WAREHOUSE SYSTEMS

WAREHOUSE FOAM FIRE PROTECTION SYSTEMS

DESCRIPTION

Due to the high risk associated with flammable liquids stored and handled in warehouses, most insurance companies now require that the owner install a foam/water sprinkler system. There are two different methods of supplying this fire protection:

1. Foam/Water Sprinkler System.
   - **a.** Closed Head
   - **b.** Open Head/Deluge

2. High Expansion Foam System.

This section deals only with sprinkler systems.
High expansion systems are the subject of a separate section of this manual.

There are four different design criteria/codes for which a foam or water sprinkler system could be designed.

> **NFPA 13** Installation of Sprinkler Systems, should be consulted with regard to the actual installation of the sprinkler system.
> **NFPA 16** Installation of Foam-Water Sprinkler and Foam Water Spray Systems.
> **NFPA 30** Flammable and Combustible Liquids Code.
>
> The Authority Having Jurisdiction may have their own design criteria with regard to application rates and discharge duration.

It is not the intention of this manual to recommend which system is preferred. Design criteria for both the Closed Head and the Open Head Systems are shown.

EXAMPLE IN ACCORDANCE WITH NFPA 16

Deluge Type System.
Warehouse storing flammable liquids.
Dimensions - 90' x 65'
Products stored - Various Polar Solvent and Hydrocarbon liquids.
Foam Concentrate - 3% AR-AFFF (suitable for use on both Hydrocarbons and Polar Solvents @ 3%)
Warehouse Area - 90 x 65 = 5,850 sq. ft.
Application Rate - 0.16 gpm per sq. ft.

The application rate may be higher depending on types of polar solvent liquids stored. Check with the applications department at Buckeye for recommendations based on Listings & Approvals.

Flow in GPM of Foam Solution -
0.16 x 5,850 = 936 gpm
Discharge Duration - 10 min.
936 x 10 = 9,360 gallons of foam solution
Qty. of Foam Concentrate - 9,360 x 0.03 = 281 gal.
3% AR-AFFF concentrate
Number of sprinkler heads - 60 (Extra Hazard occupancies, approx. <100 sq. ft. per sprinkler)

PRIMARY SYSTEM COMPONENTS

1 x 300 Gallon vertical bladder tank.
1 x 4" Wafer style ratio controller (Flow range with AR-AFFF type concentrate is 400 -1,500 gpm)
1 x 1 1/2" Hydraulic concentrate control valve.

When a closed head foam-water sprinkler system is used, the " Authority Having Jurisdiction" such as the fire department, will likely require that an application rate in excess of 0.16 gpm per sq. ft. over a specific area. Application rates ranging from 0.20 to 0.40 gpm per sq. ft. are often used. Before the final sizing of the foam system, determine from the "Authority" on what application rate will be required over what area. For example, an insurance carrier might require an application rate of 0.30 gpm per sq. ft. over 1,500 sq. ft. depending on the sprinkler head used.
NFPA 30 requires a similar application rate over 1,500 sq. ft. when using high temperature sprinkler heads or 0.30 gpm per sq. ft. over 2,550 sq. ft. when using ordinary temperature sprinkler heads.

DISCHARGE APPLICATION AREA

The area to be protected must be determined for correct sizing of the foam system. The area can vary according to which NFPA standard or " Authority having Jurisdiction" guideline the system is designed.

A deluge system requires that the system be designed to flow foam over the entire risk area. A closed head system requires the system demand area to be based on 5,000 sq. ft. unless occupancy standards specify a different demand area. NFPA 30 requires the system design to be based on 2,000 sq. ft. when used to cover solid pile or palletized storage of flammable liquids. If the system is to include an in-rack foam water sprinkler system, the overhead may be based on 1,500 sq. ft. for high temperature heads and 2,550 sq. ft. if ordinary temperature sprinkler heads are used. The in-rack system is based on 3 sprinkler heads per level being discharged multiplied by the number of levels high.

DISCHARGE DURATION

NFPA 16 requires a discharge duration of 10 min., NFPA 30 requires a discharge duration of 15 min. and many “Authorities Having Jurisdiction” may require a discharge duration of 20 min.

EXAMPLE IN ACCORDANCE WITH NFPA 30

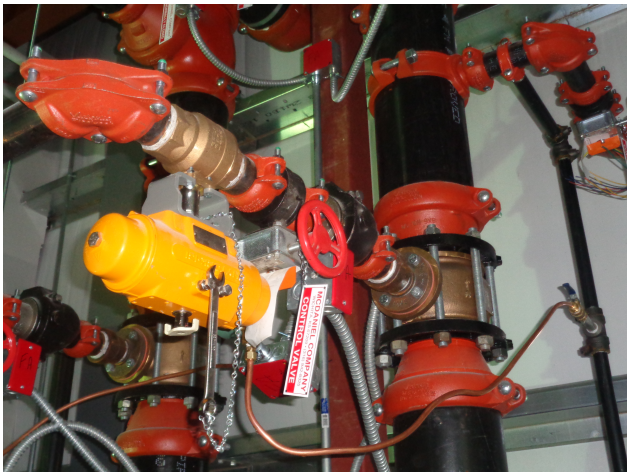
Closed Head Foam Water Sprinkler System Warehouse storing flammable liquids. Dimensions 90' x 50'
Products stored - Various Polar Solvent and Hydrocarbon liquids.
Foam Concentrate - 3% AR-AFFF
Warehouse Area - 90 x 50 = 4,500 sq. ft.
Application Rate - 0.30 gpm per sq. ft. over 2,000 sq. ft.
Flow in GPM of Foam Solution - 0.30 x 2,000 = 600 gpm
Foam concentrate required - 600 x 0.03 = 18 gpm
Discharge Duration - 15 min.
Total quantity of foam concentrate required -18 x 15 = 270 gallons.

