

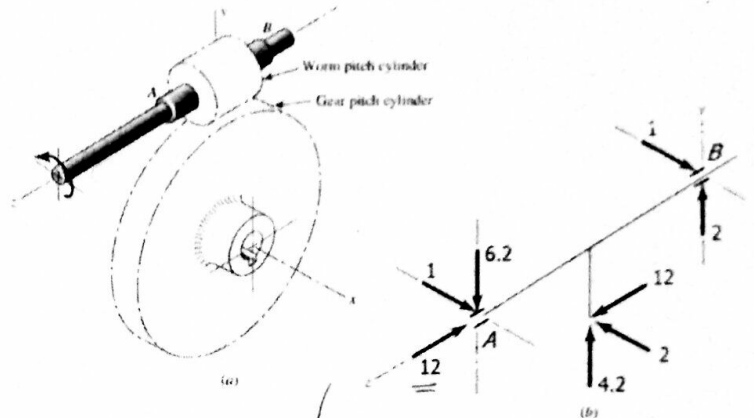


Quiz - 2

Two (3189 cone & 3120 cup) tapered-roller bearings were selected to support the shaft at **A** and **B** using direct-mounting. The shaft rotates at 1200 rpm and the bearing loads are as shown in the figure (loads are in kN).

(The Weibull parameters are $x_0 = 0.05$, $(\theta - x_0) = 4.5$ and $b = 1.5$).

Name: key
Student #: _____



- a) Find the equivalent radial loads for the bearings at **A** and **B**.

fig 11-5 ~ $C_{10} = 22.7 \text{ kN}$, $K = 1.76$

$F_{iA} = \frac{0.47 F_{rA}}{K_A} = 1.68 \text{ kN}$, $F_{iB} = \frac{0.47 F_{rB}}{K_B} = 0.6 \text{ kN}$

$F_{iB} + F_{ae} = 12.6 \text{ kN} > F_{iA}$

$\Rightarrow F_{eA} = 0.4 F_{rA} + K_A (F_{iB} + F_{ae}) = 24.69 \text{ kN}$

$F_{eB} = F_{rB} = 2.24 \text{ kN}$

$F_{ae} = 12 \text{ kN}$
 $F_{rA} = \sqrt{1^2 + 6.2^2} = 6.28 \text{ kN}$
 $F_{rB} = \sqrt{1^2 + 2^2} = 2.24 \text{ kN}$

$F_{eA} = 24.69 \text{ kN}$
 $F_{eB} = 2.24 \text{ kN}$

- b) Find the expected life (in hours) at standard reliability for the bearing used at **B**.

$C_{10} = F_{eB} \left(\frac{L_D}{L_R} \right)^{1/a} \Rightarrow L_D = \left(\frac{22.7}{2.24} \right)^{10/3} * (90 * 10^6) = 202.7 * 10^9 \text{ rev}$

$\Rightarrow \text{Life} = 202.7 * 10^9 / 1200 * 60 = 2815 \text{ kh}$

2815 kh

- c) If the life goal is 800 h, find the reliability that the bearing used at **A** will live the required life.

$X_D = \frac{800 * 1200 * 60}{90 * 10^6} = 0.64$

$R = 1 - \left[\frac{X_D \left(\frac{a_e F_e}{C_{10}} \right)^a - x_0}{\theta - x_0} \right]^b = 1 - \left[\frac{0.64 \left(\frac{1 * 24.69}{22.7} \right)^{10/3} - 0.05}{4.5} \right]^{1.5}$

$\Rightarrow R = 0.925$

0.925

5 Points

2.5 Points

2.5 Points