Warehouse Foam System

MAJOR FOAM SYSTEM COMPONENTS

- 1 x 200 Gallon vertical style bladder tank
- 1 x 4” between flange style ratio controller (Flow range with AR-AFFF type concentrate is 400 - 1,500 gpm)

The above design criteria could also apply to any system designed in accordance with NFPA 16. However, many times with a closed head foam sprinkler system, the “Authority Having Jurisdiction” over the system approval will require an application rate in excess of .16 gpm per sq. ft. over a specific area. Application densities ranging from .20 to .40 gpm per sq. ft. are often used. Before the final sizing of the foam system, establish with the “Authority” on what design density will be required over what area. For example, an insurance carrier might require an application rate of .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 .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. NFPA 16 requires that the system be designed to flow foam over the entire risk area. NFPA 16 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 three sprinkler heads per level being discharged multiplied by the number of levels high.
**DISCHARGE DURATION**

NFPA 16 requires discharge duration of 10 minutes. NFPA 30 requires discharge duration of 15 minutes. Many “Authorities Having Jurisdiction” may require discharge duration of 20 minutes.

**Design Example:**

Type System: Wet Pipe  
Design Standard: NFPA 30  
Dimensions: 80’ x 50’  
Stored Product: Assortment of Polar Solvent and Hydrocarbon based liquids  
Foam Concentrate: 3% AR-AFFF  
Warehouse Area: 80 x 50 = 4,000 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  
Foam concentrate required: 600 x .03 = 18 gpm  
Discharge Duration: 15 minutes  
Foam Concentrate: 18 x 15 = 270 gallons

There is one major difference between a deluge and a closed head system when using foam. With a deluge system, when the system operates, all heads receive foam solution. Only those heads actuated will receive foam solution on a closed head system. **THIS will only happen WHEN the low-end flow rate (gpm) of the selected ratio controller is reached.** In the above example, a 4” ratio controller is being used so there must be a minimum flow of 400 gpm before foam 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.

A solution to this issue is to use an Ultra-wide proportioner instead of a ratio flow proportioner. The Ultra-wide proportioner will proportion correctly at a minimal flow of 20 gpm which is typically one sprinkler head discharging.

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.
TYPICAL LAYOUT FOR ILBP SYSTEM IN WAREHOUSE WITH CLOSED HEAD OVERHEAD AND IN-RACK SYSTEMS

Water Sensing
Foam Concentrate Sensing
Foam Concentrate
Pressure Control Valve
Pressure Balancing Valve
Ball Valve, Normally Open
Ball Valve, Normally Closed
Gate Valve
Swing Check Valve

Pressure Relief Valve
Valved Flush-in Connection
Valved Flush-out Connection
Strainer with Valved Side Outlet
Compound Gauge
Pressure Gauge
Proportioning Controller