

ASPE NOVEMBER PRESENTATION

In order to determine the proper size fire pump you must first establish what part of the fire protection system is more demanding, the sprinkler system or the standpipe system.

Per NFPA 14, 2007 edition § 7.10.1.3.1.1 *Where the sprinkler system water supply requirement, including the hose stream allowance as determined in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, exceeds the system demand established by Section 7.7 and 7.10.1, the larger of the two values shall be provided.*

The requirements for the sprinkler systems water demand starts with determining the highest hazard in the building and most demanding location for the hazard. (Note: Max permitted spacing used but more than likely, the spacing will be much less.)

Light Hazard - .10 gpm / sq ft over 1,500 sq. ft, max spacing 225 sq ft / head =

$$1500 \text{ sq ft} / 225 \text{ sq ft} = 7 \text{ heads @ } 22.5 \text{ gpm} = 157.5 \text{ gpm or } 150 \text{ gpm} + \\ (30\% \text{ over flow} + 50 \text{ gpm inside hose stream}) = \textbf{TOTAL = 245 gpm}$$

Ordinary Group I - .15 gpm / sq ft over 1,500 sq ft, max spacing 130 sq ft / head =

$$1500 \text{ sq ft} / 130 \text{ sq ft} = 12 \text{ heads or } 225 \text{ gpm} + 30\% \text{ over flow} + 100 \\ \text{gpm inside hose stream} = \textbf{TOTAL = 393 gpm}$$

Ordinary Group II - .20 gpm / sq ft over 1,500 sq ft, max spacing 130 sq ft / head =

$$1500 \text{ sq ft} / 130 \text{ sq ft} = 12 \text{ heads or } 300 \text{ gpm} + 30\% + 100 \text{ gpm} \\ \text{inside hose stream} = \textbf{TOTAL = 490 gpm}$$

Extra Hazard Group I - .30 gpm / sq ft over 2,500 sq ft, max spacing 100 sq ft / head =

$$2500 \text{ sq ft} / 100 \text{ sq ft} = 25 \text{ heads or } 750 \text{ gpm} + 30\% + 100 \text{ gpm} \\ \text{inside hose stream} = \textbf{TOTAL = 1075 gpm}$$

Extra Hazard Group II - .40 gpm / sq ft over 2,500 sq ft, max spacing 100 sq ft / head =

$$2500 \text{ sq ft} / 100 \text{ sq ft} = 25 \text{ heads or } 1000 \text{ gpm} + 30\% + 100 \text{ gpm} \\ \text{inside hose stream} = \textbf{TOTAL = 1400 gpm}$$

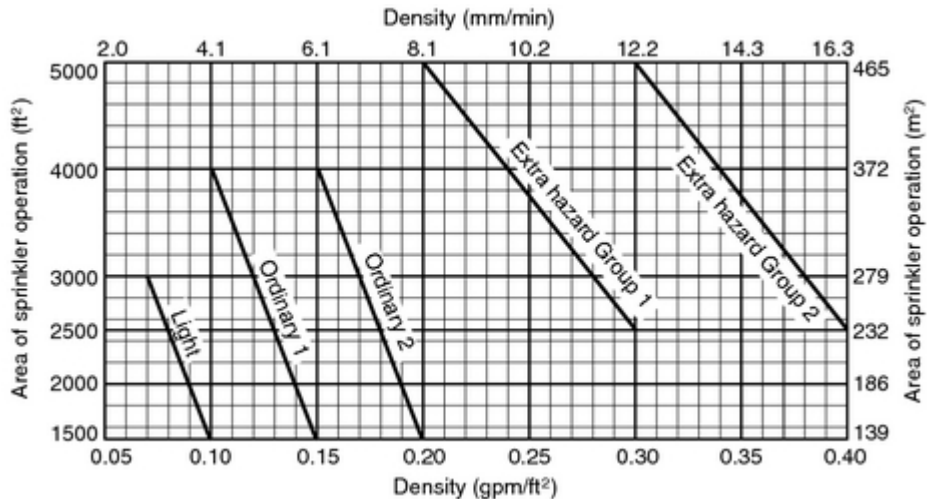


FIGURE 11.2.3.1.1 Density/Area Curves.

Determining the requirements for the standpipe system water demand is much easier:

How many standpipes are in the building?

