BASED ON 10.5

Ex) GIVEN: • 2" diam double thread ACME STUB screw
• avg. thrust collar diam: 2.75 in
• running coeff of friction:
.1 for collar, .11 for screw

FIND: • torque required to raise a 3500 lb load
• required starting torque
• raising efficiency
• WHETHER OR NOT SCREW IS "OVER HAULING" (i.e., NOT "SELF LOCKING")

GIVEN: $d = 2''$ $\quad W = 3500\,lb$

$N = 2$

$d_c = 2.75''$

running $\begin{cases} f = .11 \\ f_c = .1 \end{cases}$

RAISING TORQUE: $$T = \frac{W d_m}{2}\,\frac{f\pi d_m + L\cos\alpha_n}{\pi d_m \cos\alpha_n - fL} + \frac{W f_c d_c}{2}$$

WE NEED: d_m, L, α_n — need λ for this

TABLE 10.3 ⇒

$TPI = 4 \Rightarrow p = \frac{1}{TPI} = .25''$

$L = N \cdot p = .5''$

FIGURE 10.4 (ACME STUB)

⇒ $\alpha = 14.5°$, thread depth $= .3p = .075''$

$d_m = d - (\text{thread depth}) = 1.925''$

$\lambda = \tan^{-1}\left(\frac{L}{\pi d_m}\right) = 4.73°$

$$\alpha_n = \tan^{-1}\left[\tan\alpha \cdot \cos\lambda\right] = 14.45^\circ$$

$f = .11,\ f_c = .1$

$$T_{\substack{\text{running}\\ \text{raising}}} = \frac{3500\,(1.925)}{2}\left[\frac{.11\pi(1.925) + .5\cos 14.45^\circ}{\pi(1.925)\cos 14.45 - .11(.5)}\right] + \frac{3500(.1)\cdot(2.75)}{2}$$

$$= \boxed{1148.4 \text{ in-lb}}$$

FOR STARTING TORQUE (TO RAISE),

INCREASE f & f_c by $1/3$

$$f = (1+\tfrac{1}{3})\cdot .11 = .147$$

$$f_c = (1+\tfrac{1}{3})\cdot .1 = .133$$

SAME EQN FOR T

$$\Rightarrow \quad T_{\substack{\text{starting}\\ \text{raising}}} = \boxed{1440 \text{ in-lb}}$$

RAISING EFFICIENCY:

$$e = \frac{\text{work out}}{\text{work in}} = \frac{W\cdot L}{T_{\substack{\text{running}\\ \text{raising}}}(2\pi)} = \frac{3500(.5)}{(1148.4)(2\pi)}$$

$$= \boxed{24\%}$$

CHECK FOR "OVERHAULING"

FOR SELF LOCKING (NEGLECTING f_c),

"running" value

$$f \geq \frac{L\cos\alpha_n}{\pi d_m} = 0.08$$

$$.11 \geq .08 \Rightarrow \text{NOT OVERHAULING}$$

$$\Rightarrow \text{SELF LOCKING}$$