

Advantages and Disadvantages of Rolling Contact Bearings Over Sliding Contact Bearings

Advantages

1. Low starting and running friction except at very high speeds.
2. Ability to withstand momentary shock loads.
3. Accuracy of shaft alignment.
4. Low cost of maintenance, as no lubrication is required while in service.
5. Small overall dimensions.
6. Reliability of service.
7. Easy to mount and erect.
8. Cleanliness.

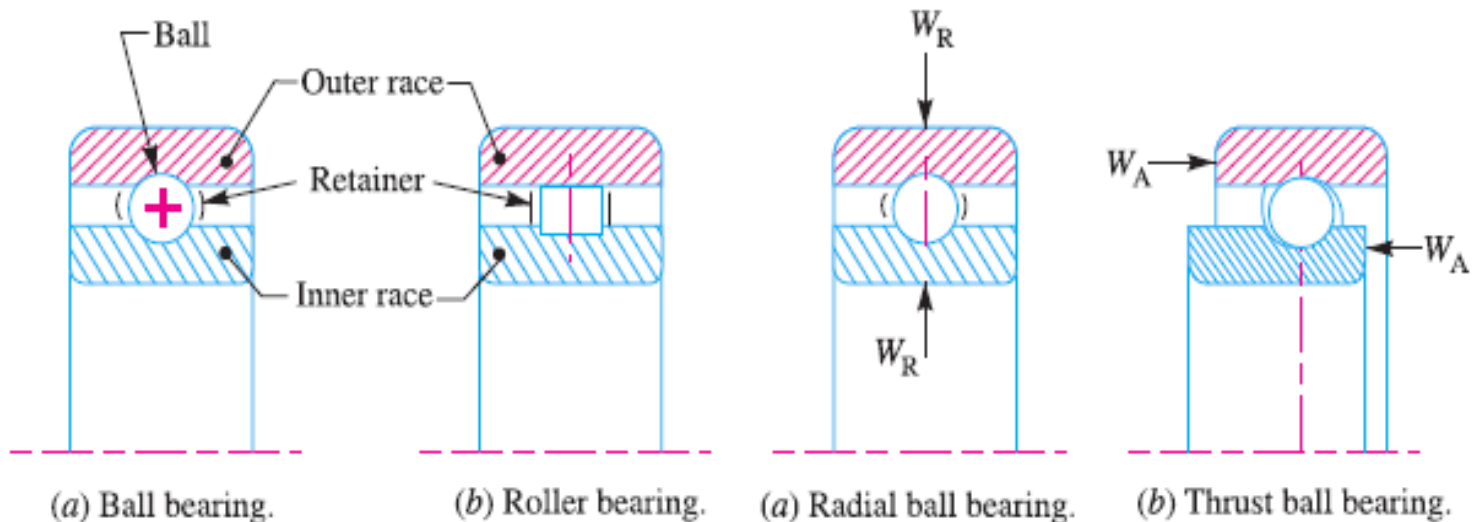
Disadvantages

1. More noisy at very high speeds.
2. Low resistance to shock loading.
3. More initial cost.
4. Design of bearing housing complicated.

Types of Rolling Contact Bearings

Following are the two types of rolling contact bearings:

