4 nozzles = 2,400 gpm (9,084 lpm) total solution flow.

7. Determine required discharge time for operation to heliport.

Based on fixed discharge protection, the required operating time is 5 minutes.

8. Determine the quantity of foam concentrate.

Since the actual application flow is higher than the design rate, the actual flow would be used to calculate the quantity of foam concentrate required:

Solution rate X % of injection X time = foam concentrate required.

2,400 gpm (9,084 lpm) solution X 0.03 X 5 minutes = 360 gallons (1,362 liters).



ALTERNATIVE:

Fixed nozzles could be strategically placed around the periphery of the helipad, supplied by a ring-main. Standard fixed nozzles, similar to the NT-C series can be used. These nozzles have both adjustable flow rates and adjustable discharge patterns and are ideally suited to this application.

To calculate the number of nozzles required and the flow rate for each nozzle, the following information is used:

Periphery:

{140 ft + 160 ft.} (42.6 m + 48.7 m) X 2 = 600 ft. (183 m.),

Nozzle spacing:

40 ft. (12 m.).

Number of nozzles:

600 ft. (183 m.) ÷ 40 ft. (12 m.) = 15.

Flow rate for each nozzle:

2,240 gpm (8,478 lpm) ÷ 15 =
150 gpm (565 lpm) each.

Select the proper type of proportioning equipment to meet the needs of the system. Correct proportioning of the foam concentrate is essential to provide the foam solution flow required to protect the hazard. Due to the small size of the proportioning requirements, a small bladder tank would be the best choice of proportioning systems. The proportioning system shall have sufficient pressure to operate against the highest expected residual water pressure as determined by hydraulic calculation of the system piping arrangement.

PROPORTIONING SYSTEMS

Foam systems for heliports can be as simple as a hose rack and hose connected to a water supply, a foam concentrate supply, and a foam pick up type nozzle, or line proportioner and nozzle combination. Although, any type of proportioning system can be used for heliports, usually the system demand is very small and the proportioning system is very simple. In addition, most heliport systems are operated manually. Hose line operation is ideally suited to the use of eductors, either portable or permanently piped to the system, or small bladder tank systems. For fixed applications the bladder tank is the preferred method of proportioning. The foam proportioning system must have a sufficient foam concentrate supply to allow system operation at the required discharge rate for the required discharge time as specified. NFPA 418 does not allow a proportionate reduction in system operating time, when the calculated system flow rate exceeds the design flow. Therefore, the quantity of foam concentrate must be adequate to supply the actual flow for the required time.

RECOMMENDED FOAM CONCENTRATES

The normal type of fire that occurs at a heliport is a spill fire with fuel depth of about 1". Heliports require a foam with ability to quickly knock down the fire to prevent damage to the helicopter and landing pad. Therefore, aqueous film-forming foams (A.F.F.F.) are the agent of choice for this application.

Protein and fluoroprotein type foam concentrates can be used, however they require higher application rates, air-aspirating discharge devices and do not provide the quick knockdown ability of A.F.F.F. In addition, they are not as fluid as A.F.F.F. and cannot flow as quickly across the deck and would typically take longer to extin-



guish the fire. Fuels typically found in this type of application do not normally contain polar solvents. Although the Alcohol resistant - aqueous film-forming foams (AR-A.F.F.F.) will function similar to the standard A.F.F.F. they are not typically used in protection of this type of hazard.

FOAM SYSTEM AUTOMATION

Because most helidecks are usually manned during operation, automatic detection systems are normally not used to detect the fire and initiate operation of the system. In addition, due to the configuration of a helipad landing area, automatic detection of a fire would not only be difficult, but it would likely be unreliable. Thus any automation might only consist of a manual pull station at strategic locations such as the point of egress, to remotely initiate the system and alert the proper authorities. Detection and actuation equipment should be designed in accordance with the appropriate sections of NFPA 72.

PORTABLE FIRE EXTINGUISHERS

At least one portable fire extinguisher as specified in the following table shall be provided for each takeoff and landing area, parking area and fuel storage area. Fire extinguishers shall comply with NFPA 10, Standard for portable fire extinguishers.

