

1. Classification and Characteristics of Rolling Bearings

1.1 Rolling bearing construction

Most rolling bearings consist of rings with raceways (an inner ring and an outer ring), rolling elements (either balls or rollers) and a rolling element retainer. The retainer separates the rolling elements at regular intervals, holds them in place within the inner and outer raceways, and allows them to rotate freely. See figures 1.1-1.8.

Rolling elements come in two general shapes: ball or rollers. Rollers come in four basic styles: cylindrical, needle, tapered, and spherical.

Balls geometrically contact the raceway surfaces of the inner and outer rings at "points", while the contact surface of rollers is a "line" contact.

Theoretically, rolling bearings are so constructed as to allow the rolling elements to rotate orbitally while also rotating on their own axes at the same time.

While the rolling elements and the bearing rings take any load applied to the bearings (at the contact point between the rolling elements and raceway surfaces), the retainer takes no direct load. The retainer only serves to hold the rolling elements at equal distances from each other and prevent them from falling out.

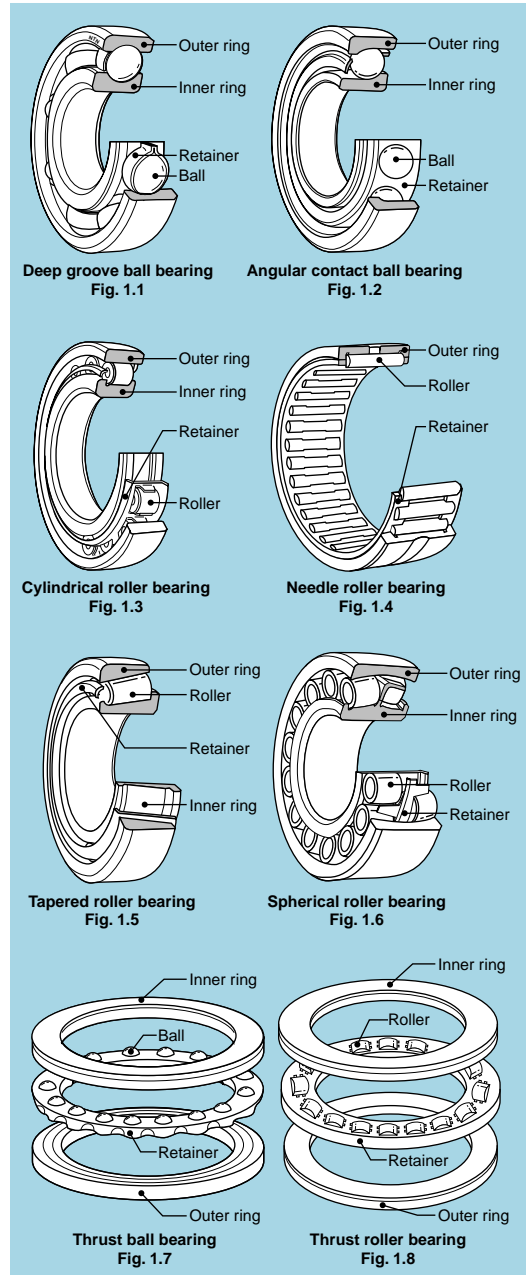
1.2 Classification of rolling bearings

Rolling element bearings fall into two main classifications: ball bearings and roller bearings. Ball bearings are classified according to their bearing ring configurations: deep groove, angular contact and thrust types. Roller bearings on the other hand are classified according to the shape of the rollers: cylindrical, needle, taper and spherical.

Rolling element bearings can be further classified according to the direction in which the load is applied; radial bearings carry radial loads and thrust bearings carry axial loads.

Other classification methods include: 1) number of rolling rows (single, multiple, or 4-row), 2) separable and non-separable, in which either the inner ring or the outer ring can be detached, 3) thrust bearings which can carry axial loads in only one direction, and double direction thrust bearings which can carry loads in both directions.

There are also bearings designed for special applications, such as: railway car journal roller bearings (RCT bearings), ball screw support bearings, turntable bearings, as well as rectilinear motion bearings (linear ball bearings, linear roller bearings and linear flat roller bearings).