1. Ball bearings; and 2. Roller bearings.



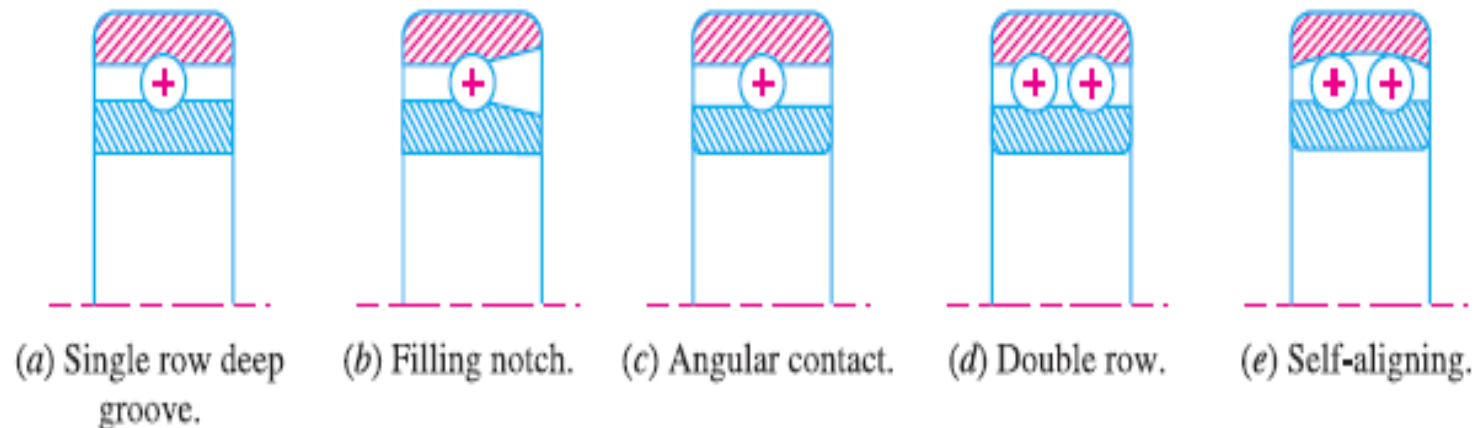
The ***ball and roller bearings consist of an inner race which is mounted on the shaft or journal*** and an outer race which is carried by the housing or casing. In between the inner and outer race, there are balls or rollers as shown in Fig. A number of balls or rollers are used and these are held at proper distances by retainers so that they do not touch each other. The retainers are thin strips and is usually in two parts which are assembled after the balls have been properly spaced. The ball bearings are used for light loads and the roller bearings are used for heavier loads. The rolling contact bearings, depending upon the load to be carried, are classified as :

(a) Radial bearings, and (b) Thrust bearings.

The radial and thrust ball bearings are shown in Fig. *(a) and (b) respectively. When a ball bearing supports only a radial load (WR), the plane of rotation of the ball is normal to the centre line of the bearing, as shown in Fig(a). The action of thrust load (WA) is to shift the plane of rotation of the balls, as shown in Fig (b). The radial and thrust loads both may be carried simultaneously.*

Types of Radial Ball Bearings

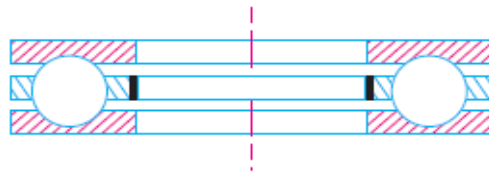
1. **Single row deep groove bearing.** *A single row deep groove bearing is shown in Fig (a).* During assembly of this bearing, the races are offset and the maximum number of balls are placed between the races. The races are then centred and the balls are symmetrically located by the use of a retainer or cage. The deep groove ball bearings are used due to their high load carrying capacity and suitability for high running speeds. The load carrying capacity of a ball bearing is related to the size and number of the balls.



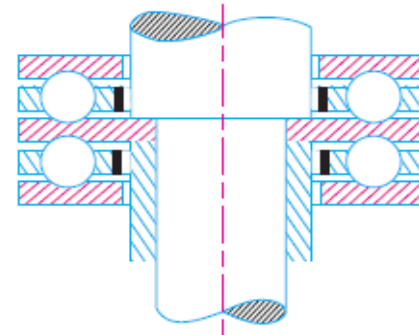
- 2. Filling notch bearing.** A filling notch bearing is shown in Fig (b). *These bearings have notches in the inner and outer races which permit more balls to be inserted than in a deep groove ball bearings. The notches do not extend to the bottom of the race way and therefore the balls inserted through the notches must be forced in position. Since this type of bearing contains larger number of balls than a corresponding unnotched one, therefore it has a larger bearing load capacity.*
- 3. Angular contact bearing.** *An angular contact bearing is shown in Fig (c). These bearings have one side of the outer race cut away to permit the insertion of more balls than in a deep groove bearing but without having a notch cut into both races. This permits the bearing to carry a relatively large axial load in one direction while also carrying a relatively large radial load. The angular contact bearings are usually used in pairs so that thrust loads may be carried in either direction.*
- 4. Double row bearing.** *A double row bearing is shown in Fig (d). These bearings may be made with radial or angular contact between the balls and races. The double row bearing is appreciably narrower than two single row bearings. The load capacity of such bearings is slightly less than twice that of a single row bearing.*
- 5. Self-aligning bearing.** *A self-aligning bearing is shown in Fig (e). These bearings permit shaft deflections within 2-3 degrees. It may be noted that normal clearance in a ball bearing are too small to accommodate any appreciable misalignment of the shaft relative to the housing. If the unit is assembled with shaft misalignment present, then the bearing will be subjected to a load that may be in excess of the design value and premature failure may occur. Following are the two types of self-aligning bearings :*
- (a) Externally self-aligning bearing, and (b) Internally self-aligning bearing.**
- In an externally self-aligning bearing, the outside diameter of the outer race is ground to a spherical surface which fits in a mating spherical surface in a housing, as shown in Fig (e). In case of internally self-aligning bearing, the inner surface of surface. Consequently, the outer race may be displaced through a small angle without interfering with the normal operation of the bearing. The internally self-aligning ball bearing is interchangeable with other ball bearings.*

