

AIRCRAFT HANGAR FIRE PROTECTION GUIDANCE

FOAM CODE COMPLIANCE

Publication of National Fire Protection Association (NFPA) 409, *Standard on Aircraft Hangars*, 2022 edition, has created confusion on foam fire suppression system requirements. The flow chart (below) provides guidance on various options to achieve code compliance relative to fire suppression systems based on the International Building Code® (IBC), 2021 edition; International Fire Code® (IFC), 2021 edition; and NFPA 409, 2016 edition. NFPA 409, 2022 edition will not be referenced by the IBC or IFC until the 2024 edition.

This document is intended to provide general understanding of hangar foam suppression system requirements, options and alternates. It is highly recommended that the services of a licensed and experienced design professional be utilized for the design and permitting process to achieve best success for the project.

STEP 1

Determine applicable codes and standards, adopted editions, and local amendments.

International Building Code, International Fire Code

NFPA 409, *Standard on Aircraft Hangars*

STEP 2

Determine Hangar Group Type Per NFPA 409 and IBC Table 412.3.6.



GROUP I

DOOR HEIGHT: 28 feet or higher OR
HANGAR BAY: over 40,000 sf
FOAM: Typically required. *Go to Step 4.*



GROUP II

DOOR HEIGHT: 28 feet or less AND
HANGAR BAY: typically 12,000–40,000 sf
FOAM: May not be required. *Go to Step 3.*



GROUP III

DOOR HEIGHT: 28 feet or less AND
HANGAR BAY: typically less than 12,000 sf, may be up to 30,000 sf (*see note*)
FOAM: May not be required. *Go to Step 3.*

Note: Hangar construction type and fire rating may allow hangar bay area increases (IBC Table 412.3.6)

AIRCRAFT HANGAR FIRE PROTECTION GUIDANCE

STEP 3

If a Group II hangar and IBC is applicable:

Is this an FBO with separate repair facilities on site and used for storage of transient aircraft?

YES

STOP. Foam fire suppression not required. (IBC Section 412.3.6 “Exception”).

Fire sprinklers may still be required due to building area. Verify with local code requirements.

NO

Continue to Step 4.

STEP 4

Determine if foam is required by hangar group and operations.



GROUP I

>28 FT. DOOR HEIGHT
OR >40,000 SF

Foam Required

GROUP II

>28 FT. DOOR HEIGHT OR
>12,000 SF OR < 40,000 SF

Foam Required

GROUP III

<28 FT. DOOR HEIGHT OR <12,000 SF,
may be up to 30,000 SF
(see note in Step 2)

Any Hazardous Operations?

Hazardous operations are defined as fuel transfer, welding, torch cutting, torch soldering, doping or spray painting.

YES

Foam Required

NO

No Foam Required
(IBC 412.3.1 and
NFPA 409 8.8.1.2)

Note: NFPA 409's use of "hazardous operations" in a Group III hangar is NOT the same as "hazardous operations" in a Group II hangar.

Foam fire suppression system required. See next page for potential alternatives to the foam requirement.



AIRCRAFT HANGAR FIRE PROTECTION GUIDANCE

If foam is still required, consider the following:



- Utilize the services of a licensed and experienced design professional (Fire Protection Engineer and/or Architect) to develop an alternative design approach in lieu of foam. Both the IBC/IFC and NFPA provide for alternative approaches if the prescriptive requirements of the code cannot be achieved.

- Discuss the use of NFPA 409, 2022 edition with the Authority Having Jurisdiction (AHJ). If acceptable:

Group I or II Hangar: Utilize the Fire Risk Assessment (Chapter 4) or the Performance-Based Design (Chapter 5) approach to eliminate foam.

Group II Hangar: Foam may be eliminated if none of the following hazardous operations are performed within the hangar: fuel transfer, welding, torch cutting, torch soldering, doping, hot work, spray painting, oxygen service, composite repairs, fuel system or fuel tank maintenance, aircraft cabling, wiring changes or initial electrical system testing.



- Use the Alternative Means and Methods Request (AMMR) process permitted by the IBC/IFC and the local AHJ.

