

LECTURE 4

Bearings

1. Introduction

A bearing is used to support a rotating shaft. When a shaft is supported at its end, during rotation, it gets sagged causing deflection (Fig. 1). Hence bearing are provided at suitable intervals to avoid deflection and to provide smooth rotation. Therefore, bearings are used for

- Smooth and free rotation of shaft
- Minimizing frictional resistance during rotation.
- Reducing wear of shaft

Bearing can be classified in various ways.

Depending on load bearing medium:

- Hydrodynamic bearing
- Hydrostatic bearing
- Rolling Type Bearing

Depending on load type:

- Axial load bearing
- Radial load bearing
- Mixed load Bearing

2. Journal Bearing

Here oil is forced between two faces and held in by means of sealing the edge. Thus a very low frictional resistance is found to generate during rotation of shaft and so such bearings are operable at pretty high speeds for really large load. A journal bearing is almost free of maintenance when in continuous use, but very much susceptible to be contaminated from dust particles or not clean oil. In some cases, wear may occur at start-up or shutdown processes. The part of the shaft remaining in contact with the bearing is called journal. A fluid film of oil or grease is maintained at the clearance space between the bearing and journal. This clearance must have to be chosen judiciously. For a large clearance, pressure cannot be build up and the bearing can be damaged very quickly. A very small clearance may create contact of shaft with bearing thus create wear. Such type of hydrodynamic bearing may suffer initial wear at starting condition and also at low rotational speed of shaft, due of absence of complete separation

between shaft and bearing. In full speed rotation, a lubrication wedge forms causing lift of journal.

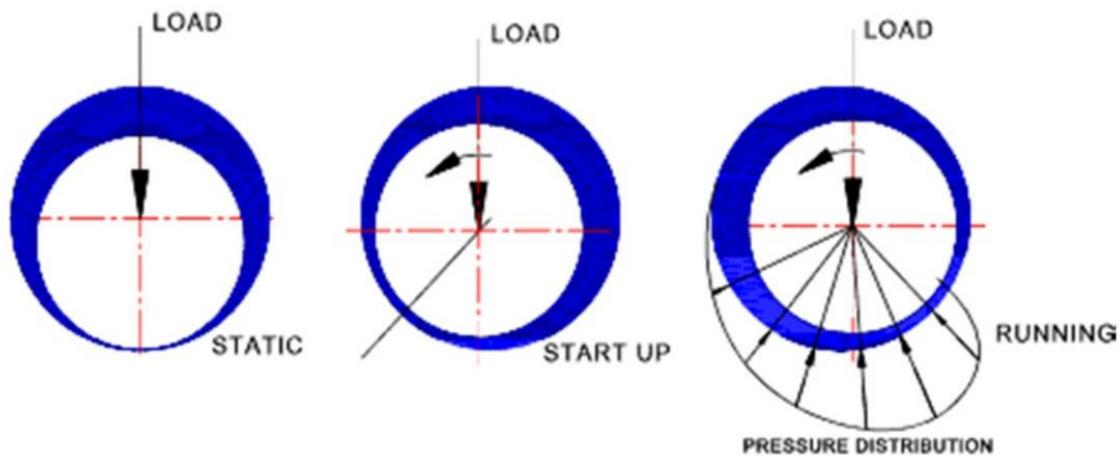
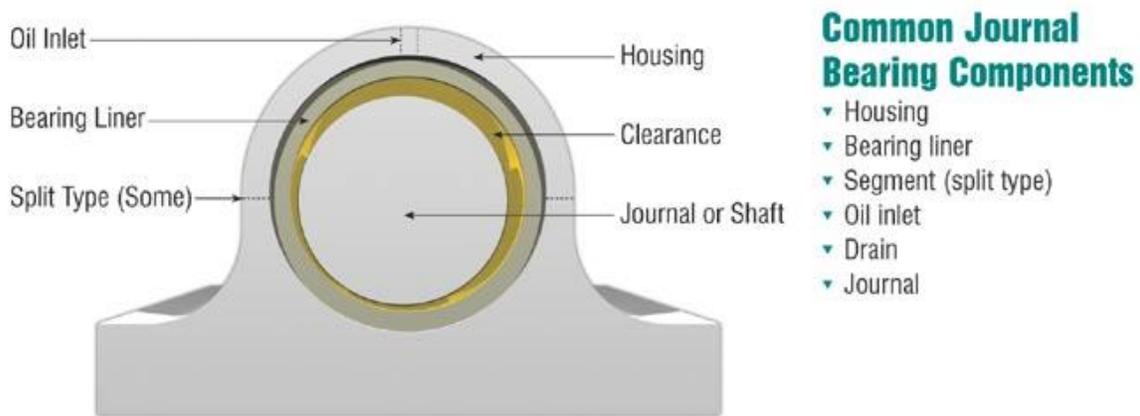


