

**46.54** 20gpm of oil with specific gravity 0.88 flows through a valve with a valve coefficient of 4.5. What is the pressure drop across the valve?

- A. 3.9psi
- B. 4.4psi
- C. 17psi
- D. 20psi

The **Valve Flow Coefficient** for a fluid other than water is given by the equation below which accounts for the specific gravity. The volume flow rate must be in *gpm* and the pressure drop must be in *psi*. Rearrange to isolate  $\Delta P$ , substitute, and solve.

$$C_v = Q \sqrt{\frac{SG}{\Delta P}}$$

$$C_v^2 = Q^2 \frac{SG}{\Delta P}$$

$$\Delta P = \left( \frac{Q}{C_v} \right)^2 SG = \left( \frac{20}{4.5} \right)^2 (0.88) = 17.4psi$$

**Answer C**

**46.55** 1000gpm of water is pumped up an incline of 200ft. The suction pressure is 50psig and the pressure at the extent of the discharge piping is 250psig. The head loss through the discharge piping is 40ft, and losses through the suction piping are negligible. The suction and discharge piping diameters are 12in and 8in, respectively. How much horsepower is supplied by the pump?

- A. 111hp
- B. 132hp
- C. 177hp
- D. 410hp

Use the modified **Bernoulli Equation** for head added by a pump.

$$h_A = \frac{P_2 - P_1}{\gamma} + \frac{v_2^2 - v_1^2}{2g} + z_2 - z_1 + h_f$$

Neglect the velocity term. Use the rule of thumb conversion factor to convert the differential static pressure from *psi* to *ft*.

$$h_A = (250\text{psig} - 50\text{psig}) \left( 2.31 \frac{\text{ft}}{\text{psi}} \right) + (200\text{ft}) + 40\text{ft} = 702\text{ft}$$

Calculate the **Water Horsepower** added by the pump.

$$whp = \frac{Q\Delta h}{3960}$$

$$whp = \frac{(1000)(702)}{3960} = 177hp$$

**Answer C**

**46.56** A threaded  $\frac{3}{4}$ in pipe has (4) 90-degree long radius elbows and (6) 45-degree elbows. The volume flow rate is 5gpm. What is the minor head loss for the system?

- A. 0.2ft
- B. 0.3ft
- C. 0.7ft
- D. 0.8ft

Use the equation for head loss from **Fittings Losses**.

$$h_{f,minor} = K \left( \frac{v^2}{2g} \right)$$

Use the **Steel Pipe Friction Tables** to find the velocity for 5gpm flowing in a nominal  $\frac{3}{4}$ in pipe.

$$v = 3.01 \frac{\text{ft}}{\text{s}}$$

Look up the **K-Factors** for **Threaded Pipe Fittings** and obtain the values for 90-degree long radius elbows and 45-degree elbows. Take the sum accounting for the quantities to find the value of  $K$  in total.

$$K = 4(0.92) + 6(0.35) = 5.78$$

Solve for the minor losses.

$$h_{f,minor} = (5.78) \frac{\left( 3.01 \frac{\text{ft}}{\text{s}} \right)^2}{2 \left( 32.2 \frac{\text{ft}}{\text{s}^2} \right)} = 0.8\text{ft}$$

**Answer D**