FOAM SYSTEMS

APPLICATION CASE STUDY

Foam Systems for Group II Hangars

Overview

As we head into a new century, one of the trends of the aviation industry is the expanded use of private and corporate jets and the advent of fractional ownership of small jets. Owning or time-sharing of corporate jets gives large companies flexibility, reliability, and potential cost savings. The corporate jets are stored and maintained in private hangars typically classified as Group II Hangars. More and more hangars of this size are being built or re-commissioned within this growing industry segment.

Per NFPA 409 *Standard on Aircraft Hangars*, a Group II Hangar is defined as a hangar having an aircraft access door height of 28 ft. (8.5 m) or less and a single fire area not exceeding 40,000 ft.^{2} (3716 m^2).

There are four options to choose from when designing a Foam System for a Group II Hangar:

a) Designed per the criteria of Group I Hangars which includes an automatic foam-water deluge sprinkler system. If air-aspirating discharge devices are installed, the discharge rate can be reduced from 0.20 gpm/ft^2 (8.1 Lpm/m^2) to a minimum of 0.16 gallons of foam solution/minute/ft^2 (6.5 Lpm/m^2) of floor area.

b) A combination of automatic sprinkler protection and an automatic, low-level, low-expansion foam system.

c) A combination of automatic sprinkler protection and an automatic, high-expansion foam system.

d) A closed-head foam-water sprinkler system.

It is important that the designer of the fire protection system explore all the options before making a final decision. It should also be noted that the military guidelines are similar to the above NFPA options. This particular case study will describe two separate Group II Hangar projects, where one was designed per Option **(a)** and the other per Option **(c)**. The details of each project and reasons for using a particular option over the others are explained.

Application/Design Criteria

Los Angeles Corporate Hangar

J.M. Cardin Sprinkler Company of Los Angeles, CA recently installed an Ansul foam system for the Air Shamrock Corporate Hangar just outside of Los Angeles. The size of the hangar is 23,180 ft^2 (2153 m^2). Adequate water supply and water supply pressure were available at the facility. Therefore, the designers determined it was best to use a foam-water deluge sprinkler system with an automatic detection system.

The total sprinkler water flow required amounted to 4,583 gpm (17,348 Lpm), based on a 0.16 gpm/ft^2 (6.5 Lpm/m^2) design density over the entire hangar storage area. This included sprinkler system overage plus the water required for two foam hand hose systems - 120 gpm (454 Lpm). Per the guidelines, each hand hose line is to have sufficient foam-liquid concentrate - 36 gallons (136 L) - to provide operation for a period of 20 minutes at a foam solution discharge rate of 60 gpm (227 Lpm). This could be supplied by using two pre-packaged Ansul 36-gallon (136 L) bladder tank/foam stations, incorporating the foam concentrate requirements - 72 gallons (273 L) - into the main system bladder tanks; or by combining an eductor, hose reel with nozzle, and a 55-gallon (208 L) drum of foam concentrate.

The total foam concentrate required was determined by the following equation:

Total System Flow X Duration (min.) X Foam % = **Foam Concentrate**

4,583 gpm X 10 min. X 0.03 = 1,375 gallons

17,348 Lpm X 10 min. X 0.03 = 5205 Liters

Based on the quantity of foam, it was determined that a balanced pressure bladder tank system would be installed. Also, because of the simple design, bladder tanks would require very little maintenance and would be less expensive than pump proportioning systems.

Project Scope

Per NFPA 409, the foam concentrate supplied with the systems is to be listed for use with the discharge devices, such as sprinklers and nozzles. For this project, ANSULITE® 3% AFFF was the foam concentrate selected. NFPA 409 also requires that a reserve supply of foam be available and directly connected to the main system supply.

The Ansul Foam System Scope of Supply was:

2 – Horizontal Bladder Tank, 1,400-gallon (5300 L)

2 – Between Flange Proportioner, 6"

2 – Hydraulic Concentrate Control Valve, 2"

2 – Hose Reel Assemblies with 1-1/2" Eductor and 60 gpm (227 Lpm) Nozzle

54 - ANSULITE® 3% (AFC-3A) AFFF Concentrate, 55-gallon (208 L) Drum

Application/Design Criteria

Philadelphia Corporate Hangar

Option **(c)**, a combination of automatic closed-head water sprinkler system and automatic high-expansion foam system, was chosen for three Philadelphia Corporate Hangars located at Philadelphia International Airport. The hangar sizes were two at 18,700 ft^2 (1737 m^2) and one at 24,300 ft^2 (2258 m^2). Majek Sprinkler of Thorofare, New Jersey installed these systems.

For this project, the owner's representative did a complete evaluation of all four options and the overall economic impact of each. The foam equipment scope for the high-expansion option worked out to be the highest initial cost, but the overall installed system cost was substantially lower. The reasons for the lower installed cost and the selection of the high-expansion foam option were mainly due to:

- A substantial reduction in required water supply and storage capacities
- Much smaller fire pumps
- Downsizing of the drainage systems, fuel/water separator systems, and associated containment
- Environmentally the best option

High-expansion foam systems have an expansion ratio typically greater than 500:1 making them suitable for total flooding applications and three-dimensional hazards. High-expansion foam output is measured by volume output rather than application rate as is typical of low-expansion foam systems. The application rate is to achieve a minimum of 3 cfm/ft^2 (0.9 $m^3/min/m^2$), with an overhead sprinkler system design density of 0.17 gpm/ft^2.(6.92 Lpm/m^2). Foam breakdown by sprinklers and normal foam shrinkage and leakage must also be factored into the rate.