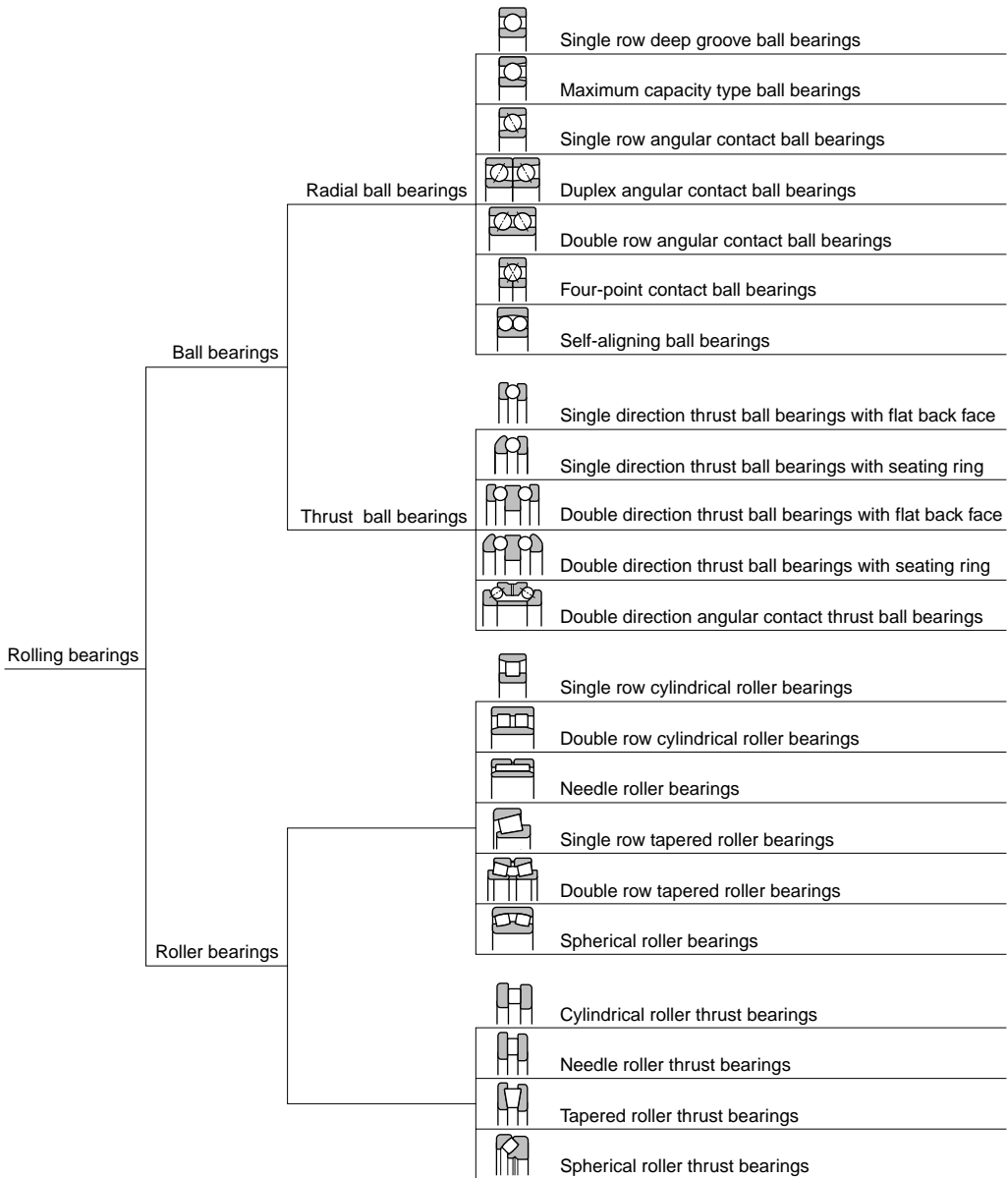


Fig. 1.9 Classification of rolling bearings

1.3 Characteristics of rolling bearings

1.3.1. Characteristics of rolling bearings

Rolling bearings come in many shapes and varieties, each with its own distinctive features.

However, when compared with sliding bearings, rolling bearings all have the followings advantages:

- (1) The starting friction coefficient is lower and only a little difference between this and the dynamic friction coefficient is produced.
- (2) They are internationally standardized, interchangeable and readily obtainable.
- (3) Ease of lubrication and low lubricant consumption.
- (4) As a general rule, one bearing can carry both radial and axial loads at the same time.
- (5) May be used in either high or low temperature applications.
- (6) Bearing rigidity can be improved by preloading.

Construction, classes, and special features of rolling bearings are fully described in the boundary dimensions and bearing numbering system section.

1.3.2. Ball bearings and roller bearings

Generally speaking, when comparing ball and roller bearings of the same dimensions, ball bearings exhibit a lower frictional resistance and lower face run-out in rotation than roller bearings.

This makes them more suitable for use in applications which require high speed, high precision, low torque and low vibration. Conversely, roller bearings have a larger load carrying capacity which makes them more suitable for applications requiring long life and endurance for heavy loads and shock loads.

1.3.3. Radial and thrust bearings

Almost all types of rolling bearings can carry both radial and axial loads at the same time.

Generally, bearings with a contact angle of less than 45° have a much greater radial load capacity and are classed as radial bearings; whereas bearings which have a contact angle over 45° have a greater axial load capacity and are classed as thrust bearings. There are also bearings classed as complex bearings which combine the loading characteristics of both radial and thrust bearings.

1.3.4. Standard bearings and special bearings

Bearings which are internationally standardized for shape and size are much more economical to use, as they are interchangeable and available on a worldwide basis.

However, depending on the type of machine they are to be used in, and the expected application and function, a non-standard or specially designed bearing may be best to use. Bearings that are adapted to specific applications, and "unit bearings" which are integrated (built-in) into a machine's components, and other specially designed bearings are also available.