

7-36

$$T_{\infty} = 27^{\circ}\text{C}$$

$$V = 20 \text{ m/s} \quad D = 0.025 \text{ m}$$

$$T_s = 127^{\circ}\text{C} \quad L = 1 \text{ m}$$

$$T_f = \frac{T_s + T_{\infty}}{2} = \frac{127 + 27}{2} = 77^{\circ}\text{C}$$

$$Pr = 0.650 \quad k = 0.0313 \text{ W/m}\cdot\text{K}$$

$$\nu = 2 \times 10^{-5} \text{ kg/m}\cdot\text{s}$$

Reynolds #

$$Re_D = \frac{VD}{\nu} = \frac{(20)(0.025)}{2 \times 10^{-5}} = 2.5 \times 10^4$$

$$Nu_D = 0.3 + \frac{0.62 Re_D^{1/2} Pr^{1/3} \left[1 + \left(\frac{Pr}{0.6} \right)^{1/4} \right]}{\left[1 + (0.4/Pr)^{1/4} \right]^{1/4} \left[\left(\frac{Re_D}{282000} \right)^{1/2} \right]}$$

$$= 96.4$$

$$h = \frac{Nu_D k}{D} = \frac{(96.4)(0.0313)}{(0.025)} = 121 \text{ W/m}^2\cdot\text{K}$$

$$q' = h(\pi D L)(T_s - T_{\infty}) = (121)(\pi)(0.025)(1)(127 - 27)$$

$$= 9.48 \times 10^2 \text{ W/m}$$

7-37

$$P_{\text{atm}} = 2 P_{\text{atm}}$$

$$Re_D = 5 \times 10^4 \quad Nu_D = 149$$

$$h = \frac{Nu_D k}{D} = \frac{(149)(0.0313)}{0.025} = 187 \text{ W/m}^2\cdot\text{K}$$

$$q' = h(\pi D L)(T_s - T_{\infty}) = (187)(\pi)(0.025)(1)(127 - 27)$$

$$= 1.47 \times 10^3 \text{ W/m}$$