

LAB #4 - JOURNAL BEARINGS

ME 840

2/4/98

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$$d = 50 \text{ mm}$$

$$L = 55 \text{ mm}$$

$$T_{in} = 55^\circ\text{C}$$

$$P_s = 200 \text{ kPa}$$

$$C = 42 \text{ } \mu\text{m}$$

$$N = 48 \text{ rev/sec}$$

$$W = 10 \text{ kN}$$

5 mm OIL GROOVE

$$S = \left(\frac{r}{c}\right)^2 \frac{\mu N}{P} = \left(\frac{0.025 \text{ m}}{42 \times 10^{-6} \text{ m}}\right)^2 \frac{22 \times 10^{-3} \text{ Pa}\cdot\text{sec} (48 \text{ rev/sec})}{4 \times 10^6 \text{ Pa}} = 0.094$$

$$\text{GUESS } T_{avg} = 65, \Delta T = 20^\circ \rightarrow \mu = 22 \times 10^{-3} \text{ Pa}\cdot\text{sec}$$

$$P = \frac{\frac{1}{2}(10,000 \text{ N})}{(0.05 \text{ m})(0.05 \text{ m})} = 4,000,000 \text{ N/m}^2 \text{ (REMEMBER, TREAT AS TWO BEARINGS)}$$

1ST
ITERATION

$$\text{FROM CHARTS; } \frac{r}{c}f = 3.3, \quad \epsilon = 0.8$$

$$\Delta T = \frac{1956 \times 10^6}{1 + 1.5(0.8)^2} \frac{3.3}{200 \text{ kPa} (25 \text{ mm})^4} 0.094 (5 \text{ kN})^2 = 99^\circ\text{C}$$

SINCE $\Delta T_{calc} > \Delta T_{guess}$, WE MUST REITERATE WITH A LARGER GUESS, CHOOSE $\frac{99 + 20}{2} \approx 60^\circ\text{C} = \Delta T$; $T_{avg} = 85$

$$S = \left(\frac{0.025}{42 \times 10^{-6}}\right)^2 \frac{10.5 \times 10^{-3} \text{ Pa}\cdot\text{sec} 48 \text{ rev/sec}}{4 \times 10^6 \text{ Pa}} = 0.045$$

$$\text{FROM CHARTS; } \frac{r}{c}f = 2, \quad \epsilon = 0.88$$

$$\Delta T = \frac{1956 \times 10^6}{1 + 1.5(0.88)^2} \frac{2}{200 \text{ kPa} (25 \text{ mm})^4} 0.045 (5 \text{ kN})^2 = 26^\circ\text{C}$$

SINCE $\Delta T_{calc} < \Delta T_{guess}$, WE MUST RE-ITERATE, USE $\Delta T = 43^\circ\text{C}$

2ND
ITERATION

$$S = 0.06$$

$$(GUESS \Delta T = 43^\circ, T_{avg} = 76.5^\circ C \rightarrow \mu = 14 \times 10^{-3} \text{ Pa} \cdot \text{sec})$$

$$\text{FROM CHARTS ; } \frac{l}{c} f = 2.4, \quad \epsilon = 0.85$$

$$\Delta T = \frac{1956 \times 10^6}{1 + 1.5(0.85)^2} \frac{2.4}{200 \text{ kPa} (25 \text{ mm})^4} 0.06 (5 \text{ kN})^2 = 43.3^\circ C$$

* THIRD TIME'S A CHARM (AS THEY SAY)

$$\frac{h_o}{c} = 1.5 \rightarrow h_o = 1.5 (42 \times 10^{-6} \text{ m}) = 0.00006 \text{ m} = 6 \times 10^{-5} \text{ m}$$

$$\frac{Q}{rcNl} = 5.5 \rightarrow Q = 5.5 (0.025 \text{ m}) 42 \times 10^{-6} \text{ m} (48 \text{ rev/sec}) 0.025 \text{ m}$$

$$= 6.9 \times 10^{-6} \text{ m}^3/\text{sec} = 6.9 \text{ cm}^3/\text{sec}$$

BUT THIS FEEDS ONLY ONE SIDE!

$$Q_{TOTAL} = 13.8 \text{ cm}^3/\text{sec}$$

3RD
ITERATION

OK