- a) One standpipe – 500 gpm
- b) Two standpipes – 750 gpm
- c) Three standpipes – 1000 gpm
- d) Four or more standpipes – 1000 gpm **in fully sprinkled buildings.**
- e) Five or standpipes – 1250 gpm **non-fully sprinkled buildings.**

Reference Codes

NFPA 14, 2007 § 7.10.1.1.1 *For Class I and Class III systems, the minimum flow rate for the hydraulically most remote standpipe shall be 500 gpm (1893 L/min), and the calculation procedure shall be in accordance with 7.10.1.2*

NFPA 14, 2007 § 7.10.1.1.3 *The minimum flow rate for additional standpipes shall be 250 gpm (946 L/min) per standpipe, with the total not to exceed 1250 gpm (4731 L/min) or 1000 gpm (3785 L/min) for buildings sprinklered throughout*

Determining pressure requirements.

Typically, a minimum of 65 psi available water pressure would be sufficient to design a light hazard or ordinary hazard fire sprinkler system. Extra hazard sprinkler systems should always be calculated to determine if sufficient pressure is available.

A minimum of 100 psi is required for all standpipe systems. NFPA 14, 2007 § 7.8.1 - *Minimum Design Pressure for Hydraulically Designed Systems. Hydraulically designed standpipe systems shall be designed to provide the waterflow rate required by Section 7.10 at a minimum residual pressure of 100*

psi (6.9 bar) at the outlet of the hydraulically most remote 2½ in. (65 mm) hose connection and 65 psi (4.5 bar) at the outlet of the hydraulically most remote 1½ in. (40 mm) hose station

Exception from the Virginia Uniform Statewide Building Code:

§ 905.2 Exception: The residual pressure of 100 psi for 2-1/2" inch hose connection and 65 psi for 1-1/2" hose connection is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and where the highest level is not more than 150 feet above the lowest level of fire department vehicle access.

CONTACT THE AUTHORITY HAVING JURISDICTION FOR WHAT IS REQUIRED!

Key pressure losses to consider in properly sizing a fire pump:

Pressure loss due to elevation (Sprinkler system highest point - water supply elevation x .433)

Friction losses in materials to supply water to the top of standpipe:

System requirements most demanding standpipe or sprinkler system?
Valves (backflow prevention, butterfly valves, check valves)
Pipe (total length of pipe)
Fittings (elbows and tee's)

Sample problem:

- 10 story office building
- 120' to ceiling height on top floor
- Fire pump located at negative 10'-0" below grade
- 2 standpipes required in building total of 250' of pipe from pump discharge to top of most remote standpipe = 300'-0"
- 10 elbows and 5 tees – (4" Victaulic)
- Authority Having Jurisdiction (AHJ) is requesting 99 psi @ 500 gpm @ top of the most remote standpipe
- Water Supply from water authority @ negative 10'-0"
 - Static: 50 psi
 - Residual : 40 psi (46 psi @ 750 gpm)
 - Flow: 1100 gpm

What is required for the sprinkler system? = **Office – Light Hazard – 245 gpm**

What is required for the standpipe system? = **@ standpipes – 750 gpm – MOST DEMANDING**

Pressures Requirements determine losses

- 1) Elevation loss – 120'-0" minus negative 10'-0" (pump elevation)
Total Loss in elevation 130'-0" x .433 = **56.29 psi** loss in elevation
- 2) Backflow preventer loss – **5 psi**
- 3) Friction Loss (FL) total pipe lengths from pump to top of standpipe
300'-0" x .055 (4" sch 10 @ 500 gpm) = **16.5 psi**
- 4) Fitting Losses - 10 elbows @ 6.8 ft = 68 ft 5 Tees @ 16.0 ft = 80ft
Total = 68 + 80 = 148 ft x .055 (4" sch 10 @ 500 gpm) = **8.14 psi**

Total Pressure Loss of System – **56.29 + 5 + 16.5 + 8.14 = 85.93 psi or 86 psi**

99 psi is required at the top most remote standpipe per the AHJ + Total Pressure Loss of the Standpipe System to top of most remote standpipe. This would include pipe losses of 16.5 psi + , elevation loss 56.29 psi + fittings and valves loss +8.14 psi and backflow preventer loss + 5psi) = 86 psi in the system design.

Thus , total loss is AHJ requirement of 99 psi + Standpipe system loss of 86psi. = 185 psi is required to make the system work at the pump discharge.

The fire protection system water supply currently has 46 psi @ 750 gpm (Based on the water supply curve.)

Therefore: 185 psi is required by the system – 46 psi available in the flow test = 139 psi is needed

The minimum pump required would be a minimum 139 psi boost pump @ 750 gpm (standpipe requirement)

*Note: No fire pump manufacturer that we are aware of permits a pump to be run at a capacity exceeding the UL listing of 100% capacity.