PROBLEM 10-1

Statement: The shaft shown in Figure P10-1 was designed in Problem 9-1. For the data in the row(s) assigned from Table P10-1, and the corresponding diameter of shaft found in Problem 9-1, design suitable bearings to support the load for at least 7E7 cycles at 1 500 rpm. State all assumptions.

(a) Using hydrodynamically lubricated bronze sleeve bearings with $O_N = 20$, $l/d = 1.25$, and a clearance ratio of 0.001 5.

(b) Using deep-groove ball bearings.

Assumptions: The US units for the data shown in Table P10-1 are consistent with those stated in Problem 9-1. The finish is machined. Assume a reliability of 99% and room temp.

PROBLEM 10-9

Statement: Find the minimum film thickness for a long bearing with the following data: 30-mm dia, 130 mm long, 0.0015 clearance ratio, 1 500 rpm, ISO VG 100 oil at 200°F, and supporting a load of 7 kN.

S	0.1750		Sommerfeld Number
hmin	14.8887	um	minimum film thickness based on ex

PROBLEM 10-13

Statement: Find the torques and power lost in the bearing of Problem 10-9.

Ts	0.1854	N–m	stationary torque
T0	0.1745	N–m	no–load Petroff torque
Tr	0.2342	N–m	rotating torque
power	0.037	kw	power loss in bearing
frict	0.0022		coefficient of friction in bearing

PROBLEM 10-19

Statement: The shaft shown in Figure P10-4 was designed in Problem 9-19. For the data in the row(s) assigned from Table P10-1, and the corresponding diameter of shaft found in Problem 9-19, design suitable bearings to support the load for at least 5E8 cycles at 1 200 rpm. State all assumptions.

(a) Using hydrodynamically-lubricated bronze sleeve bearings with $O_N = 40$, $l/d = 0.80$, and a clearance ratio of 0.002 5.

(b) Using deep-groove ball bearings.

Problem 10-1 part b
Results for all rows of Table P10-1

Row	Side	F (lb)	shaft (mm)	ID (mm)	Brg #	cycles
a	left	125	30.2	30	6306	6.40E10
a	right	1125	30.2	30	6306	8.80E07
b	left	1250	30.5	30	6406	8.80E07
b	right	1750	30.5	30	6406	6.40E07
c	left	1500	41.1	40	6308	1.20E08
c	right	2250	41.1	40	6308	3.50E07
d	left	1000	36.9	35	6307	1.90E08
d	right	2000	36.9	35	6307	2.30E07
e	left	1500	47.2	45	6309	2.30E08
e	right	3000	47.2	45	6309	2.80E07
f	left	281	38.3	35	6307	8.30E09
f	right	1031	38.3	35	6307	1.70E08

(handwritten annotation: TOO LOW! SEE PROBLEM STATEMENT — pointing to several cycle values)

Problem 10-19 part b
Results for all rows of Table P10-1

Row	Side	F (lb)	shaft (in)	ID (in)	Brg #	cycles
a	left	67	33	30	6306	4.2E+11
a	right	1467	33	30	6306	4.0E+7
b	left	214	30	25	6305	5.6E+9
b	right	914	30	25	6305	7.2E+7
c	left	75	25	20	6304	6.4E+10
c	right	975	25	20	6304	2.9E+7
d	left	200	32	30	6306	1.6E+10
d	right	1200	32	30	6306	7.2E+7
e	left	325	43	40	6308	1.2E+10
e	right	2425	43	40	6308	2.8E+7
f	left	14	27	25	6305	2.2E+13
f	right	1036	27	25	6305	4.9E+7