Helicopter Minimum Category Overall Length Rating:

H-1 Up to but not including 50 ft (15.2 m).

30-A-240-B.

H-2 From 50 ft (15.2 m) up to but not including 80 ft (24.4 m).

30-A-240-B.

H-3 From 80 ft (24.4 m) up to but not including 80 ft (24.4 m).

30-A-240-B.





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Code of Federal Regulations TITLE 46 – SHIPPING - USCG Department of Transportation

The following requirements apply for offshore applications

Sec. 108.486 Helicopter decks.

At least two of the accesses to the helicopter landing deck must each have a fire hydrant on the unit's fire main system located next to them.

Sec. 108.487 Helicopter deck fueling operations.

(a) Each helicopter landing deck on which fueling operations are conducted must have a fire protection system that discharges protein foam or aqueous film forming foam.

(b) A system that only discharges foam must:

(1) Have enough foam agent to discharge foam continuously for at least 5 minutes at maximum discharge rate;

(2) Have at least the amount of foam agent needed to cover an area equivalent to the swept rotor area of the largest helicopter for which the deck is designed with foam at:

(i) If protein foam is used, 6.52 liters per minute for each square meter (0.16 gallons per minute for each square foot) of area covered for five minutes:

(ii) If aqueous film forming foam is used, 4.07

liters per minute for each square meter (0.1 gallons per minute for each square foot) of area covered for five minutes; and

(3) Be capable of discharging from each hose at 7 kilograms per square centimeter (100 pounds per square inch) pressure.

(i) A single foam stream at a rate of at least 340 liters (90 gallons) per minute; and

(ii) A foam spray at a rate of at least 190 liters (50 gallons) per minute.

(c) Each system must have operating controls at each of its hose locations, be protected from icing and freezing, and be capable of operation within 10 seconds after activation of its controls.

(d) Each system must have at least one hose at each of the two access routes required by Sec. 108.235(f) of this part. Each hose must be reel mounted and long enough to cover any point on the helicopter deck. Each hose that discharges foam must have a nozzle that has foam stream, foam spray, and off positions.

Sec. 108.489 Helicopter fueling facilities.

(a) Each helicopter fueling facility must have a fire protection system that discharges one of the following agents in the amounts prescribed for the agents over the area of the fuel containment systems around marine portable tanks, fuel transfer pumps and fuel hose reels:

(1) Protein foam at the rate of 6.52 liters per minute for each square meter (0.16 gallons per



minute for each square foot) of area covered for five minutes.

(2) Aqueous film forming foam at the rate of 4.07 liters per minute for each square meter (0.1 gallon per minute for each square foot) of area covered for five minutes.

(3) 22.5 kilograms (50 pounds) of dry chemical (B-V semi-portable) for each fueling facility of up to 27.87 square meters (300 square feet).

(b) If the fire protection system required by Sec. 108.487 of this subpart is arranged so that it covers both a helicopter fueling facility and a landing deck, the system must have the quantity of agents required by this section in addition to the quantity required by Sec. 108.487.





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U. K. Regulations International Maritime Organisation (IMO) for MODU (Mobile Offshore Drilling Units).

The following requirements are taken from the Code for the Construction and Equipment of Mobile Offshore Drilling Units, Chapter 9, Fire Safety.

Paragraph 9.11.2 states:

On any helicopter deck there should be provided and stored near the means of access to that deck:

- .1 at least two dry powder extinguishers having a total capacity of not less than 45 kg.
- .2 a suitable foam application system consisting of monitors or foam-making branch pipes capable of delivering foam solution to all parts of the helicopter deck at a rate of not less than 6 l/min for at least 5 minutes for each square metre of the area contained within a circle diameter "D", where "D" is the diameter in metres across the main rotor and tail rotor in the fore-and-aft line of a helicopter with a single main rotor and across both rotors for a tandem rotor helicopter. The Administration may accept other fire-fighting systems, which provide a fire-extinguishing capability at least as effective as the required foam application system.
- .3 carbon dioxide extinguishers of a total capacity of not less than 18 kg. or equiva-

lent, one of these extinguishers being so equipped as to enable it to reach the engine area of any helicopter using the deck; and...

