

$$A_4 = \frac{\pi}{4} D_4^2$$

$$D_4 = \sqrt{\frac{4}{\pi} A_4} = 0.38 \text{ ft} \left(\frac{12 \text{ in}}{\text{ft}} \right) = 4.6 \text{ in}$$

Answer C

47.48 What is the Reynolds number for 1500gpm of 70°F water flowing in a standard weight steel pipe with a diameter of 10in?

- A. 32,000
- B. 380,000
- C. 480,000
- D. 5,800,000

Use the [Schedule 40 Steel Pipe](#) table or the [Steel Pipe Friction Tables](#) to find the diameter of nominal 10in pipe.

$$D = 10.02 \text{ in}$$

Use the [Steel Pipe Friction Tables](#) to find the velocity for 1500gpm flowing in a 10in pipe. This saves time as compared with calculating $v = \frac{Q}{A}$, which is equally valid.

$$v = 6.1 \frac{\text{ft}}{\text{s}}$$

Look up the kinematic viscosity for 70°F water in the [Properties of Water](#) table.

$$\nu_{@70^\circ F} = 1.059 \times 10^{-5} \frac{\text{ft}^2}{\text{s}}$$

Calculate the [Reynolds Number](#).

$$Re = \frac{vD}{\nu} = \frac{\left(6.1 \frac{\text{ft}}{\text{s}}\right) \left(\frac{10.02 \text{ in}}{12 \frac{\text{in}}{\text{ft}}}\right)}{1.059 \times 10^{-5} \frac{\text{ft}^2}{\text{s}}} = 480,000$$

Answer C

47.49 A gauge reads the static pressure for air flowing in a pipe as 1psig. A pitot tube reads the total pressure as 60mm of mercury. What is the velocity of the air?

- A. 5600fpm
- B. 8400fpm

C. 11,800 *fpm*

D. 16,300 *fpm*

Total Pressure is the sum of static pressure and velocity pressure. Rearrange the formula for velocity pressure.

$$p_t = p_s + p_v$$

$$p_v = p_t - p_s$$

Both the total pressure and the static pressure are measured by gauges and therefore report gauge pressure. It is the *difference* between the two which is relevant in this scenario, which is the same regardless of whether gauge or absolute pressures are used, since atmospheric pressure washes out in the subtraction. In summary, there is no need for converting to absolute pressure.

Use **Commonly Used Equivalents** to find the conversion from mm of mercury to psi. Calculate the total pressure minus the static pressure. Convert to inches of water.

$$p_v = (60 \text{ mm Hg}) \left(\frac{1 \text{ in}}{25.4 \text{ mm}} \right) \left(0.491 \frac{\text{psi}}{\text{in Hg}} \right) - 1 \text{ psi} = 0.16 \text{ psi}$$

$$p_v = 0.16 \text{ psi} \left(\frac{2.31 \text{ ft H}_2\text{O}}{\text{psi}} \right) \left(\frac{12 \text{ in H}_2\text{O}}{\text{ft H}_2\text{O}} \right) = 4.43 \text{ in H}_2\text{O}$$

Since no temperature is given, assume air is at standard conditions. Solve the **Velocity Pressure** equation for velocity in *fpm*.

$$p_v = \left(\frac{V_{[fpm]}}{4005} \right)^2 = 4.43 \text{ in H}_2\text{O}$$

$$V = 8430 \text{ fpm}$$

Answer B

47.50 An open loop condenser water system holds 20,000 *gallons*. The system is to be treated with a 45% by volume biocide solution until the average concentration after mixing is 10 *ppm*. Ignoring evaporation and the addition of make-up water, what volume of the solution is required?

A. 0.2 *gal*

B. 0.4 *gal*

C. 2 *gal*

D. 4 *gal*