Bearings & Bushes

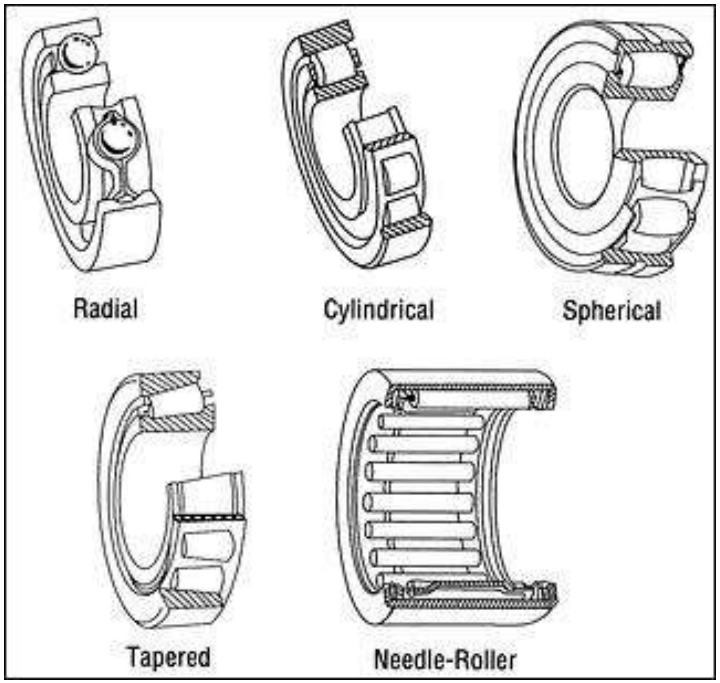
Part Two Rolling Element Bearings

Rolling Contact or Rolling Element Bearings

Rolling Contact Bearings

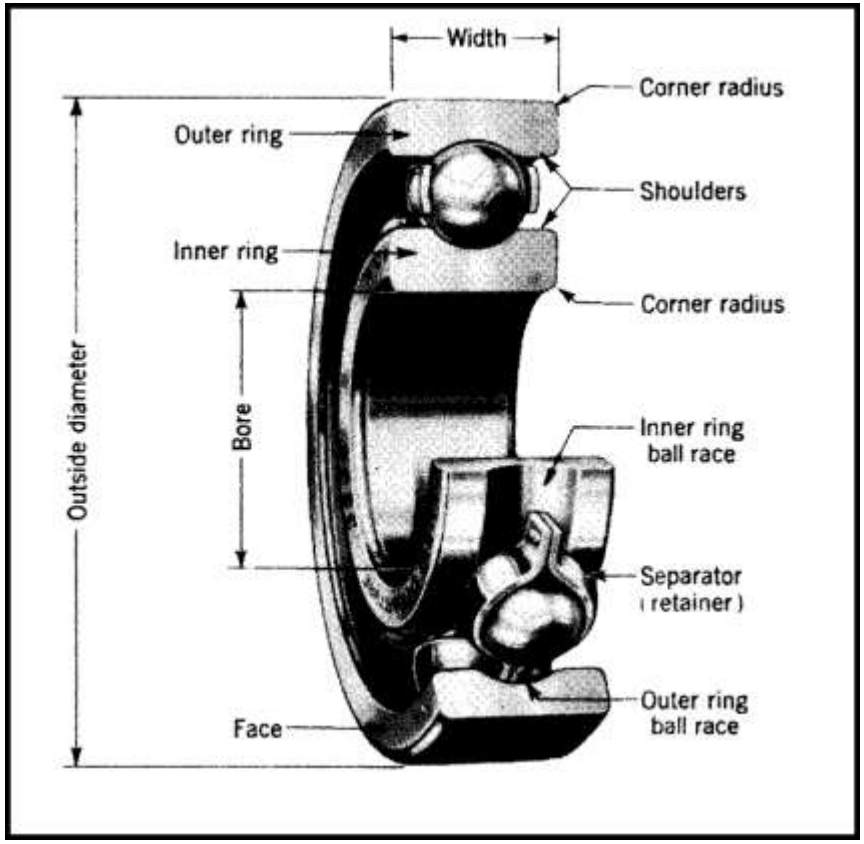
Load is transferred through rolling elements such as balls, straight and tapered cylinders and

•Rolling Element, Rolling element bearings have three parts, an inner race, an outer race, and a rolling centre element that can either have balls or cylindrical rollers.