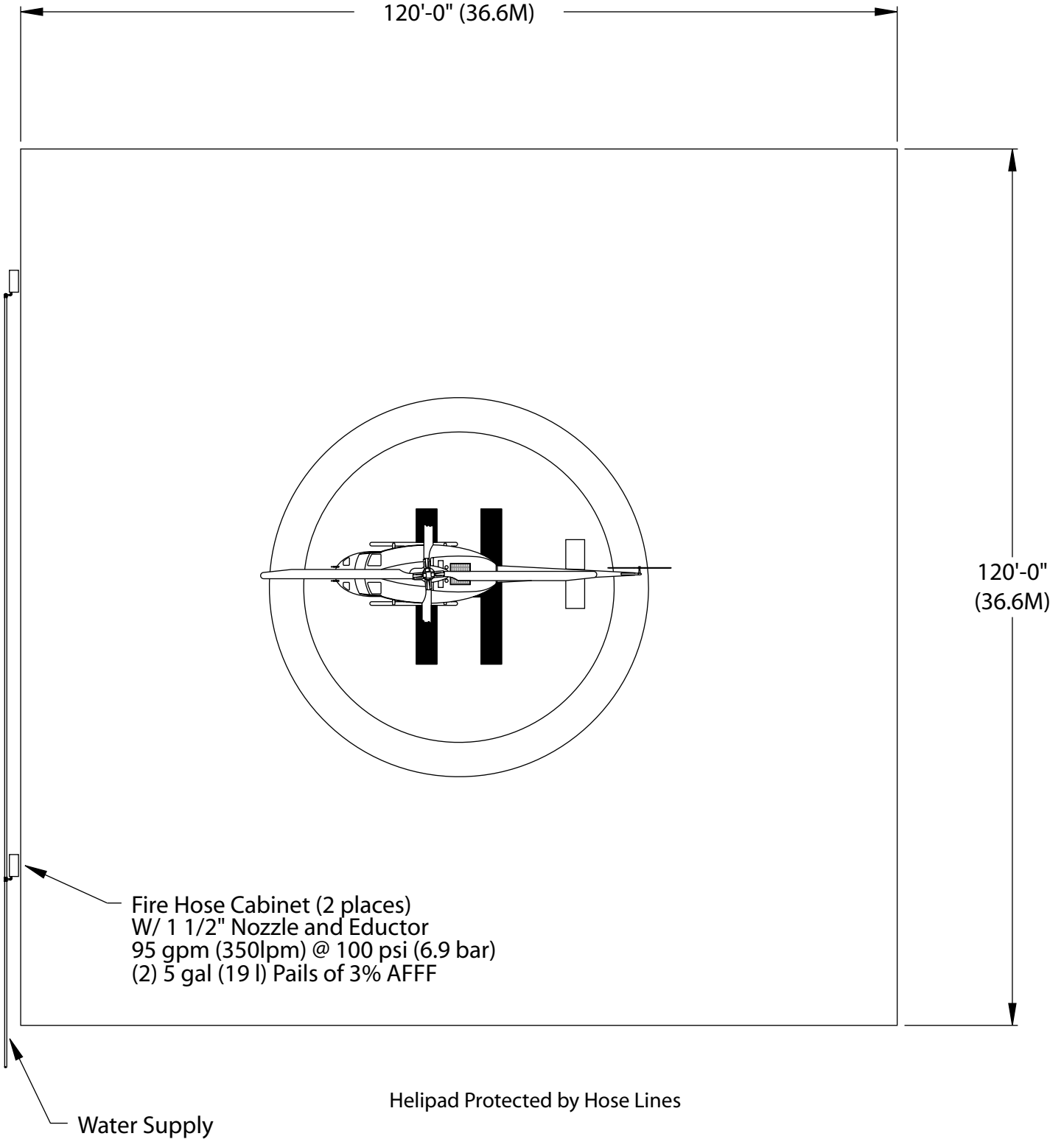
- .4 at least two dual-purpose nozzles and hoses sufficient to reach any part of the helicopter deck.





