

Introduction

Even when bearings are being used under ideal conditions, failures of bearings are caused by deterioration of the material due to rolling fatigue. Generally, the service life of bearings is expressed either as a period of time or as the total number of rotations before the occurrence of failures in the inner ring, outer ring or rolling element because of rolling fatigue, due to repeated stress.

Rolling bearings sometimes fracture earlier than expected. The following causes should be considered;

- ① Inappropriate use of bearings
- ② Faulty installation or improper processing
- ③ Improper lubricant, lubrication method or sealing device
- ④ Inappropriate speed and operating temperature
- ⑤ Contamination by foreign matter during installation
- ⑥ Abnormally heavy load

When bearing failure is found, even if it is insignificant, is important to investigate the phenomenon to determine the causes. At this time, not only the bearing but also the shaft, housing, and lubricant used with the bearing should be comprehensively investigated, together with the bearing.

To judge the causes of failure, sufficient knowledge and experience in bearings and lubricants and a good understanding of the characteristics of the equipment are necessary. In addition, consideration of the installation conditions and operational process of the bearing is required.

[Reference] Rated service life of rolling bearing

$$L = \left(\frac{C_r}{P} \right)^p \quad L : \text{Rated service life, } 10^6 \text{ rotations}$$

$$L_h = \frac{10^6}{60n} \left(\frac{C_r}{P} \right)^p \quad L_h : \text{Rated service life, h}$$

C_r : Basic dynamic load rating, N
 P : Dynamic equivalent load rating, N
 n : Rotational speed, min⁻¹
 p : 3 ……Ball bearing,
 10/3 ……Roller bearing

I . Bearing Fracture

1. Time of fracture occurrence and causes

For failure analysis, it is important to accurately determine the time a fracture occurs, because the possible causes of failure can be limited in according to the time of fracture occurrence.

For reference, time of fracture occurrence and related causes are categorized and listed in Table 1-1.

Table 1-1 Time of Breakage Occurrence and Causes

Time of fracture occurrence \ Causes	Inappropriate use of bearings	Faulty design of shaft, housing or other installation aspects or improper processing	Improper lubricant, lubrication method or sealing device	Defect in bearings	Mis-mounting of bearings	Defect in sealing device, contamination of water, dust or other foreign matters, or shortage of lubricant
(1) Fracture occurring immediately after bearings were mounted or within a short time after mounting	○	○	○	○	○	
(2) Fracture occurring immediately after overhaul			○		○	
(3) Fracture occurring immediately after lubricant was supplied			○			
(4) Fracture occurring immediately after repair or removal of shaft, housing or other parts		○	○		○	
(5) Fracture occurring during normal operation			○		○	○