These alternative approaches typically require the integration of a Fire Protection Engineer and/or Architect to assist in evaluation, assembly of the reports and coordination with the AHJ.

- Evaluate if the fire rating of the hangar can be increased.

For example, a 20,000 square foot Group II hangar (typically required to have foam) can be downgraded to a Group III hangar (without foam) by increasing the fire rating of the structure. (IBC Table 412.3.6)

- Decrease the fire area of a single hangar by creating multiple hangars separated by 2-hour fire walls, thus limiting the hangar to Group II or Group III. (IBC 412.3.6.2)

- Separate accessory spaces, such as offices and shops, by a 1-hour fire barrier wall (gypsum board, concrete block or concrete) to reduce the hangar fire area. Accessory spaces can then be excluded from the hangar area used to determine the hangar “group.” (IBC 412.3.6.2)

- Use high-expansion foam (no PFAS) with foam generators at the ceiling or synthetic fluorine free foam (no PFAS) with monitors (canons) along the perimeter. In a Group II or Group III hangar, consider a closed-head sprinkler system using synthetic fluorine free foam.

- Most importantly, engage the services of a qualified Fire Protection Engineer and/or Architect to start discussions with the AHJ. The design professional must have experience with aircraft hangars, current protection methods and applicable codes/standards.

AIRCRAFT HANGAR FIRE PROTECTION GUIDANCE

Recommendations to Reduce Inadvertent (Accidental) Discharge

Keep in mind that inadvertent (accidental) foam system discharges have occurred due to inappropriate activation of the foam releasing system (the electronic components). NFPA 409 only requires the foam system to discharge upon activation of the ceiling sprinkler system waterflow switch or a manual release station. These are the minimum requirements; however, additional features can be added to increase the robustness and reliability of the foam releasing system. Consider the following:

Use optical flame detection in lieu of the fire sprinkler waterflow switch with AHJ approval.

- Less prone to inadvertent activation
- More robust device
- Can be sequenced to require activation of two flame detectors before releasing foam
- Use multi-spectrum infrared flame detectors with no UV component
- Some landing lights utilize a light within the UV spectrum that could cause an inadvertent activation

Use two methods of activation to eliminate a single point of failure with AHJ approval.

Methods include:

- Two optical detectors
- One optical detector and a sprinkler waterflow switch
- One optical detector and a ceiling heat detector
- One ceiling heat detector and a sprinkler waterflow switch

Use weatherproof/weather resistant manual release stations mounted in weather resistant covers.

- Provide gasketing around the cover to reduce water entry
- Install with conduit entering from the bottom of the manual release station to reduce water/condensation entry into the device

Use a foam releasing control unit (panel) separate from the building fire alarm system.

- Reduces potential for discharge when testing the fire alarm system
- Isolates all foam initiating features in one separate location

Discuss the use of abort/stop stations with the AHJ.

- Abort stations can hold discharge when first activation signal occurs
- Stop stations (combined with special valves) located adjacent to manual release stations can stop the flow of foam once started

Most importantly, engage the services of a qualified design professional (Fire Protection Engineer or Architect), experienced in aircraft hangars and current fire protection methods.

RESOURCES | LINKS

Click on report names below to view online.

- [NATA Fire Marshal Toolkit >](#)
- [Review of Foam Fire Suppression System Discharges in Aircraft Hangars, November 2019 >](#)
- [Review of Foam Fire Suppression System Discharges in Aircraft Hangars, February 2021 >](#)
- [Performance Criteria for Aircraft Hangar Fire Protection Systems, January 2022 >](#)
- [NFPA 409, Standard on Aircraft Hangars, 2022 edition >](#)
- [US Air Force Foam Sundown Policy, November 2021 >](#)



AIRCRAFT HANGAR FIRE PROTECTION GUIDANCE

Top 10 Most Frequently Asked Questions about Foam Requirements

Q: Are Fire Marshals required to use the 2022 edition of NFPA 409? **A:** Each local authority adopts new versions of NFPA standards at different cycles. Since NFPA 409 is typically adopted by reference in the IBC/IFC, these codes still reference the 2016 NFPA 409. The 2022 edition may not be adopted until the 2024 IBC/IFC are adopted.