Rolling Contact Bearings

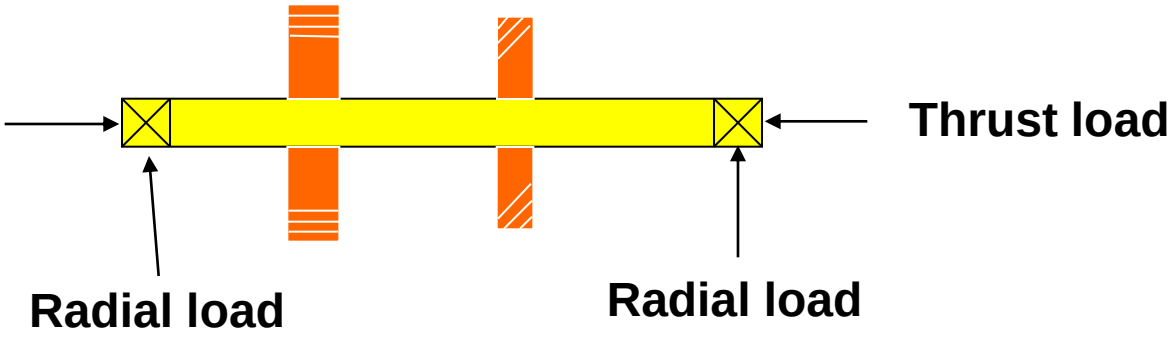
Load is transferred through elements in rolling contact rather than sliding contact.



Design Considerations

Bearings are selected from catalogs, before referring to catalogs you should know the followings:

Bearing load – radial, thrust (axial)



Bearing reliability and life depends on:-

Bearing speed (rpm)