Figure 1. Journal Bearing

3. Rolling Element Bearing

This type of bearing uses ball or roller as rolling element that reduces frictional wear. In general rolling element bearing has an outer ring, inner ring and a rolling elements. Inside the outer ring there is a groove which is called outer ring race. Inner ring race is a circular ring placed concentrically within outer race ring. These two grooves (inner and outer ring) accommodates the rolling elements, either ball or roller.

In rolling element bearing, several types of rolling elements such as ball, rollers and needles can be used.

Ball Bearing

Here balls, generally made of hard steel are the rolling elements and such bearings can support loads both along axial and radial direction.

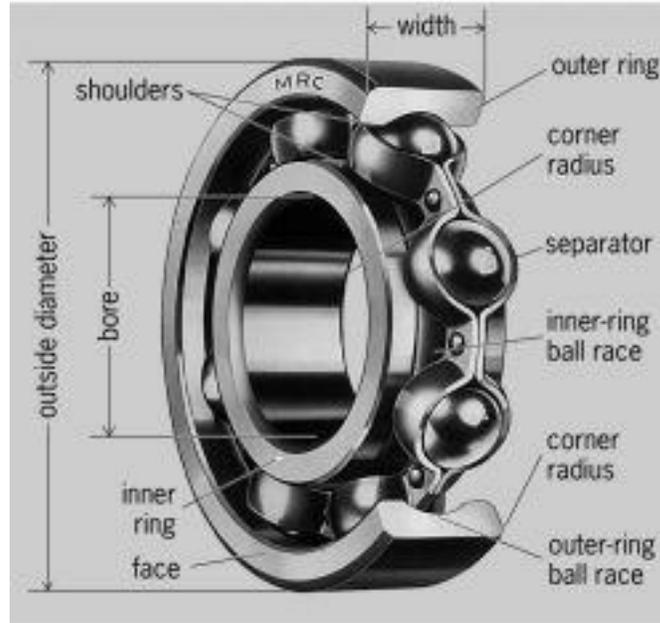


Figure 2. Structural Details of a ball bearing

Cylindrical roller bearing

Here cylinders, generally made of hard steel are the rolling elements. This bearing can be used for higher load than ball bearing. Due to larger contact area than ball bearings, cylindrical roller bearing can be used for axial and radial loads higher than ball bearing.

Tapered roller bearing

Here rollers of conical shapes running on conical surfaces, generally made of hard steel are the rolling elements. Due to larger contact area than roller bearings, tapered roller bearing can be used for moderately high axial and radial loads than cylindrical roller bearing.

Spherical roller bearing

The roller used for this type of bearings are thicker at middle and thinner at ends, which facilitates adjustment to support loads not aligned properly. The shapes of the races are prepared in compliance with the shape of the rollers. Due to production difficulties such bearings are costly.

Needle Bearing

In this type of bearings, very long and thin cylinders are used. Sometimes the ends of the rollers are made tapered to points to keep rollers captive.