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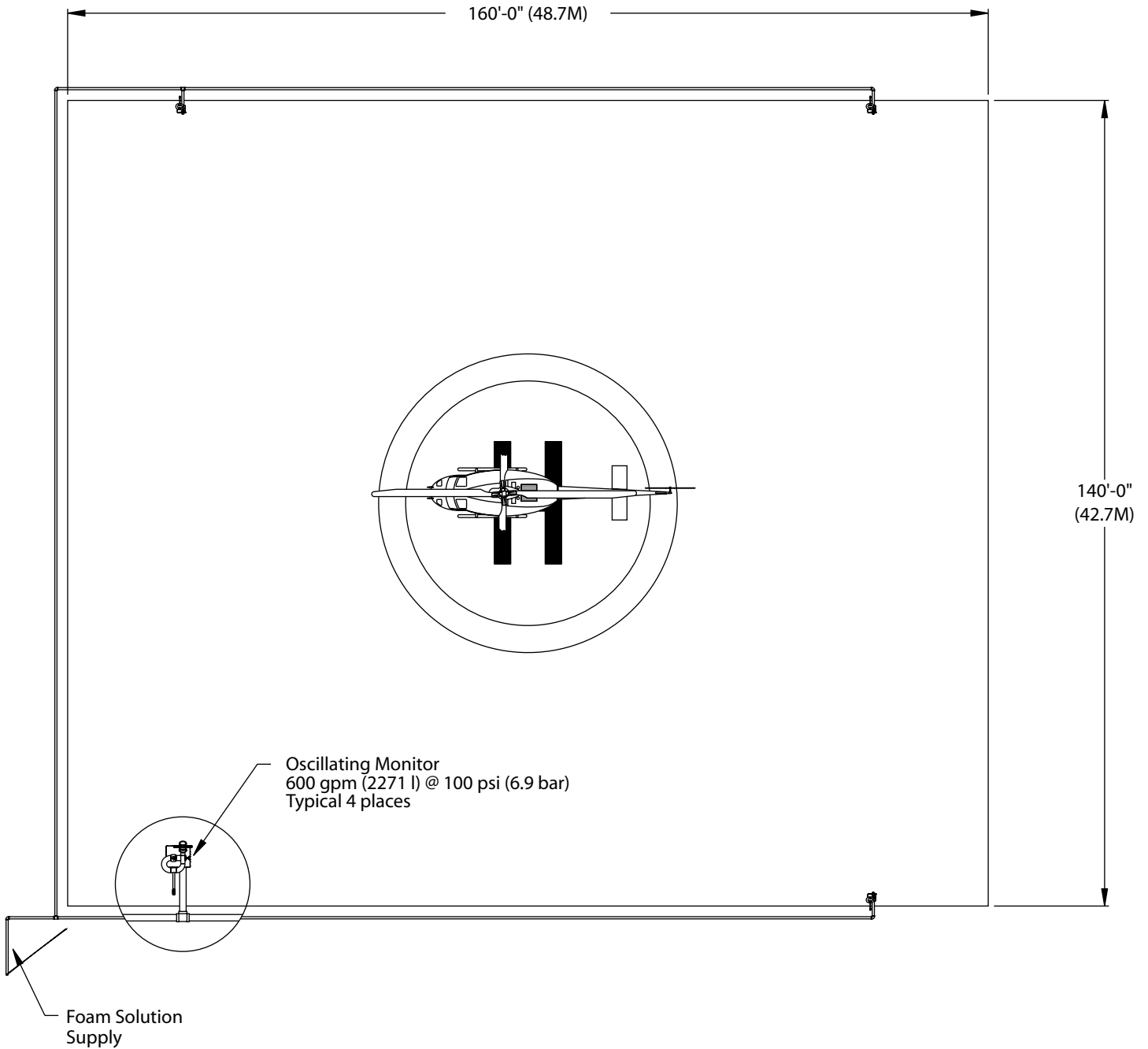
HELIPAD PROTECTED BY HAND LINES