Using the larger hangar as an example, the foam calculations are as follows:

Hangar Floor Area X Application Rate = **Generator Output**

24,300 ft^2 X 3 cfm/ft^2 = 72,900 cfm
2258 m^2 X 0.914 $m^3/min/m^2$ = 2064 m^3/min

Application Rate X Area X Foam Breakdown = **Sprinkler Breakdown**

0.17 gpm/ft^2 X 5,000 ft^2 X 10 cfm/gpm = 8,500 cfm
6.92 Lpm/m^2 X 465 m^2 X 0.075 $m^2/m/Lpm$ = 241 m^3/m

Total Output x 1.15 (Shrinkage) x 1.1 (Leakage) = **Total Generator Output**

(72,900 cfm + 8,500 cfm) X 1.15 X 1.1 = 102,971 cfm
(2064 m^3/m + 241 m^3/m) X 1.15 X 1.1 = 2916 m^3/m

Using 60 psi (4.14 bar) inlet pressure, each JET-X-15A generator will discharge approximately 15,000 cfm (425 m^3/min) of expanded foam, using 129 gpm (488 Lpm) of foam solution. Therefore, seven generators were chosen with a total solution flow of 903 gpm (3418 Lpm).

Total Foam Solution X Duration X Foam % = **Total Foam Concentrate**

903 gpm X 12 min. X 0.0275 = 298 gallons
3418 Lpm X 12 min. X 0.0275 = 1128 Liters

Total System Flow Requirement:

Foam Solution + Foam-Water Hose Demand + Sprinkler Demand = **Total Flow**

903 gpm + 120 gpm (2 units @ 60 gpm) + 850 gpm (.17 gpm/ft^2 X 5,000 ft^2) = 1,873 gpm
3418 Lpm + 454 Lpm (2 units @ 227 Lpm) + 3218 Lpm (6.92 Lpm/m^2 X 465 m^2) = 7090 Lpm

The calculation shows that with high-expansion foam, the total system flow requirements will greatly decrease as compared to the other options. This has led to a resurgence of high-expansion foam to protect Group II hangars. Other recently installed Ansul high-expansion foam systems are in Manchester, NH and West Palm Beach, FL, in addition to a system for the Michigan Air National Guard at Selfridge Air Force Base. Roof vents and automatic closure of hangar doors are requirements of these systems.

Project Scope

A balanced pressure bladder tank system with a reserve high-expansion concentrate supply was provided for all three hangars. JET-X® high-expansion foam concentrate is listed for use with the provided high-expansion foam generators. JET-X concentrate is a synthetic based foam that is proportioned into the system at 2.75% and extinguishes the fire by cooling, smothering, penetrating, and insulating. The JET-X generators are water-driven at a minimum of 50 psi (3.5 bar) inlet pressure with no electrical hook-up required. High-expansion foam is created by moving large volumes of air through a perforated screen which is coated with high-expansion foam solution. The JET-X-15A generator can achieve an output greater than 19,000 cfm (538 m^3) of expanded foam solution.

The Ansul Foam System total Scope of Supply for the three hangars was as follows:

4 - Vertical Bladder Tank, 300-gallon (1136 L)

2 - Vertical Bladder Tank, 400-gallon (1514 L)

3 - Between Flange Proportioners, 6"

3 - Hydraulic Concentrate Control Valve

18 - JET X-15A (UL) Generator

6 - Hose Reel Station, 36-gal. (136 L)

33 - JET-X® Foam Concentrate, 55-gallon (208 L) Drum

48 - ANSULITE® 3% (AFC-3A) AFFF Concentrate, 5 gallon (19 L) Pail

Conclusion

These two projects involved similarly sized Group II hangars, but with two completely different foam system designs. For both cases; the owner, design engineer, and sprinkler contractor weighed all the options up-front and selected a foam system that best suited the resources at their facilities. In the end, all were pleased with the installed systems. Ansul can supply equipment for all the options offered by NFPA 409. Contact Ansul early in the design phase of hangar projects so we can assist with the scope of supply and pricing options. Ansul also has detailed design specifications for both Group I and II Hangars.

When designing foam systems for Group II Hangars, always take into account the following:

- There are four options offered by NFPA 409. Each can provide a distinct economic advantage based on the facility resources and location.
- Thoroughly review the total water supply and foam system demand. If the expense of adding water (fire pumps, storage tanks) is great, the high-expansion option may become the most cost effective.
- Factor-in the cost of discharged foam solution containment and collection, including the drainage and containment measures.
- Review additional requirements such as ventilation and detection/control to assure the total fire protection system requirements are met.

If you have questions concerning the design of foam systems for hangar protection, please call Ansul Technical Services at 800-862-6785 or 715-735-7415. See our Web Site at www.ansul.com.

ANSUL®

ISO 9001 Registered

