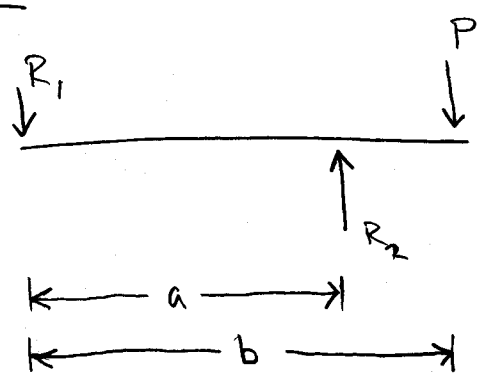
FBD:



$\Sigma F = 0;\quad R_1 + P = R_2$

$\Sigma M = 0;\quad R_2 a = Pb$

$R_2 = \frac{Pb}{a}$

$R_1 = R_2 - P = \frac{Pb}{a} - P$

$= P\left(\frac{b}{a} - 1\right)$

SPECIFY BEARINGS AT R_1 & R_2

1500 rpm (NOT APPLICABLE, FEW BEARINGS HAVE LIMITS THIS LOW)

LIFE = 7×10^7 CYCLES

ASSUME SHAFT DIAMETER UNKNOWN (9.1 NOT ASSIGNED), THUS WE WILL SPECIFY A MINIMUM BORE BEARING TO CARRY THE KNOWN LOADS

ASSUME APPLICATION FACTOR OF UNITY ($K_a = 1$)
RELIABILITY OF 90% ($K_R = 1$)
} NO OTHER INFO GIVEN

$$C_{REQ} = K_a F_e \left(L / K_R L_R\right)^{0.3}$$

THUS AT R_1 $\quad C_{REQ} = P\left(\frac{b}{a} - 1\right)\left[\frac{7}{9}\right]^{0.3}$

AND AT R_2 $\quad C_{REQ} = \frac{Pb}{a}\left[\frac{7}{9}\right]^{0.3}$

HAND CALCS FOR ROW a:

R_1; $C_{REQ} = 1000\left(\frac{18}{16} - 1\right)\left[\frac{7}{9}\right]^{0.3} = 116\text{lb} = 516\text{N}$

ANY BEARING ON THE CHART (PG RB-14, NOTES) WILL GIVE MORE THAN THE REQUIRED DESIGN LIFE.

R_2; $C_{REQ} = 1000\left(\frac{18}{16}\right)\left[\frac{7}{9}\right]^{0.3} = 1043\text{lb} = 4.6\text{kN}$

300 SERIES, 20mm BORE → 304 BEARING OR LARGER
200 SERIES, 30mm BORE → 206 BEARING OR LARGER
L00 SERIES, 45mm BORE → L09 BEARING OR LARGER

NOTE: THE ABOVE BEARINGS WERE SELECTED USING THE CLASS NOTES AND TABLE ON PAGE RB-14. THE BOOK USES SLIGHTLY DIFFERENT EXPONENTS IN THE BEARING EQN AND A DIFFERENT MANUFACTURER'S CHARTS (SEE NEXT PAGE).

NORTON 10.1 b						Left Hand Side				Right Hand Side			
						Book Method Chart RB-11		Notes Method Chart RB-14		Book Method Chart RB-11		Notes Method Chart RB-14	
ROW	a (in)	b (in)	P (lb)	R1	R2	Creq (lb)	Bearing	Creq (kN)	Bearing	Creq (lb)	Bearing	Creq (kN)	Bearing
a	16	18	1000	125	1125	515	6300	0.5	L00,200,300	4636	6306	4.6	L09,206,304
b	2	7	500	1250	1750	5152	6307	5.2	L09,206,304	7212	6308	7.2	L11,207,306
c	4	12	750	1500	2250	6182	6308	6.2	L11,207,306	9273	6310	9.3	L14,208,307
d	4	8	1000	1000	2000	4121	6306	4.1	L07,206,304	8243	6309	8.2	L11,207,306
e	6	12	1500	1500	3000	6182	6308	6.2	L11,207,306	12364	6311	12.4	L16,212,308
f	16	22	750	281	1031	1159	6300	1.2	L02,200,300	4250	6306	4.3	L08,206,304

NOTE: IN THE SOLUTIONS MANUAL THE CODE USES THE BEARING FROM THE CHART ON RB-11 (PG 684, TEXT) WHICH HAS THE SAME BORE AS THE SHAFT DIAMETER, AND SIMPLY CALCULATES ESTIMATED LIFE. THIS RESULTS IN BEARING SELECTIONS WHICH DO NOT MEET THE SPECIFIED DESIGN CRITERIA OF 7×10^7 CYCLES. NOTE ALSO, THAT THE CLASS NOTES USE 0.3 FOR THE EXPONENT IN THE C_{REQ} EQUATION, WHILE THE TEXT USES 1/3. THIS IS MOST LIKELY DUE TO DIFFERENT BEARING MANUFACTURERS. THE MORAL OF THE STORY IS TO USE THE EQUATIONS FROM THE BEARING CATALOG YOU INTEND TO USE FOR BEARING SELECTION.