Space limitation

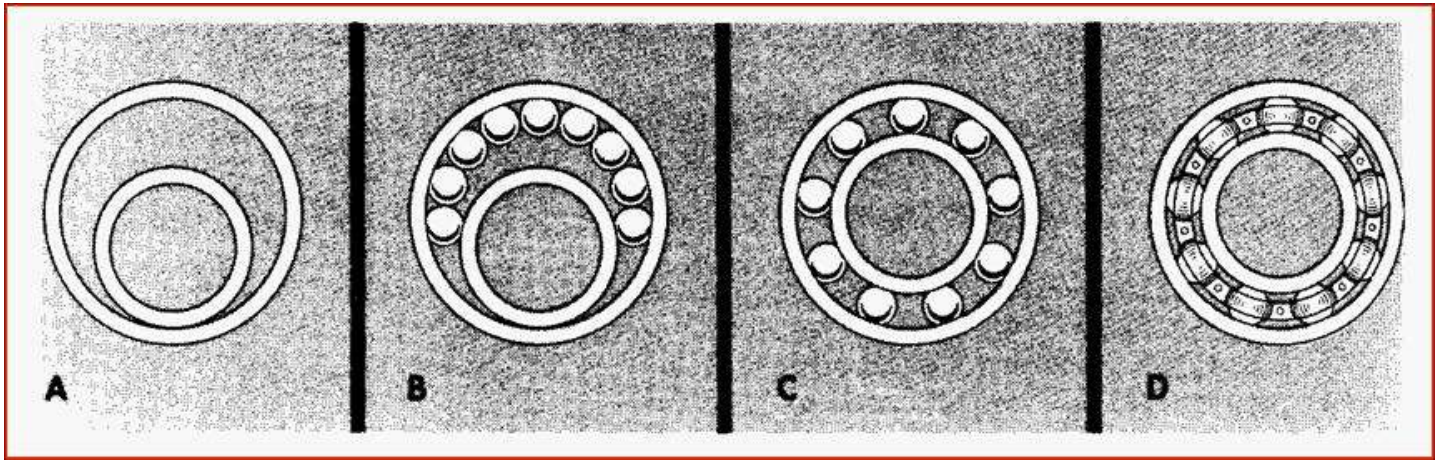
Accuracy

Main Types of Bearings

1. Ball bearings
   - Deep groove
   - Filling notch ball bearing or maximum capacity bearing
   - Angular contact bearings (AC)
2. Roller bearings
   - Cylindrical bearings
   - Needle bearings
   - Tapered bearings
3. Thrust bearings
4. Linear bearings

Ball Bearings

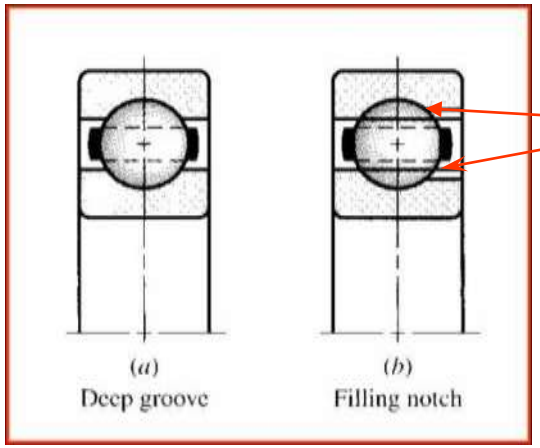
Deep groove bearing



Primarily designed to support radial loads, the thrust capacity is about 70% of radial load capacity

Filling notch or maximum capacity ball bearings

Bearings have the same basic radial construction as Deep Grove type. However, a *filling notch* (loading groove) permits more balls to be used.

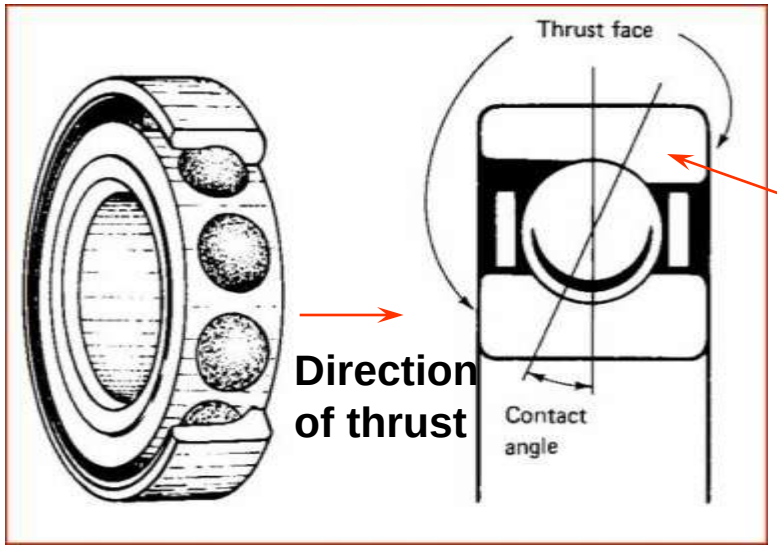


Notch

Radial load capacity is 20 – 40% higher than Deep Grove type, but thrust load capacity drops to 20% (2 directions) of radial load capacity.

Angular contact bearings

The centerline of contact between the balls and the raceway is at an angle to the plane perpendicular to the axis of rotation



Extra support in the back

Used for high radial and thrust load applications (Helical gears)

Shielded Bearings

The shielded bearings were the shield does not contact the inner track this allows it to turn without friction but reduces the chances of dirt entering the bearing causing contamination. Type description is ZZ.S for two shields or Z.S for one.