HELI-DECKS & HELI-PORTS

HELIPAD PROTECTED BY FIXED OSCILLATING MONITORS



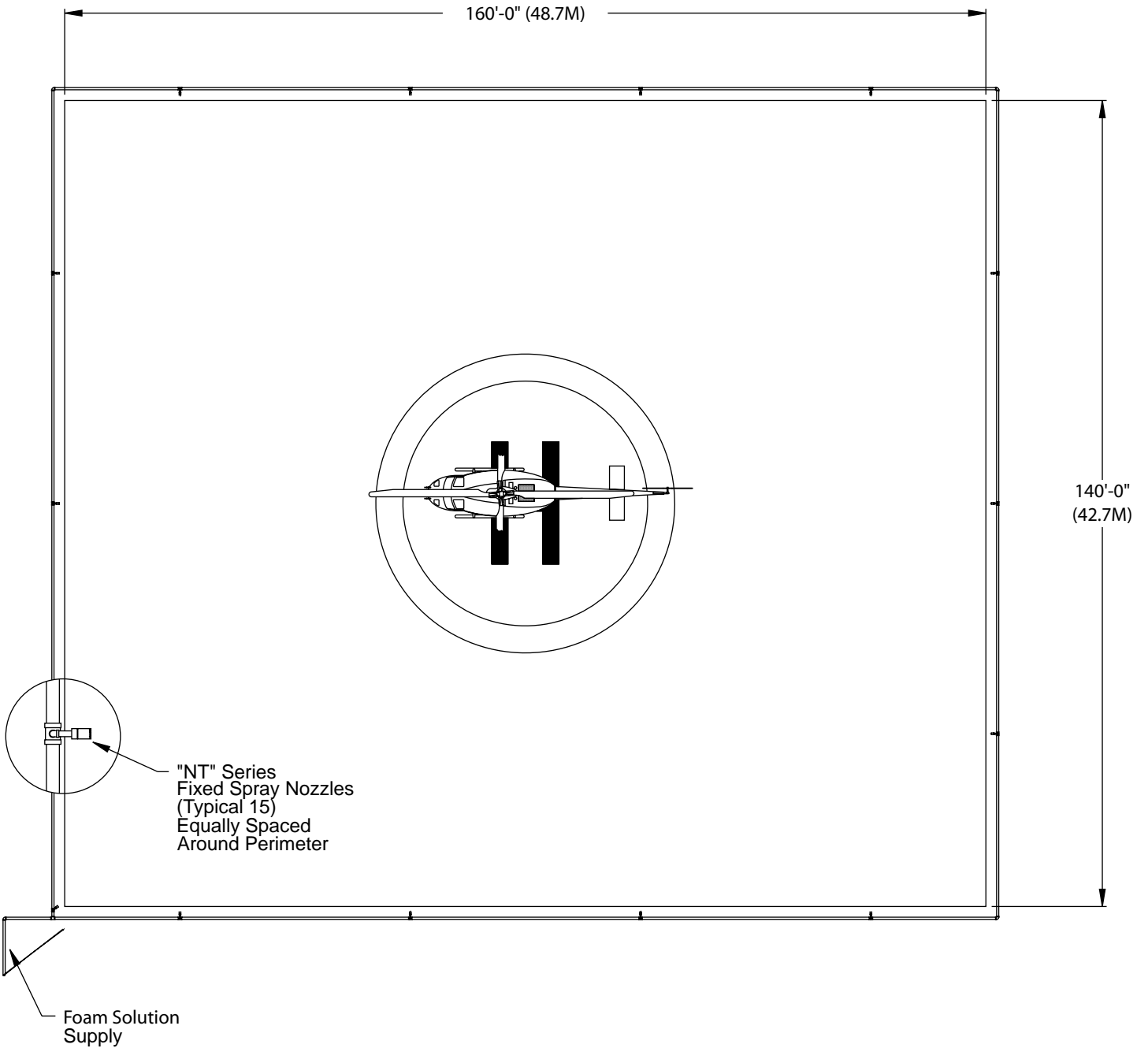
Helipad Protected by Fixed Oscillating Monitors





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HELIPAD PROTECTED BY FIXED NOZZLES



Helipad Protected by Fixed Nozzles

