#1) 4-Thread Power Screw ①

If $d_m > L$

$$f = \frac{L}{\pi d_m} = \frac{2}{\pi(1.25)} \simeq 0.5 \leftarrow (e)$$

where $L = 4p = 4(0.5) = 2$

#2) M10 × 1.5 Grade 5.8 $\left(S_p = 380,\ A_t = 58\ mm\right)$

$$F_e = \frac{40\,000}{4} = 10\,000\ N$$

$$F_b = F_i + C F_e = 16530 + 0.75(10\,000)$$

where $F_i = 0.75\ A_t S_p$

$$= 0.75\ (58)(380) = 16530\ N$$

and $$C = \frac{K_b}{K_b + K_m} = \frac{3K_m}{3K_m + K_m} = 3/4 = 0.75$$

(d)

$F_b = 24030 \leftarrow$

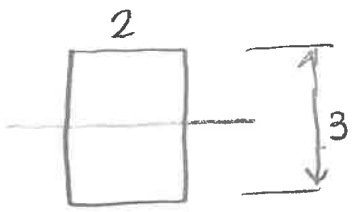
#3) Welded Plate

$$\tau_b = \frac{MC}{I_t} = \frac{8400\,(1.5)}{3.58} = 3519 \text{ Psi}$$

where

$M = 600\,(14) = 8400$ lb-in

$C = 1.5$



and $I_t = I_u \cdot t = 13.5\,(0.2651) = 3.58$

where

$t = 0.707\,(0.375) = 0.2651$"

and

$$I_u = \frac{d^2}{6}(3b+d)$$

$$= \frac{(3)^2}{6}(3(2)+3) = 13.5 \text{ in}^3$$

$$n = \frac{0.3\,S_{ut}}{\tau_b} = \frac{0.3\,(62000)}{3519} \cong 5.3 \leftarrow \text{(c)}$$

#4)

$$\tau = K_B \frac{8FD}{\pi d^3} = 1.135 \frac{8(100)(20)}{\pi (2)^3}$$

where

$$K_B = \frac{4C+2}{4C-3} = \frac{4(10)+2}{4(10)-3} = 1.135$$

where

$$C = \frac{D}{d} = \frac{20}{2} = 10$$

$$\tau = 722.5 \text{ MPa} \leftarrow (e)$$

#5)

$$C_{10,min} = F_R K_a \left(\frac{L}{x}\right)^{0.333}$$

$$= (1000 \times 4.45)(1.2)\left(\frac{100}{0.62}\right)^{0.333}$$

$$= 5340 \underbrace{(161.29)}_{5.43}^{0.333}$$

$$= 28996 \text{ N} \Rightarrow (a)$$

#6)

$F_R = 10\,000$ N

$L = 50$ million

$K_a = 1.4$

75 mm bore

$C_{10} = 66.3$ KN

$$C_{10} = F_R K_a \left(\frac{L}{x}\right)^{1/3}$$

$$66300 = 10\,000\,(1.4)\left(\frac{50}{x}\right)^{1/3}$$

$$\Rightarrow \left(\frac{50}{x}\right)^{1/3} = 4.736$$

$$\left(\frac{50}{x}\right) = (4.736)^3 = 106.23$$

$\Rightarrow x = 0.47 \Rightarrow$ between 96% & 99%

(d)

#7)

$F_R = 200^{lbs} = 200(4.45) = 890\ N$

$F_a = 70^{lbs} = 70(4.45) = 311.5\ N$

$bore = 15^{mm} \Rightarrow C_0 = 3.55$

$\frac{F_a}{C_0} = \frac{311.5}{3550} = 0.088 \Rightarrow e = 0.28$

$\frac{F_a}{F_R} = \frac{70}{200} = 0.35$

$F_e = X_2 F_R + Y_2 F_a$

$= 0.56(200) + 1.55(70) = 220.5$ ⟵ (b)

#8) $F_t = \frac{33000\ hp}{V} = \frac{33000(10)}{586.4} = 562.7\ lbs$

where $V = \frac{\pi n d}{12} = \frac{\pi(700)(3.2)}{12} = 586.4\ ft/min$

where $P = \frac{N}{d} \Rightarrow d = \frac{N}{P} = \frac{32}{10} = 3.2$

$F_r = F_t \tan 20 = 562.7 \tan 20$

$F_r = 204.8\ lbs$ (a)

