Fire Safety and Prevention 110

Some workplaces train employees to fight fires that may occur. Standpipe and small hose systems provide the water used to fight the fires. There are several classifications of these water-supply systems; each classified by the diameters of the hose connections.

A Class I system has a 2 1/2 inch diameter hose connection.

A Class II system has a 1 1/2 inch diameter hose connection.

Small hose systems have 5/8 inch to 1 1/2 inch diameter hose connections.

Since the cross-sectional areas of the hoses are circles, the amount of water each hose provides can be compared not only by calculating the cylindrical volume of the hose, but also by calculating the cross-sectional area of the hoses, if the length of hose is the same.

Area of circle $= \pi r^2$

where $\pi \approx 3.14$

r = radius of circle = 1/2 (diameter)

EXAMPLE:

The minimum diameter of a small hose system is 5/8 inch. A Class II system has a 1 1/2 inch diameter hose connection. How many times more water can be provided by the Class II system compared to the small hose system?

SOLUTION:

Small hose system

diameter = 5/8 in = .625 in

radius = .625 in/2 = .3125 in

$A = \pi r^2$

$A = (3.14)(.3125 \text{ in})^2 \approx .307 \text{ in}^2$

Class II system

diameter = 1 1/2 in = 1.5 in

radius = 1.5 in/2 = .75 in

$A = \pi r^2$

$A = (3.14)(.75 \text{ in})^2 \approx 1.77 \text{ in}^2$

Comparing the two areas: $\frac{1.77\ in^2}{.307\ in^2} \approx 5.77$

The cross-sectional area of the Class II hose is approximately 5.77 times larger than the cross-sectional area of the 5/8 inch small hose system. That means that for the same length hose, the Class II hose will provide approximately 5.77 times the amount of water.

How does that compare to a ratio of the diameters or radii?

$$\frac{\text{Class II radius}}{\text{small hose radius}} = \frac{1\frac{1}{2}\text{ in}}{\frac{5}{8}} = \frac{.75 \text{ in}}{.3125 \text{ in}} = 2.4$$

The comparison of the diameters or radii does not match the comparison of the cross-sectional areas. That is because the formula for the area depends on r^2. The squaring effect of the radii (or diameters) is also carried over to the comparisons of the cross-sectional areas.

Ratio of diameters (or radii) = 2.4

Square this ratio = $(2.4)^2$ = 5.76

The squared ratio of the diameters (or radii) equals the ratio of the cross-sectional areas.

EXERCISES:

1. A Class I standpipe system has a 2 1/2 inch diameter hose. A small hose system can have a 1 inch diameter hose.

   a. Determine the cross-sectional area of the Class I hose.

   b. Determine the cross-sectional area of the small hose system.

   c. Compare the cross-sectional area of the Class I hose to the cross-sectional area of the small hose system. How many times larger is the area of the Class I hose?

   d. Explain what the answer in part c means.

   e. Compare the Class I hose diameter to the small hose diameter. How many times larger is the Class I diameter?

   f. Explain why the answers to parts c and e are not the same.

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