**34.5 A storage tank contains $250°F$ air at $100psia$. The air is released and expanded through a 86% efficient turbine to $15psia$. What is the specific work produced by the turbine? Assume air behaves as an ideal gas.**

A. $61\frac{Btu}{lb}$

B. $90\frac{Btu}{lb}$

C. $124\frac{Btu}{lb}$

D. $142\frac{Btu}{lb}$

Consider the pressurized air entering the turbine as State 1 and the air exiting the turbine as State 2. Use the Air at Low Pressure table to obtain the enthalpy and relative pressure at State 1. Notice that for air these parameters are a function of temperature only.

$$T_1 = 250°F$$

$$P_1 = 100psia$$

$$h_1 = 170\frac{Btu}{lb}$$

$$P_{r,1} = 3.623$$

Set up a proportion and use the actual pressures at State 1 and State 2 along with the relative pressure at State 1 to determine the relative pressure at State 2.

$$\frac{P_{r,1}}{P_{r,2}} = \frac{P_1}{P_2}$$

$$P_{r,2} = P_{r,1}\left(\frac{P_2}{P_1}\right) = 3.623\left(\frac{15psia}{100psia}\right) = 0.543$$

Use the air table again to obtain the *ideal* enthalpy corresponding to the relative pressure at State 2.

$$h_2 = 98.6\frac{Btu}{lb}$$

To find the *actual* specific work for the turbine, take the difference between the entering and exiting enthalpies and multiply by the turbine efficiency.

$$w = \eta\left(h_1 - h_2\right) = (0.86)\left(170\frac{Btu}{lb} - 98.6\frac{Btu}{lb}\right) = 61.4\frac{Btu}{lb}$$

**Answer A**