#9)

$$N_p = \frac{2K}{(1+2m)\sin^2\phi}\left(m + \sqrt{m^2 + (1+2m)\sin^2\phi}\right)$$

$$N_p = \frac{2}{(1+12)\sin^2 20}\left(6 + \sqrt{36 + 13\sin^2\phi}\right)$$

$$N_p = \frac{2}{13(0.117)}\left(6 + \underbrace{\sqrt{36 + 13(0.117)}}_{6.125}\right)$$

$N_p = 15.9 \Rightarrow N_p = 16$ (e)

#10 $\phi = 20$

$N_p = 20$

$N_g = 60$

$P = 16$

$P = \frac{N}{d} \Rightarrow d = \frac{N}{P}$

$d_p = \frac{20}{16} = 1.25$

$d_g = \frac{60}{16} = 3.75$

Excel $\Rightarrow$ CR = 1.813 (d)

#11)

$$r_2 + d_3 + r_4 = r_6 + r_7$$

$$\Rightarrow d_2 + 2d_3 + d_4 = d_6 + d_7$$

$$N_2 + 2N_3 + N_4 - N_6 = N_7$$

$$N_7 = 20 + 2(16) + 30 - 36$$

$$N_7 = 46$$

$$n_2 = +100$$

$$n_7 = 0$$

$$n_A = ?$$

$$\frac{n_{2/A}}{n_{7/A}} = \frac{n_2 - n_A}{n_7 - n_A} = \frac{100 - n_A}{-n_A}$$

also $$\frac{n_{2/A}}{n_{7/A}} = \left(\frac{n_{2/A}}{n_{3/A}}\right)\left(\frac{n_{3/A}}{n_{4/A}}\right)\left(\frac{n_{4/A}}{n_{6/A}}\right)\left(\frac{n_{6/A}}{n_{7/A}}\right)$$

$$= \left(-\frac{N_3}{N_2}\right)\left(-\frac{N_4}{N_3}\right)(1)\left(-\frac{N_7}{N_6}\right)$$

$$= -\frac{N_4 N_7}{N_2 N_6} = -\frac{30(46)}{20(36)} = -1.917$$

$$\frac{100 - n_A}{-n_A} = -1.917$$

$$100 - n_A = 1.917\, n_A$$

$$100 = 2.917\, n_A \Rightarrow n_A \cong +34.3 \leftarrow$$

#12

$$\sigma = W^t K_o K_V K_S \frac{P}{FJ} K_B K_m$$

where $W^t = \frac{33000\ hp}{V} = \frac{33000\ (2)}{1392.7} = 168$ lbs

$V = \frac{\pi n d}{12} = \frac{\pi (2000)(0.75)}{12} = 392.75$ ft/min

$d = \frac{N}{P} = \frac{18}{24} = 0.75$ inch

and $K_o = 1.25$ $K_V = 1.3$

$J = 0.31$

$K_B = 1$

$K_m = 1 + C_{mc}(C_{pf} C_{pm} + C_{ma} C_e)$ $C_{mc}=1$ $C_{pf}=0.042$ $C_{pm}=1.1$ $C_{ma}=0.13$ $C_e=1$

$$\sigma = 168\ (1.25)(1.3)\ \frac{24}{0.5(\ )} \cdot (1)(1.18) =$$

$$C_{pf} = \frac{F}{10\,dP} - 0.025 = \frac{0.5}{10\,(0.75)} - 0.025 = 0.042$$

$$K_m = 1 + 1\,(0.042 * 1.1 + 0.13 * 1) = 1.18$$

$$\sigma = 168\,(1.25)(1.3)(1)\,\frac{24}{(0.5)(0.31)} * (1)(1.18)$$

$$\sigma = 49880 \text{ PSI}$$

Strength

$$S_b = \frac{Y_N}{K_T K_R} S_t = \frac{0.92}{(1)(0.85)}(54) = 58.4 \text{ KSi}$$

where $S_t = 54$ KSi

$Y_N = 0.92$

$K_R = 0.85$

Factor of Safety

$$n = \frac{58.4}{49.9} \cong 1.17$$