Problem of Practices
on
Mechanical Engineering Design
Chapter-13 Rolling Contact Bearings

Prepared By

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1. Select a suitable ball-bearing subjected to following loads:
Radial load of 600 kgf at 150 r.p.m. for 25 % of time.
Radial load of 750 kgf at 600 r.p.m. for 20% of time.
Radial load of 200 kgf at 200 r.p.m. for 55 % of time.
The loads are steady. The outer ring remains stationary. The bearing has to have an expected average life of 2500 hours. The shaft diameter can be adjusted to the bearing selected.
The data given below may be used:

No.	Inner	Outer	Width	Basic	Capacity	Max.
SKF	Dia.mm	Dia.mm	mm	static	kgf Dynamic	RPM
6007	35	62	14	880	1250	13000
6008	40	68	15	980	1320	10000
6009	45	75	16	1270	1630	10000
6010	50	80	16	1370	1700	8000
6011	55	90	18	1800	2200	8000
6012	60	95	18	1930	2280	8000
6013	65	100	18	2120	2400	8000

6014	70	110	20	2550	3000	6000

2. What is the classical Reynold's Equation for one dimensional fluid flow based on Hydrodynamic lubrication theory? What are the assumptions made in arriving at this equation? Explain me significance of Somerfield Number, Temperature Rise and Minimum Film Thickness for assessing a bearing performance.

3. Explain the mechanism of hydrodynamic and boundary lubrications. State with justification the important properties of lubricant in each case.

4. The ball bearings are to be selected for an application in which the radial load is 2 kN during 90 percent of the time and 8 kN during the remaining 10 percent. The shaft is to rotate at 150 rpm. Determine the minimum value of the basic dynamic load rating for 5000 hours of operation with not more than 10 percent failures.

5. Mention three different methods used to prevent an antifriction bearing from sliding axially in a shaft at the inner race and in a bore at the outer race.

6. An oil ring bearing supports a shaft of diameter 95 mm which runs at 230 rpm. The maximum load on the bearing is 18 kN. Determine the bearing characteristic number for l/d = 1.5 and absolute viscosity 0.0225 kg/ms.

7. What are common modes of failure of rolling element bearings?

8. A ball bearing operates on a work cycle consisting of three parts — a radial load of 3500 N at 1440 rpm, for 30% of the cycle, a radial load of 6000 N, 750 rpm, for 35% of the cycle and a radial load of 2500 N at 1440 rpm for the remaining cycle. The expected life of the bearing is 10,000 hours. Calculate the dynamic load carrying capacity of the bearing.

9. Describe angular contact bearings and taper roller bearings with the help of neat sketches. Also, cite at least two advantages and two disadvantages of each.

10. A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20 × 10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing.

11. Select a single row deep groove ball bearing for a radial load of 4500 N and axial load of 55,000 N operating at speed of 1500 rpm for an average life of 5 years running for 12 hours per day.

12. Select a suitable roller bearing to carry a radial load of 25,000 N. The shaft rotates at 1500 rpm, average life is 4000 hours. Inner race rotates. Take mild shock.

13. A deep groove ball bearing having bore diameter of 60 mm and rotating at 1440 rpm is subjected to a radial force of 2500 N and an axial force of 1200 N. The radial and axial thrust factors are 0.56 and 2.0 respectively. The load factor is 1.2. If the expected rating life is 25000 hrs, calculate the required basic dynamic capacity of the bearing and select the bearing.