

Problems 1 (Power Screws)**Given:**

$$d_{\text{major}} = 25 \text{ mm}$$

$$p = 5 \text{ mm}$$

$$F = 6E3 \text{ N}$$

$$f_c = 0.05$$

$$f = 0.08$$

$$d_c = 40E-3$$

Find:**a.) "raise" torque**

$$d_m = d - \frac{p}{2} = 25 - \frac{5}{2} = 22.5 \text{ mm}$$

$$l = np = 1(5) = 5 \text{ mm}$$

$$T_R = \frac{Fd_m}{2} \left(\frac{l + \pi f d_m}{\pi d_m - fl} \right) + \frac{Ff_c d_c}{2}$$

$$T_R = \frac{(6E3)(22.5E-3)}{2} \left(\frac{(5E-3) + \pi(0.08)(22.5E-3)}{\pi(22.5E-3) - (0.08)(5E-3)} \right) + \frac{(6E3)(0.05)(40E-3)}{2}$$

$$T_R = 16.23 \text{ N} \cdot \text{m}$$

b.) "lower" torque

$$T_L = \frac{Fd_m}{2} \left(\frac{\pi f d_m - l}{\pi d_m + fl} \right) + \frac{Ff_c d_c}{2}$$

$$T_L = \frac{(6E3)(22.5E-3)}{2} \left(\frac{\pi(0.08)(22.5E-3) - (5E-3)}{\pi(22.5E-3) + (0.08)(5E-3)} \right) + \frac{(6E3)(0.05)(40E-3)}{2}$$

$$T_L = 6.62 \text{ N} \cdot \text{m}$$

c.) Overall efficiency

$$e = \frac{T_o}{T_R} = \frac{Fl}{2\pi T_R}$$

$$e = \frac{(6E3)(5E-3)}{2\pi(16.23)}$$

$$e = 0.294$$

Problems 2 (Load Factor)

Given:

10 bolts

$d = 150 \text{ mm}$

$P_t = 6E6 \text{ Pa}$

ISO 8.8 bolts: $S_p = 600E6 \text{ Pa}$

12 mm dia: $A_t = 84.3E-6 \text{ m}^2$

$C = 0.24$

Find:

a.) n_y

$$F_T = A \cdot P_t$$

$$F_T = \pi \left(\frac{150E-3}{2} \right)^2 (6E6) = 106028.75 \text{ N}$$

$$P = \frac{\text{Force}}{\text{bolt}} = \frac{F_T}{10} = 10602.8 \text{ N}$$

Nonpermanent connections, reused fasteners:

$$F_i = 0.75 S_p A_t$$

$$F_i = 0.75 (600E6) (84.3E-6)$$

$$F_i = 37935 \text{ N}$$

$$n_y = \frac{S_p A_t - F_i}{CP}$$

$$n_y = \frac{(600E6)(84.3E-6) - 37935}{0.24(10602.8)}$$

$$n_y = \mathbf{4.969}$$

b.) n_s

$$n_y = \frac{F_i}{P(1-C)}$$

$$n_y = \frac{37935}{(10602.8)(1-0.24)}$$

$$n_y = \mathbf{4.707}$$