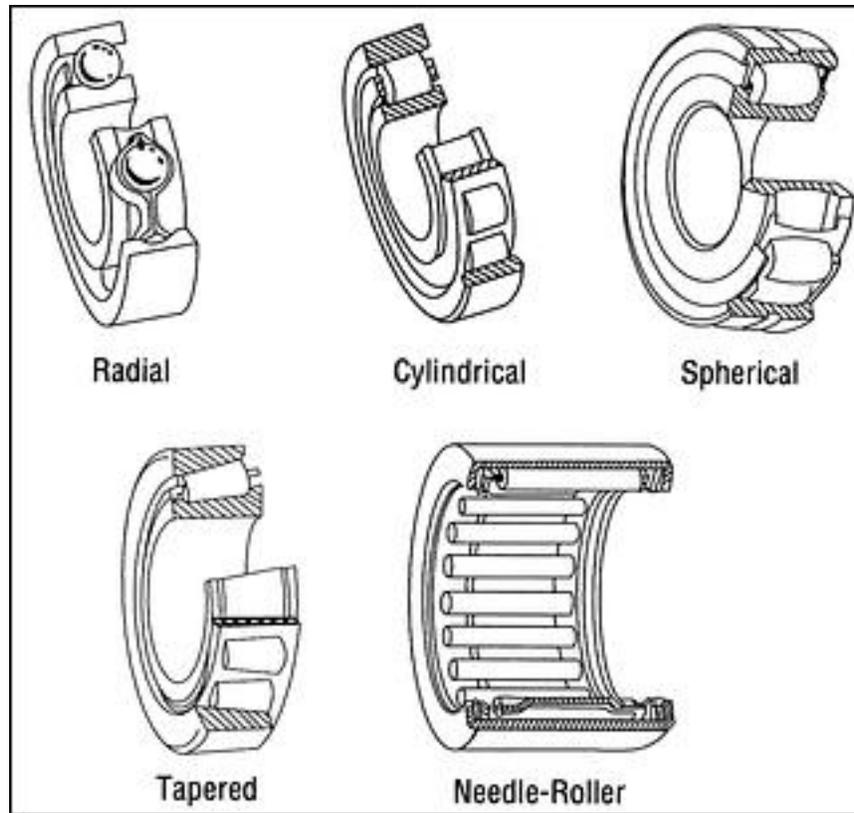


Figure 3. Different types of rolling element bearing

Loading for rolling element bearing

Depending on the configuration of races, rolling element bearing can be made to support different types of loadings and are classified as follows

Thrust Loading

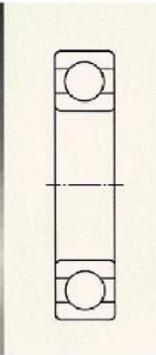
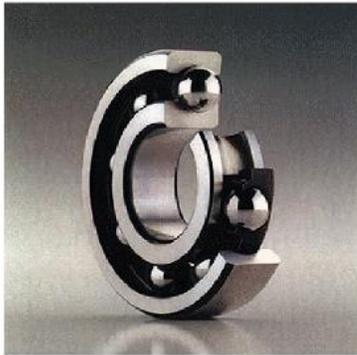
It is also called axial loading. All sorts of roller bearings can take such type of loading.

Radial Loading

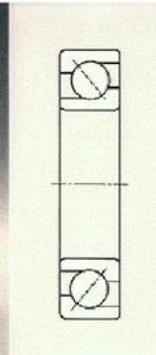
Ball bearing are widely used for smaller loadings. For heavier Loadings, tapered bearings are very suitable.

Several types of rolling element bearings are shown in the following figures:

Ball Bearings

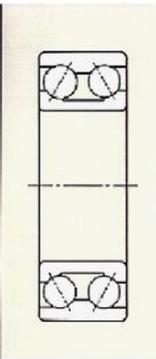


Deep groove ball bearings

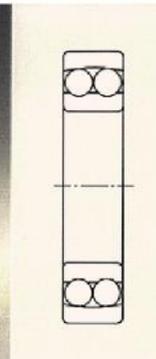


Single row angular contact ball bearings

Ball Bearings

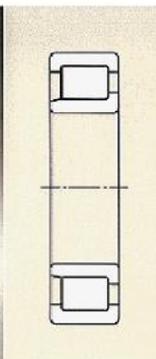


Double row angular contact ball bearings

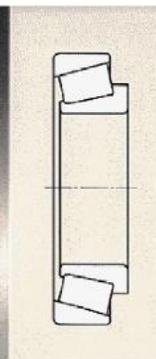
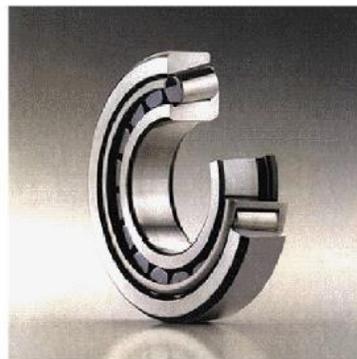


