

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

- A. 5600fpm
- B. 8400fpm
- C. $11,800\text{fpm}$
- D. $16,300\text{fpm}$

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 .

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

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

Answer B