8-4 Given $F = 6$ kN, $l = 5$ mm, and $d_m = 22.5$ mm, the torque required to raise the load is found using Eqs. (8-1) and (8-6)

$$T_R = \frac{6(22.5)}{2}\left[\frac{5 + \pi(0.08)(22.5)}{\pi(22.5) - 0.08(5)}\right] + \frac{6(0.05)(40)}{2}$$

$$= 10.23 + 6 = 16.23 \text{ N} \cdot \text{m} \quad \textit{Ans.}$$

The torque required to lower the load, from Eqs. (8-2) and (8-6) is

$$T_L = \frac{6(22.5)}{2}\left[\frac{\pi(0.08)22.5 - 5}{\pi(22.5) + 0.08(5)}\right] + \frac{6(0.05)(40)}{2}$$

$$= 0.622 + 6 = 6.622 \text{ N} \cdot \text{m} \quad \textit{Ans.}$$

Since T_L is positive, the thread is self-locking. The efficiency is

Eq. (8-4):
$$e = \frac{6(5)}{2\pi(16.23)} = 0.294 \quad \textit{Ans.}$$