47.26 $1000\frac{Btu}{lb}$ **of heat is added to** $70°F$ **,** $14.7psia$ **air. What is the temperature after heating?**

A. $3665°F$

B. $3815°F$

C. $3965°F$

D. $4125°F$

Consider the condition of the air before heating as State 1 and the condition of air after heating as State 2. Use the Air at Low Pressure tables to look up the enthalpy of air at $70°F$. For low pressure air, enthalpy may be reasonably approximated as a function of temperature only.

$$h_1 \approx 126\frac{Btu}{lb}$$

Calculate the enthalpy after heating.

$$h_2 = 126\frac{Btu}{lb} + 1000\frac{Btu}{lb} = 1126\frac{Btu}{lb}$$

Return to the low pressure air table to look up the corresponding temperature for State 2. Without interpolating, notice h_2 is about halfway between two values, making the temperature straightforward to obtain.

$$T_2 \approx 3665°F$$

Answer A

47.27 $400\frac{lbm}{hr}$ **of** $62°F$**, 60% relative humidity air is heated to** $96°F$ **without changing the moisture content. How much heat is needed?**

A. $3300\frac{Btu}{hr}$

B. $6700\frac{Btu}{hr}$

C. $10,100\frac{Btu}{hr}$

D. $13,600\frac{Btu}{hr}$

Since the moisture content is not changing, the heat transfer depends on the the mass flow rate, specific heat capacity of air, and the dry bulb temperature differential only. There is no need to account for humidity ratio or enthalpy.

$$\dot{Q} = \dot{m}c_p\Delta T$$

$$\dot{Q} = \left(400\frac{lb}{hr}\right)\left(0.24\frac{Btu}{lb°F}\right)(96°F - 62°F) = 3624\frac{Btu}{hr}$$

Answer A

47.28 Air at $75°F$ db / $64°F$ wb enters a cooling coil with an ADP of $45°F$ and a bypass factor of 15%. What is the wet bulb temperature of the leaving air?

A. $45°F$

B. $48°F$

C. $50°F$

D. $61°F$

Use the Psychrometric Chart to plot the process line from the room condition to the ADP.

Determine the coil efficiency using the bypass factor.

$$\eta_{coil} = 1 - BF = 1 - 0.15 = 0.85$$

Set the coil efficiency equal to the ratio of the actual reduction in wet bulb temperature from $1 \rightarrow 2$ to the maximum possible reduction which would be achieved only when State 2 is the ADP, corresponding to 100% coil efficiency. Substitute and solve for $T_{2,wb}$.

$$\eta_{coil} = \frac{T_{1,wb} - T_{2,wb}}{T_{1,wb} - ADP}$$

$$0.85 = \frac{64°F - T_{2,wb}}{64°F - 45°F}$$

$$T_{2,wb} = 47.9°F$$

Answer B

47.29 A 230V, single-phase, 5-hp motor operates at full load with a power factor of 0.8. The motor efficiency is 75%. What is the current drawn?

A. $10A$

B. $13A$

C. $15A$

D. $27A$

The current drawn by an AC motor is a function of the number of phases, power, voltage, motor efficiency, and power factor. Search for Motor Phases and find the table Power for Different Motor Phases. Select the first equation in the "Single-Phase" column. Substitute and solve using the values given.

$$I_{amps} = \frac{P_{hp}\left(746\frac{W}{hp}\right)}{V\eta\,(pf)}$$