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

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.

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

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.

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

Answer D

46.57 **A $6in$ gate valve with flow coefficient 150 permits $500gpm$ of oil ($SG = 0.88$) to flow through a piping system. What is the pressure drop across the valve?**

A. $2.9psi$

B. $3.3psi$

C. $9.8psi$

D. $11.1psi$

Use the equation for the Valve Flow Coefficient for fluids other than water to account for the specific gravity of oil. Rearrange to isolate ΔP.

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

$$\Delta P = \left(\frac{Q}{C_v}\right)^2 SG$$

Substitute and solve. Make sure the volume flow rate, Q, is in gpm, and the pressure drop will be obtained in psi.

$$\Delta P = \left(\frac{500}{150}\right)^2 (0.88) = 9.8psi$$

Answer C