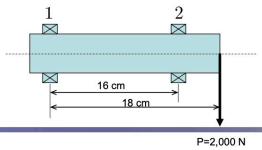
Ex 1) Bearing Selection (radial load)

- **Select bearings such that we can achieve**

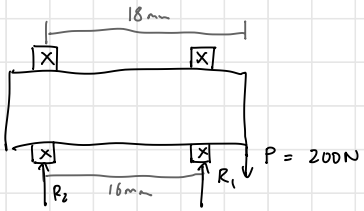
1) **the static safety factor $f_s \geq 2$**
2) **bearing fatigue life at both ends to be at least 1,000 million rev's for 10% failure rate**

The minimum shaft diameter is given by 45.9 mm.



Minimum shaft diameter $d = 45.9$ mm

$\Rightarrow$ $d = 50$ mm (to use table)



Bearing forces: $R_1 + R_2 = 2000$

$0.16\,R_2 = 0.18\,(2000)$

$\Rightarrow$ $R_2 = 2250$ N, $R_1 = -250$ N

No axial load $\Rightarrow$ $P_o = P = 2250$ for bearing 2 (we choose this first)

Boundary Dimensions (mm)				Basic Load Ratings (N)		Basic Load Ratings (kgf)		Factor	Limiting Speeds (min⁻¹) Grease		Limiting Speeds (min⁻¹) Oil	Bearing Numbers			
d	D	B	r min.	C_r	C_{0r}	C_r	C_{0r}	f_0	Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
50	65	7	0.3	6 400	6 200	655	635	17.2	9 500	5 300	11 000	**6810**	**ZZ**	**VV**	**DDU**
	72	12	0.6	14 500	11 700	1 480	1 200	16.1	9 000	5 300	11 000	**6910**	**ZZ**	**VV**	**DDU**
	80	10	0.6	15 400	12 400	1 570	1 260	16.1	8 500	—	10 000	**16010**	—	—	—
	80	16	1	21 800	16 600	2 220	1 700	15.6	8 500	4 800	10 000	**6010**	**ZZ**	**VV**	**DDU**
	90	20	1.1	35 000	23 200	3 600	2 370	14.4	7 100	4 800	8 500	**6210**	**ZZ**	**VV**	**DDU**
	110	27	2	62 000	38 500	6 300	3 900	13.2	6 000	4 300	7 500	**6310**	**ZZ**	**VV**	**DDU**

1) Let us consider both ball and roller for bearing 2.

(1) For ball bearings, $f_s = \frac{C_0}{P_o} > 2$ $\Rightarrow$ $C_0 > 2P_o = 4500$ N

$\Rightarrow$ All sizes are okay.

Fatigue life for standard 10% failure rate

$$L_{10} = \left(\frac{C}{P}\right)^3 = \left(\frac{C}{2250}\right)^3 \geq 1000 \quad \Rightarrow \quad C \geq 1000^{1/3} \times 2500 = 22.5 \text{ kW}$$

$\Rightarrow$ 6210 ($D = 90$, $B = 20$) or 6810 ($D = 110$, $B = 27$)

(2) For roller bearings, f_s OK for all sizes

$$L_{10} = \left(\frac{C}{P}\right)^{10/9} \geq 1000 \quad \Rightarrow \quad C \geq 1000^{\frac{9}{10}} \times 2250 = 17.87 \text{ kN}$$

$\Rightarrow$ All sizes are OK, choose 1010 ($D = 80$, $B = 16$)

50	80	16	1	0.6	57.5	72.5	32 000	36 000	8 000	10 000	NU1010	NU NJ NUP
	90	20	1.1	1.1	—	80.4	48 000	51 000	7 100	8 500	N 210	— — —
	90	20	1.1	1.1	59.5	—	69 000	76 500	6 300	7 500	NU 210 EW	NU NJ NUP
d	D	B					C_r	C_{0r}				

2) For bearing 1

$C \geq 1000^{\frac{1}{3}} \times 250 = 2500 \quad \Rightarrow$ We can chose 6810

$\Rightarrow f_s = \frac{C_o}{P_o} = \frac{6200}{250} = 248, \quad L_{10} = \left(\frac{6400}{250}\right)^3 =$ 16780 million revs