44.14 **A $2ton$ AC unit with remote compressor using R-134a operates with a condenser pressure of $150psia$ and an evaporator pressure of $50psia$. The suction line is a $^5/_8in$ diameter type L copper tube with a length of $30ft$. What is the pressure drop for the suction line?**

A. $0.5psi$

B. $1.3psi$

C. $1.9psi$

D. $5.8psi$

Look up Suction Line Capacities in Tons for Refrigerant 134a in the Reference Handbook. Using the Pressure Versus Enthalpy Curves for Refrigerant 134a, determine the evaporator temperature that corresponds to an evaporator pressure of $50psia$. Use the evaporator temperature and the diameter of the suction line to obtain the capacity from the table. Also note the corresponding pressure drop from the table.

$$P_{evap} = 50psia$$

$$T_{evap} = 40°F$$

$$Capacity = 0.66tons$$

$$\Delta P = 1.93psi/100ft$$

Use the equation from Note 3 below the table to adjust for the actual length and capacity given:

$$\Delta t = Table\,\Delta t \left(\frac{Actual\,L_e}{Table\,L_e}\right) \times \left(\frac{Actual\,Capacity}{Table\,Capacity}\right)^{1.8}$$

$$\Delta t = (2°F)\left(\frac{30ft}{100ft}\right) \times \left(\frac{2tons}{0.66tons}\right)^{1.8} = 4.41°F$$

The actual pressure drop is linearly related to the actual temperature drop. Set up a proportion and solve, using the actual length:

$$\frac{\Delta P_{actual}}{\Delta P_{table}} = \frac{\Delta T_{actual}}{\Delta T_{table}}$$

$$\Delta P_{actual} = \Delta P_{table}\left(\frac{\Delta T_{actual}}{\Delta T_{table}}\right) = \left(1.93\frac{psi}{100ft}\right)\left(\frac{4.41°F}{2°F}\right) = 4.25\frac{psi}{100ft}$$

$$\Delta P = \left(4.25\frac{psi}{100ft}\right)(30ft) = 1.3psi$$

Answer B

44.15 Air at $85°F$ and 40% relative humidity enters a direct evaporative cooler with a saturation efficiency of 60%. What is the leaving air temperature?

A. $62°F$

B. $68°F$

C. $74°F$

D. $78°F$

The efficiency (Saturation Efficiency) of an Evaporative Cooler is the ratio of the actual temperature reduction achieved compared with the temperature differential if the air was cooled to the wet bulb temperature, i.e. fully *saturated*.

The entering conditions, State 1, are fully defined. Use the Psychrometric Chart to obtain the wet bulb temperature:

$$T_{1,db} = 85°F$$

$$\phi_1 = 40\%$$

$$T_{1,wb} = 67.3°F$$

Write the equation for the Saturation Efficiency and solve for the leaving air temperature, T_2:

$$\varepsilon_e = \frac{T_1 - T_2}{T_1 - T_{wb}}$$

$$.6 = \left(\frac{85°F - T_2}{85°F - 67.3°F}\right) \rightarrow T_2 = 74.4°F$$

Answer C