Self-aligning ball bearings

Roller Bearings

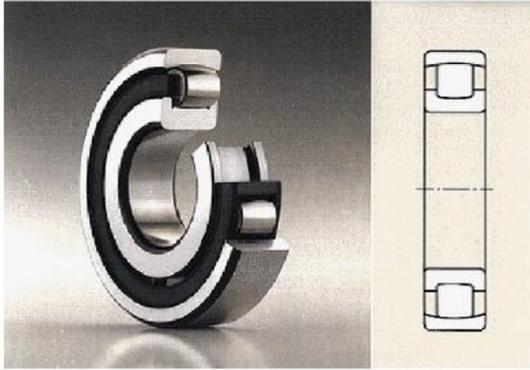


Cylindrical roller bearings

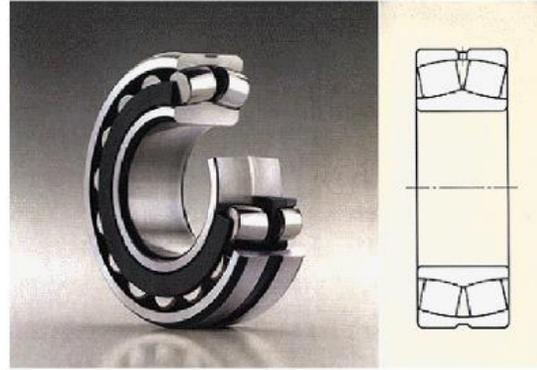


Tapered roller bearings

Roller Bearings

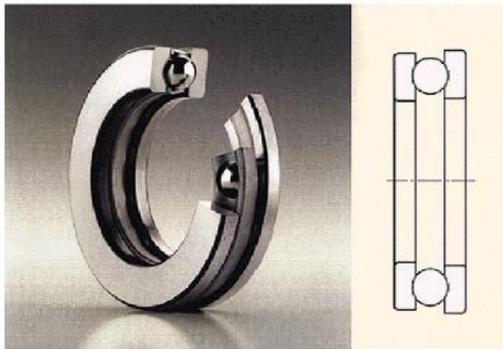


Barrel roller bearings

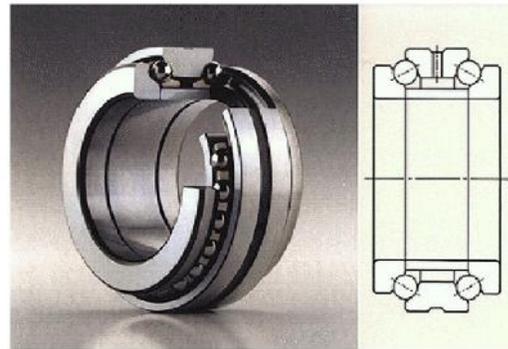


Spherical roller bearings.

Thrust Bearings

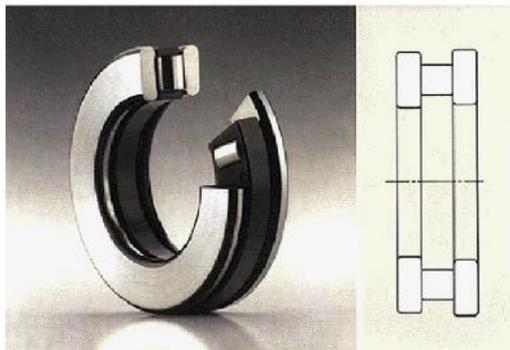


Thrust ball bearings

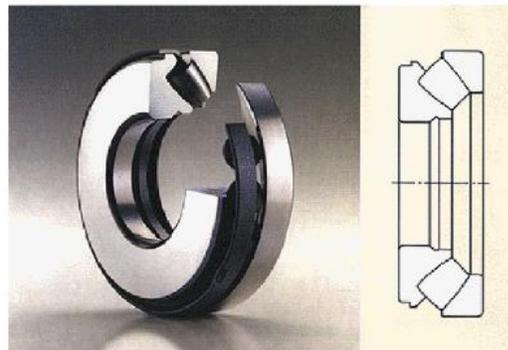


Angular contact thrust ball bearings

Thrust Bearings



Cylindrical roller thrust bearings



Spherical roller thrust bearings

Types of Cages



Bearings Mounting And Dismounting