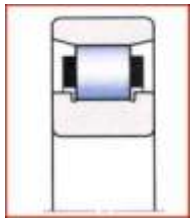
Sealed Bearings

The seal bearing is very similar, but the high contact pressure of the seal against the rotating inner race keeping the bearing free of continuation. But the increases of friction and torque losses and can cause a build up of heat. Type description is RR.S for two seals or R.S for one.

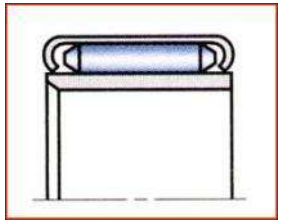
Roller Bearings

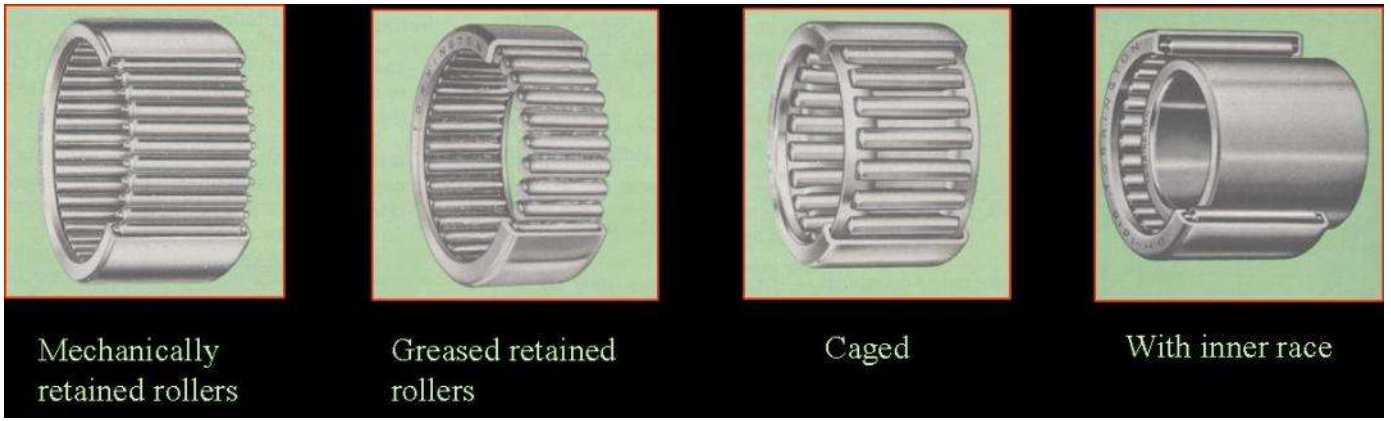
Roller bearings have higher load capacity than ball bearings, load is transmitted through line contact instead of point contact.

