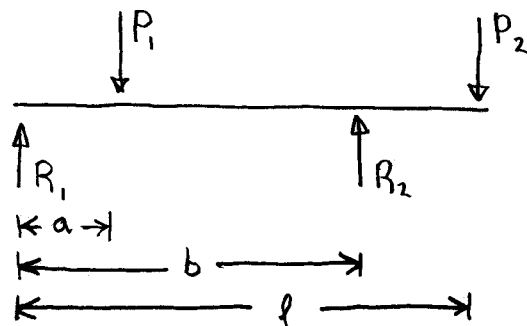


FBD:

$$\sum F = 0; R_1 + R_2 - P_1 - P_2 = 0$$

$$\sum M = 0; -P_1 a + R_2 b - P_2 l = 0$$

$$R_2 = \frac{P_1 a + P_2 l}{b}$$

$$\begin{aligned} R_1 &= P_1 + P_2 - R_2 \\ &= P_1 + P_2 - \frac{P_1 a + P_2 l}{b} \\ &= P_1 \left(1 - \frac{a}{b}\right) + P_2 \left(1 - \frac{l}{b}\right) \end{aligned}$$

SPECIFY BEARINGS @  $R_1$  &  $R_2$ 

1200 rpm (NOT APPLICABLE, FEW BEARINGS HAVE LIMITS THIS LOW)

LIFE =

ASSUME SHAFT DIA, UNKNOWN (9.19 NOT ASSIGNED), THUS WE WILL SPECIFY A MINIMUM BORE BEARING TO CARRY THE KNOWN LOADS

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

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

$$\text{THUS AT } R_1, C_{REQ} = \left[ P_1 \left(1 - \frac{a}{b}\right) + P_2 \left(1 - \frac{l}{b}\right) \right] \left[ \frac{50}{9} \right]^{0.3}$$

$$\text{AND AT } R_2, C_{REQ} = \left[ \frac{P_1 a + P_2 l}{b} \right] \left[ \frac{50}{9} \right]^{0.3}$$

HAND CALCS FOR ROW A:

$$R_1; C_{REQ} = \left[ 400 \left(1 - \frac{16}{18}\right) + 1000 \left(1 - \frac{20}{18}\right) \right] \left[ \frac{50}{9} \right]^{0.3} = 11216 = 0.5 \text{ kN}$$

ANY BEARING FROM THE CHART ON RB-14 WILL WORK,

$$R_2; C_{REQ} = \left[ \frac{400(16) + 1000(20)}{18} \right] \left[ \frac{50}{9} \right]^{0.3} = 245116 = 10.9 \text{ kN}$$

L00 SERIES, 70 mm BORE  $\rightarrow$  L14 }  
 200 SERIES, 55 mm BORE  $\rightarrow$  211 } OR LARGER BEARING  
 300 SERIES, 40 mm BORE  $\rightarrow$  308 }

NOTE: THE ABOVE BEARINGS WERE SELECTED USING THE CLASS NOTES AND THE 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 10.19 b |        |        |        |         |         |         |         |                            |         |                             | Left Hand Side |                            |         |                             | Right Hand Side |  |  |  |
|----------------|--------|--------|--------|---------|---------|---------|---------|----------------------------|---------|-----------------------------|----------------|----------------------------|---------|-----------------------------|-----------------|--|--|--|
|                |        |        |        |         |         |         |         | Book Method<br>Chart RB-11 |         | Notes Method<br>Chart RB-14 |                | Book Method<br>Chart RB-11 |         | Notes Method<br>Chart RB-14 |                 |  |  |  |
| ROW            | l (in) | a (in) | b (in) | P1 (lb) | P2 (lb) | R1 (lb) | R2 (lb) | Creq (lb)                  | Bearing | Creq (kN)                   | Bearing        | Creq (lb)                  | Bearing | Creq (kN)                   | Bearing         |  |  |  |
| a              | 20     | 16     | 18     | 400     | 1000    | -67     | 1467    | 529                        | 6300    | 0.5                         | L00,200,300    | 11641                      | 6311    | 10.9                        | L14,211,308     |  |  |  |
| b              | 12     | 2      | 7      | 200     | 500     | -214    | 914     | 1701                       | 6302    | 1.6                         | L04,203,300    | 7257                       | 6308    | 6.8                         | L11,207,306     |  |  |  |
| c              | 14     | 4      | 12     | 300     | 750     | 75      | 975     | 595                        | 6300    | 0.6                         | L00,200,300    | 7739                       | 6309    | 7.3                         | L11,207,306     |  |  |  |
| d              | 8      | 4      | 8      | 400     | 1000    | 200     | 1200    | 1587                       | 6301    | 1.5                         | L04,202,300    | 9524                       | 6310    | 8.9                         | L13,208,307     |  |  |  |
| e              | 17     | 6      | 12     | 600     | 1500    | -325    | 2425    | 2580                       | 6304    | 2.4                         | L05,203,301    | 19247                      | 6315    | 18.0                        | L19,216,311     |  |  |  |
| f              | 24     | 16     | 22     | 300     | 750     | 14      | 1036    | 108                        | 6300    | 0.1                         | L00,200,300    | 8226                       | 6309    | 7.7                         | L11,207,306     |  |  |  |

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  $5 \times 10^8$  CYCLES. NOTE ALSO THAT THE CLASS NOTES USE 0.3 FOR THE EXPOONENT IN THE GREGG 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.