$$L = 2(50m) = 100m$$

Determine the resistance.

$$R = \frac{\rho L}{A} = \frac{\left(1.724 \times 10^{-8}\Omega \cdot m\right)(100m)}{(16,509cmil)\left(5.066 \times 10^{-10}\frac{m^2}{cmil}\right)} = 0.206\Omega$$

Find the voltage drop due to the wire by applying Ohm's Law.

$$V_{drop} = IR = (40A)(0.206\Omega) = 8.25V$$

Determine the percentage voltage drop by dividing by the nominal voltage of the source.

$$\frac{V_{drop}}{V_{source}} = \frac{8.25V}{230V} = 0.036 = 3.6\%$$

Answer D

46.8 $1000cfm$ of $350°F$, $80psia$ air is supplied by an air compressor. What is the standard volume flow rate (SCFM)?

A. $100cfm$

B. $300cfm$

C. $3500cfm$

D. $8500cfm$

Since the air being supplied is at an elevated temperature and pressure, it is necessary to make Temperature and Altitude Corrections for Air. This can be achieved using the factors in the table; however, the pressure is given in psia rather than as an elevation, therefore it is more straightforward to multiply by the ratio of the pressure as compared to standard atmosphereic pressure. Similarly, a temperature ratio multiplier is also convenient to use, provided absolute temperature units are used. Standard temperature and pressure may be considered $60°F$ and $14.7psia$.

In terms of qualitative expectations, a higher than standard pressure implies the standard CFM (SCFM) will be higher than the actual CFM. A higher than standard temperature implies the standard CFM will be lower than the actual CFM. In concept, SCFM is attempt to explain how much volume the compressor would move if pumping air at STP.

$$SCFM = (1000cfm)\left(\frac{80psia}{14.7psia}\right)\left(\frac{60°F + 460°R}{350°F + 460°R}\right) = 3,493cfm$$

Answer C

46.9 $40gpm$ **of water flows through a parallel piping network with two branches, A and B. Branch A consists of** $100ft$ **of straight Schedule 40** $2in$ **steel pipe. Branch B consists of** $60ft$ **of Schedule 40** $2in$ **steel pipe, several valves with a total equivalent length of** $35ft$**, and six 90-degree elbows. What is the flow rate through branch A?**

A. $19gpm$

B. $21gpm$

C. $23gpm$

D. $25gpm$

Sketch the piping network. Since there are two branches in parallel, the head loss through each branch must be equal. Write the Darcy equation for both sides and set them equal.

$$h_{f,A} = h_{f,B}$$

$$\frac{fL_A v_A^2}{2D_A g} = \frac{fL_B v_B^2}{2D_B g}$$

Assume the friction factor is approximately the same for both branches and will cancel out, along with the constants, 2 and g. Also, $D_A = D_B$,so the diameters will cancel out.

$$L_A v_A^2 = L_B v_B^2$$

Rearrange the relation to express the ratio of the velocities through the two branches as a function of the equivalent lenghts of the branches.

$$\frac{v_B}{v_A} = \sqrt{\frac{L_A}{L_B}}$$

Recognize from the Continuity Equation, $Q = Av$, since the diameters are the same, the areas of the two branches are also the same, therefore the ratio of the velocities is equal to the ratio of the volume flow rates.

$$Q_A = A_A v_A \rightarrow v_A = \frac{Q_A}{A_A}$$

$$Q_B = A_B v_B \rightarrow v_B = \frac{Q_B}{A_B}$$

$$A_A = A_B$$

$$\frac{v_B}{v_A} = \frac{\left(\frac{Q_B}{A_B}\right)}{\left(\frac{Q_A}{A_A}\right)} = \frac{Q_B}{Q_A} = \sqrt{\frac{L_A}{L_B}}$$

The total volume flow rate is the sum of both branches and is given as $40gpm$.