Straight cylindrical roller



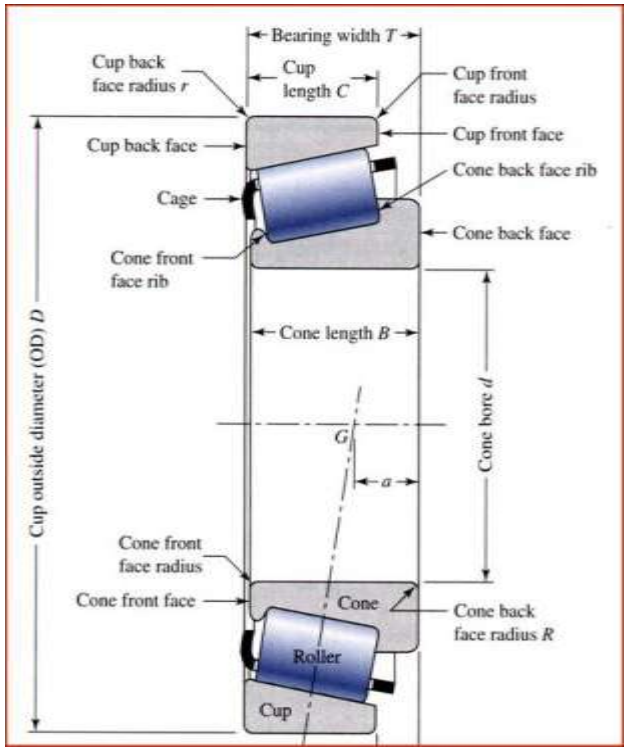
Needle type



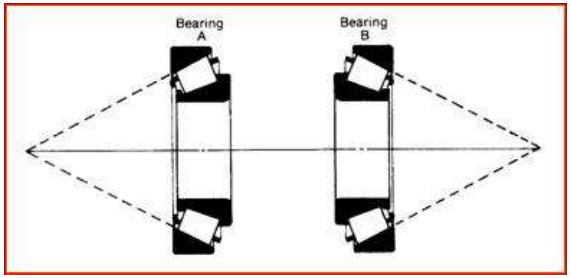


Tapered bearings

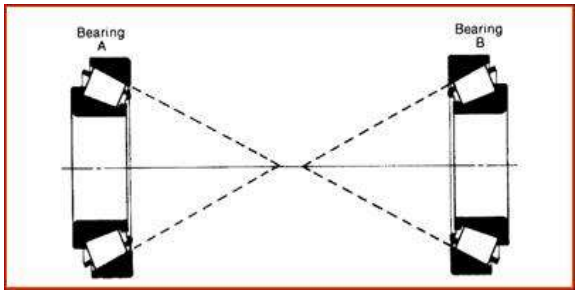
Designed to withstand high radial loads, high thrust loads, and combined loads at moderate to high speeds. They can also withstand repeated shock loads.



Direct and Indirect mounting



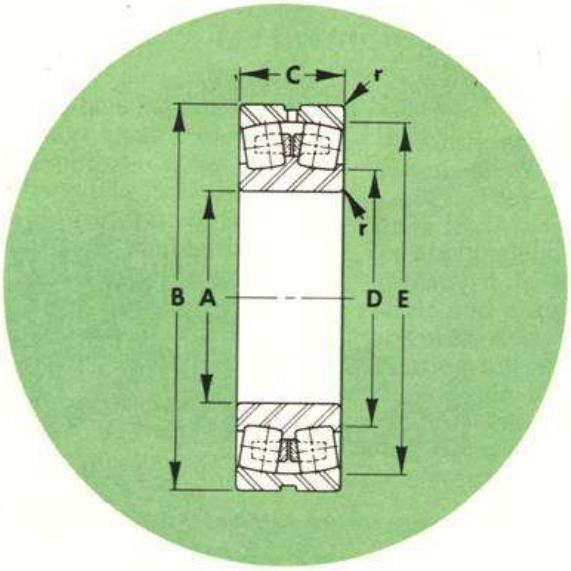
Direct mounting provides greater rigidity when pair of bearings is not closely spaced: transmission, speed reducers, rollers,..



Indirect mounting provides greater rigidity when pair of bearings is closely spaced: front wheel of a car, drums, sheaves,..

Spherical bearings

This bearing design uses barrel shaped rollers. Spherical roller bearings combine very high radial load capacity with modest thrust load capacity and excellent tolerance to misalignment.



