



Factors Influencing the Performance of Ball and Roller Bearings

An Online Continuing Education Course for Engineers

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Introduction

There are many factors that affect the performance of ball and roller bearings. Some are obvious and some are not very obvious. This course starts out explaining the performance characteristics of the various ball and roller bearings. It then deals with some of the aspects affecting performance such as; how different types of bearing loads can affect expected life calculations; how the material used and different refining and heat treatment methods can improve bearing performance; how oil lube film thickness affects expected life; and what the effect of misalignment and preloading have on a machine tool bearing application. It is the hope that understanding all the above will insure that bearing application engineering will be a more successful venture.

Performance Characteristics of Rolling Contact Bearings

Ball bearings are a common type of rolling contact bearing. Radial ball bearings can support radial loads and a lesser amount of bi-directional thrust loads. Angular contact ball bearings can support both radial and thrust loads and are often used in pairs. (See Figures 1, 2, & 3.) Because of the much smaller contact between balls and rings, ball bearings cannot support loads as heavy as equal sized roller bearings; however, ball bearings can operate with lower torque and higher speed and precision than roller bearings. Radial ball bearings can be furnished prelubricated and sealed and operate for life without maintenance. Ball and roller bearings can be furnished with snap rings installed in grooves in the outer ring outside for mounting purposes.

Roller bearings are also a common type of rolling bearing. Cylindrical roller bearings can support higher radial loads than similar size ball bearings but lack the capacity to support substantial thrust loads. Tapered roller bearings can support high radial and high thrust loads and are often used in pairs. (See Figures 4 & 5.)

Following is a summary of Figure 6 which has a table of the characteristics of ball and roller bearings:

- Radial ball bearings have fair radial and thrust load carrying capability. They are excellent for high speed, high accuracy, low torque, and good for shaft misalignment. They can be used on both ends of a shaft. Angular contact ball bearings have good radial and thrust load carrying capability. They are excellent for high speed and high accuracy, fair for low torque, but poor for supporting shafts that are misaligned.
- Angular contact pairs are good for radial and thrust loads. They are good for high speed and accuracy and are poor for supporting shafts that are misaligned. They are commonly used on both ends of a shaft.
- Some forms of cylindrical roller bearing have good radial load and fair thrust load carrying capacity. Others are excellent for high speed and accuracy. All are fair for shaft misalignment. Some forms are good for mounting on both ends of a shaft.
- Tapered roller bearings have excellent radial and good thrust load carrying capability. They are good for high speed and accuracy. Tapered roller bearings pairs are excellent for radial and thrust loads. They are good for accuracy and poor for misalignment. They too are commonly mounted on both ends of the same shaft.

Figure 1

Ball Bearing Terminology

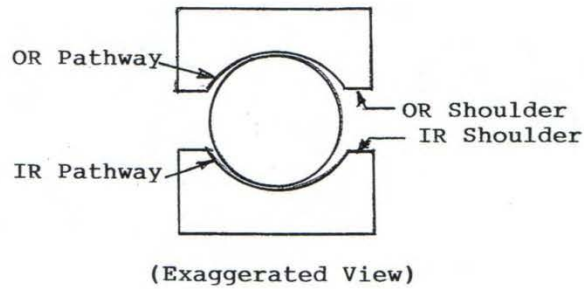
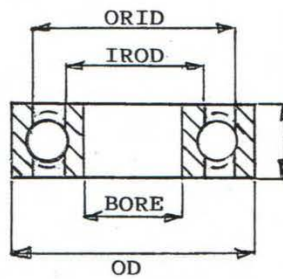
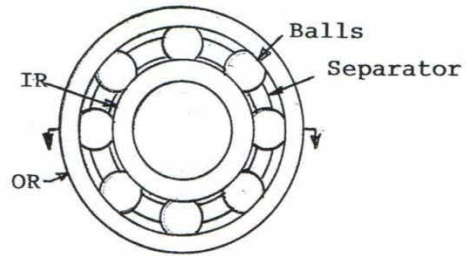
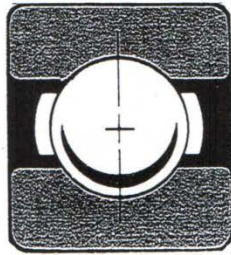


Figure 2
Ball Bearing Types



Radial Ball Bearing



Angular Contact Ball Bearing

Figure 3
Bearing Loads

