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

46.58 An air handler uses $52°F$ chilled water to cool and dehumidify a room which is maintained at $78°F$ and 50% relative humidity. The AHU has a single chilled water coil from which air is discharged at $60°F$ db / $58°F$ wb. The unit also has a bypass damper which is modulated to allow 25% of the required airflow to bypass the coil under normal operating conditions. The unit provides $10,000cfm$ of supply air to the space. Prior to returning to the unit, 10% of the air is exhausted and outside air at $95°F$ db / $75°F$ wb is mixed into the return stream for ventilation. What is the total cooling load provided by the air handler?

A. $13tons$

B. $16tons$

C. $18tons$

D. $21tons$

Sketch the system and label all given information. Consider the air entering the coil as State 1 and the air being discharged from the coil as State 2. The total cooling load provided by the air handler is a function of airflow over the coil only, as the bypass air is neither cooled nor dehumified. Since the unit provides a total volume flow rate of $10,000cfm$, and the bypass damper allows 25% of the airflow to bypass the coil, the volume flow rate over the coil is the remaining 75%.

$$Q = (0.75)\,(10,000cfm) = 7500cfm$$

Use the total cooling rule of thumb.

$$\dot{Q}_t = 4.5cfm\Delta h$$

The coil discharge condition is fully defined. Use the Psychrometric Chart to obtain the enthalpy of the discharge air coming off the coil.

$$T_{2,db} = 60°F$$

$$T_{2,wb} = 58°F$$

$$h_2 = 25.1\frac{Btu}{lb}$$

The entering condition is a mixture of return air and outside air. 10% of the return air is exhausted and replaced by outside air. Use the Psychrometric Chart again to find the enthalpy for the room/return condition, and the enthalpy of the outside air. Then perform a mixing calculation to find the enthalpy of the mixed air. This is the entering coil condition.

$$T_R = 78°F$$