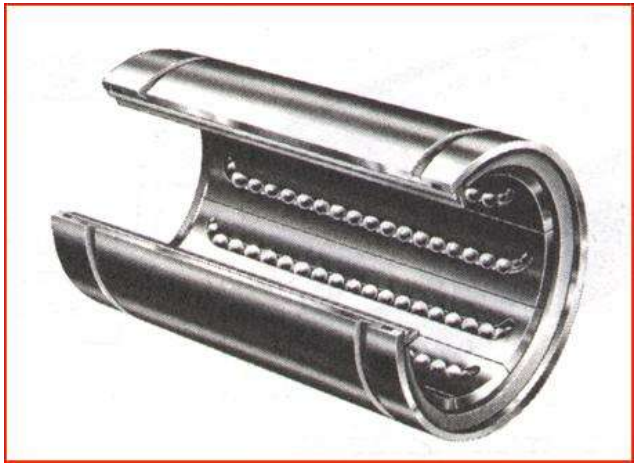
Thrust Bearings

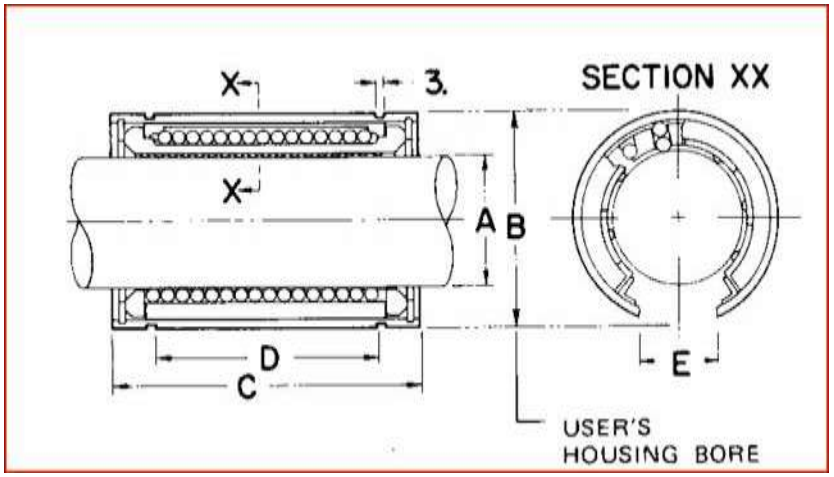
Ball thrust bearing

Roller thrust bearing

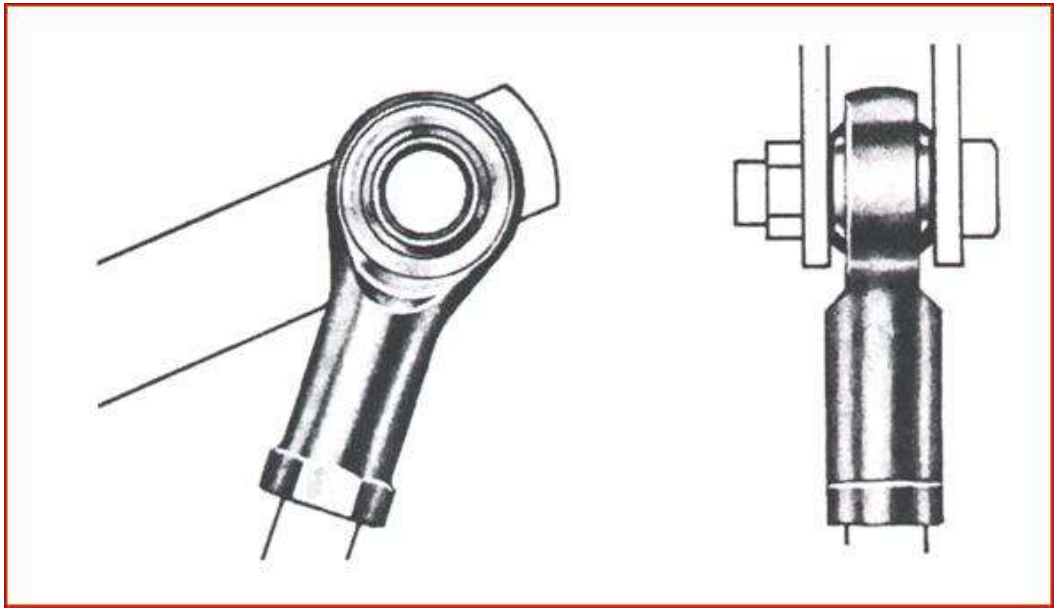
Linear Bearings

Sometimes referred too as re-circulation ball bearing





Spherical rod end or Rose bearings

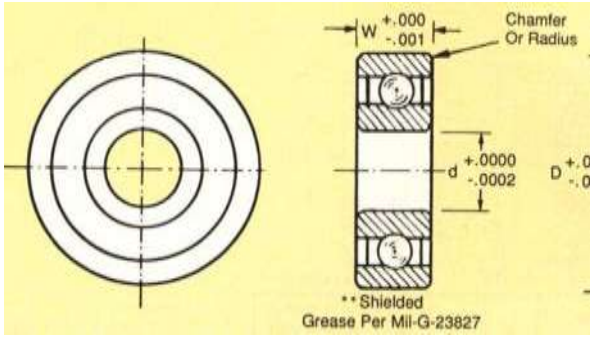


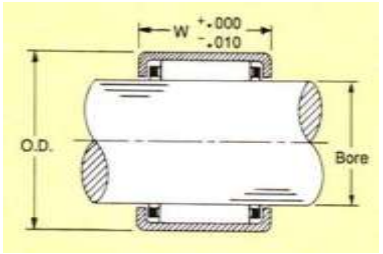
Precision Bearings and High rpm Applications

Precision bearings are designed to deliver the high accuracy, high rotational speed, and high rigidity needed for demanding applications

Precision ball and needle roller bearings are designed to meet the following requirements:-

- Extreme accuracy
- High rotational speed
- Quiet and smooth running
- Minimum friction and heat generation
- Controlled rigidity