There is one major difference between a deluge and a closed head system when using foam. With the NFPA 16 example being a deluge system, when the system operates, all heads receive foam solution. In the closed head system, only those heads actuated will receive foam solution. This will only happen WHEN the low end flow rate in gpm of the selected ratio controller is reached. In the example above, a 4" ratio controller is being used so there must be a minimum flow of at least 400 gpm before proper foam solution is generated.

With each sprinkler head discharging approximately 16 gpm, at least 25 heads must open to ensure correct operation of the foam system.

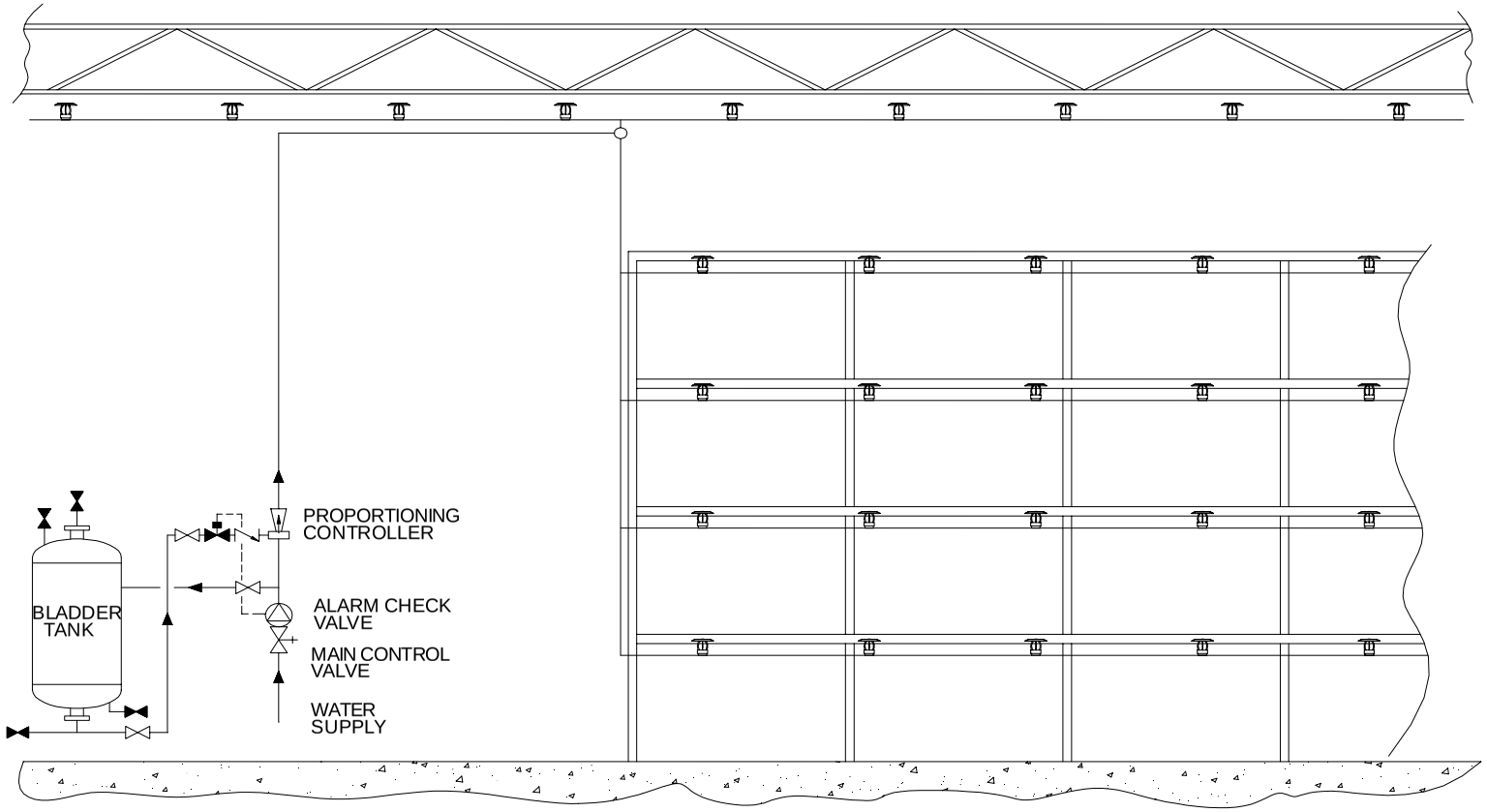
This is a major disadvantage when using a bladder tank with a closed head foam sprinkler system.

Many installations are using In-line Balanced Pressure Proportioning Units (ILBP) in conjunction with positive displacement foam pumps in lieu of bladder tanks. The major advantage is that with a foam pump system, mixing of the foam concentrate and water to form the foam solution will take place at lower rates through the same size ratio controller than with a bladder tank. With the foam pump, the concentrate has a slight positive pressure over the water at the ratio controller; therefore, it is “ forced” into the water stream even at low flow rates through the ratio controller. If using a 3% concentrate, the ratio mix may be 4-6% at low flows. In a closed head foam water sprinkler system, it is better to have a rich foam solution being discharged through the activated sprinkler heads when the flow is below the range for the ratio controller. A bladder tank may not proportion foam concentrate at flow rates below the minimum U.L. Listed flow range. This occurs because the flow through the controller is insufficient to create the low pressure area which allows the foam concentrate from the bladder tank to flow into the ratio controller.



WAREHOUSE SYSTEMS

FOAM/WATER SPRINKLER



OVERHEAD AND IN-RACK SPRINKLER
FIXED FOAM FIRE PROTECTION SYSTEM

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