Thrust Ball Bearings

The thrust ball bearings are used for carrying thrust loads exclusively and at speeds below 2000 r.p.m. At high speeds, centrifugal force causes the balls to be forced out of the races. Therefore at high speeds, it is recommended that angular contact ball bearings should be used in place of thrust ball bearings.



(a) Single direction thrust ball bearing.

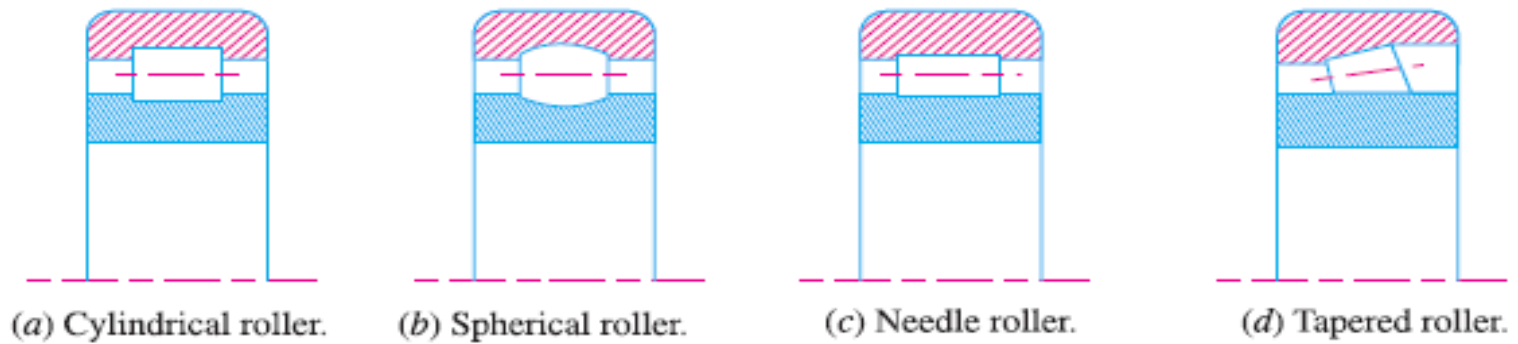


(b) Double direction thrust ball bearing.

A thrust ball bearing may be a single direction, flat face as shown in Fig (a) or a double direction with flat face as shown in Fig (b).

Types of Roller Bearings

1. **Cylindrical roller bearings.** *A cylindrical roller bearing is shown in Fig (a).* **These** bearings have short rollers guided in a cage. These bearings are relatively rigid against radial motion and have the lowest coefficient of friction of any form of heavy duty rolling-contact bearings. Such type of bearings are used in high speed service.
2. **Spherical roller bearings.** A spherical roller bearing is shown in Fig (b). These bearings are self-aligning bearings. The self-aligning feature is achieved by grinding one of the races in the form of sphere. These bearings can normally tolerate angular misalignment in the order of $\pm 1\frac{1}{2}^\circ$ and when used with a double row of rollers, these can carry thrust loads in either direction.



- 3. Needle roller bearings.** A *needle roller bearing is shown in Fig (c)*. These bearings are relatively slender and completely fill the space so that neither a cage nor a retainer is needed. These bearings are used when heavy loads are to be carried with an oscillatory motion, e.g. *piston pin bearings in heavy duty diesel engines, where the reversal of motion tends to keep the rollers in correct alignment.*
- 4. Tapered roller bearings.** A *tapered roller bearing is shown in Fig (d)*. The rollers and race ways of these bearings are truncated cones whose elements intersect at a common point. Such type of bearings can carry both radial and thrust loads. These bearings are available in various combinations as double row bearings and with different cone angles for use with different relative magnitudes of radial and thrust loads.