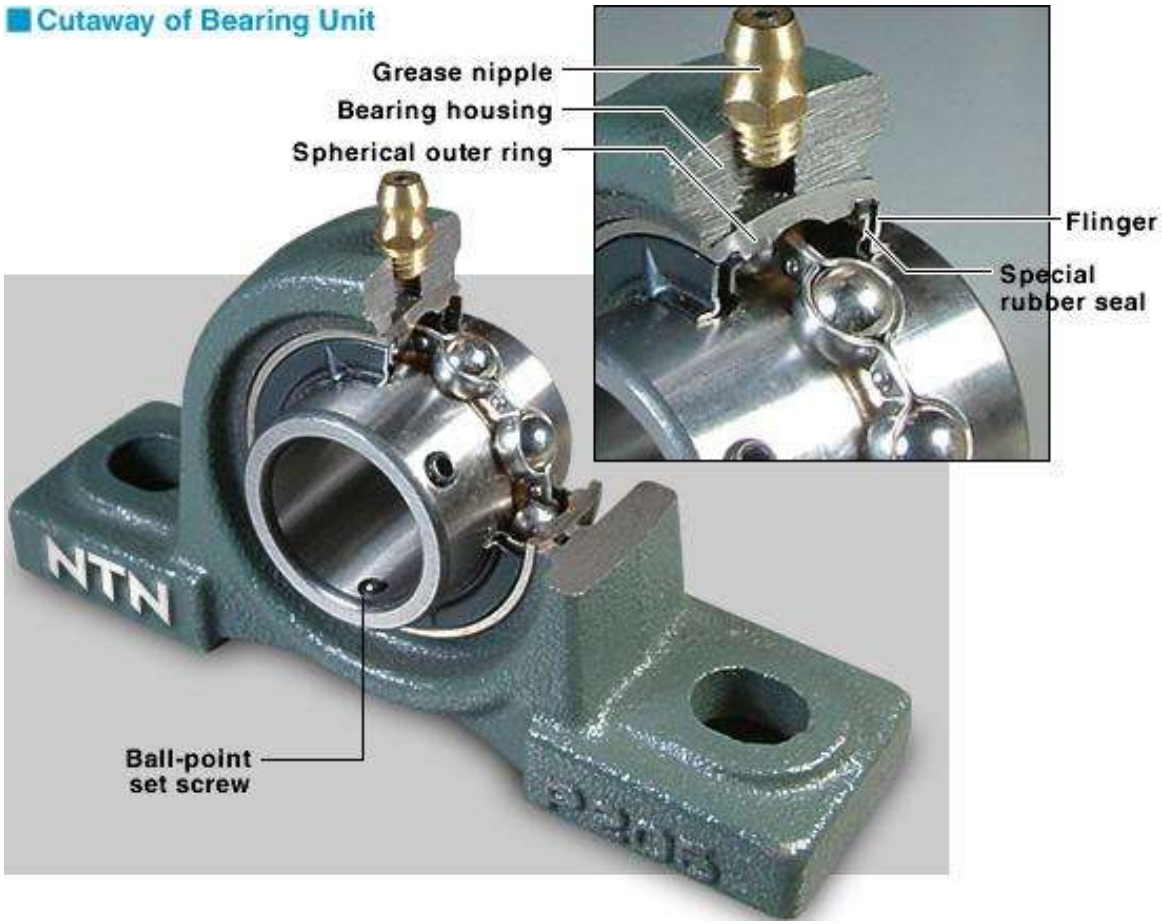
Shaft Mounted Bearings