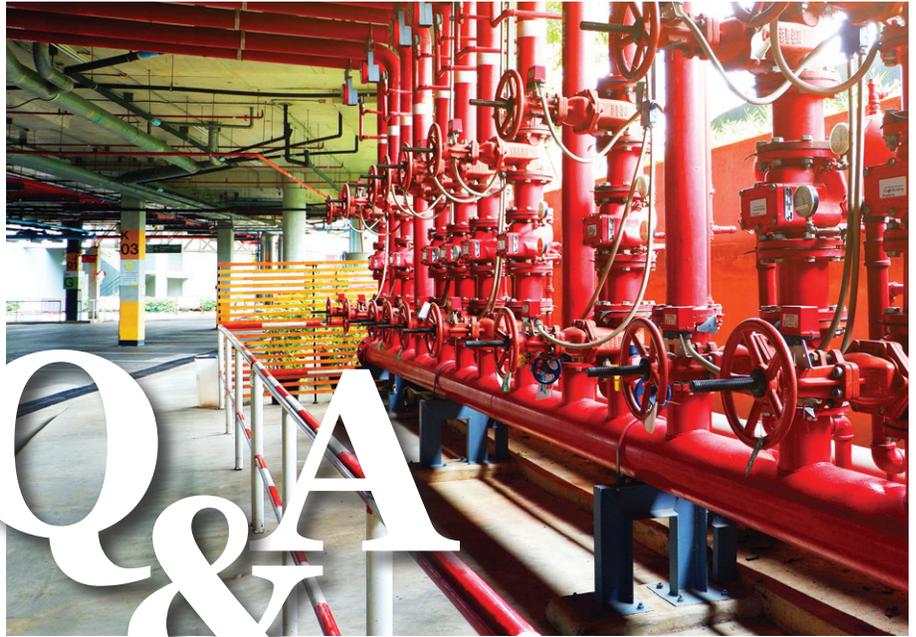
Q: Why are Fire Marshals still enforcing the 2016 edition of NFPA 409? **A:** NFPA 409 is typically adopted through reference with the IBC/IFC and these codes will not adopt the 2022 edition until the 2024 edition is released.

Q: How often does the NFPA 409 standard get updated?
A: Every five years.

Q: How often does the IBC/IFC get updated? **A:** Every three years.

Q: Does the IBC/IFC take precedence over NFPA 409? **A:** Yes, the IBC/IFC reference NFPA 409 for fire suppression requirements. Where NFPA 409 provides non-suppression design requirements in conflict with the IBC/IFC, the IBC/IFC shall govern unless the entirety of NFPA 409 has been adopted by the local AHJ. It is advised to consult the local AHJ if a conflict occurs.

Q: What is the relationship between the IBC/IFC and NFPA 409? **A:** The IBC/IFC provide reference to NFPA 409 for fire suppression requirements.



Q: What are my options for new construction if my Fire Marshal is not willing to follow the 2022 edition of NFPA 409? **A:** If the code does not allow for removal of the foam system for new construction, the IBC/IFC allow for the use of an Alternate Means and Methods Request (AMMR) approach. Many AHJs have a standard format to use for this approach.



Q: When should I use the AMMR process? **A:** An AMMR should be used if a prescriptive approach to code compliance, or “by the book,” cannot be used to eliminate foam.

Q: When should I consider using a high-expansion foam system?
A: Whenever foam is required.

High-expansion (hi-ex) foam does not contain PFAS and typically requires less foam concentrate than other foam systems. In addition, high-expansion foam systems use generators that mount up in the ceiling area so they do not take up floor area in the hangar.

Q: Do high-expansion foam systems use AFFF? **A:** No. AFFF (aqueous film forming foam) contains PFAS, which has become an environmental hazard, and makes very small bubbles that float on the hangar floor. Hi-ex does not contain PFAS, discharges through a generator at the ceiling level, and drops bubbles down to the hangar floor. Hi-ex systems are designed to fill the hangar to at least 1 meter of foam bubbles.