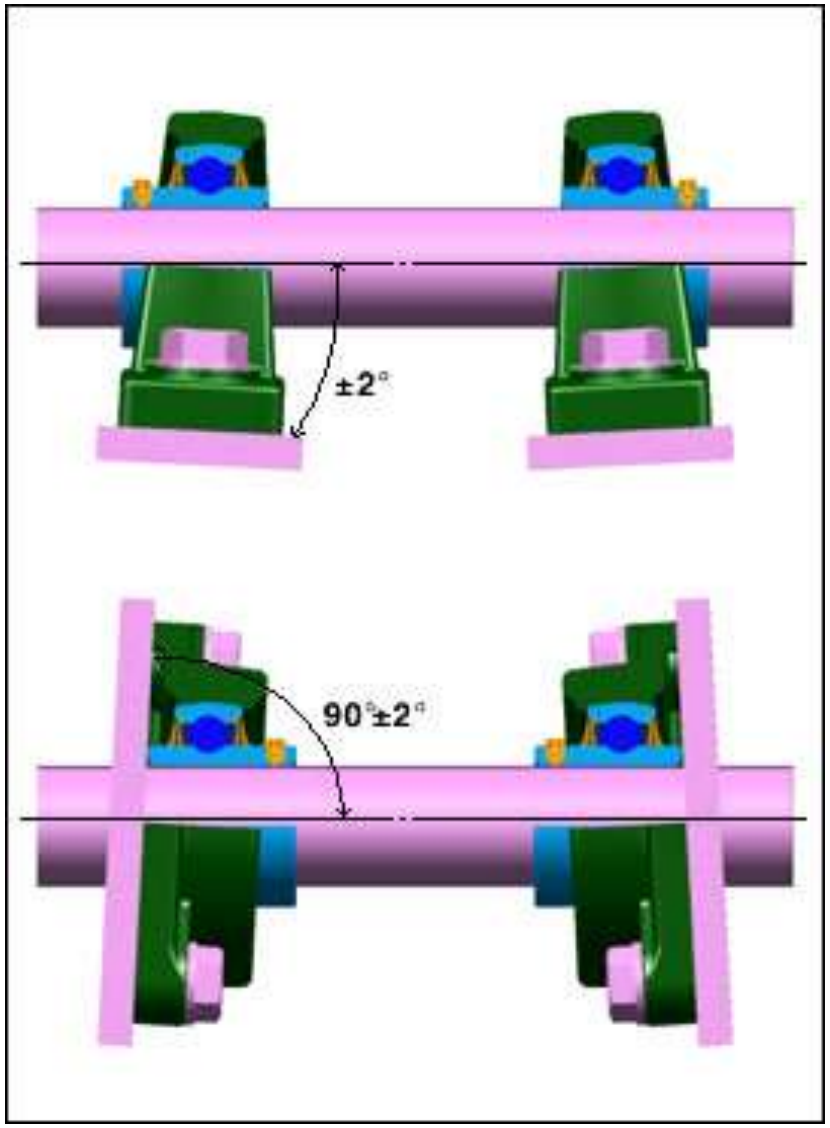
Pillow or Plumber Block Type Mounting

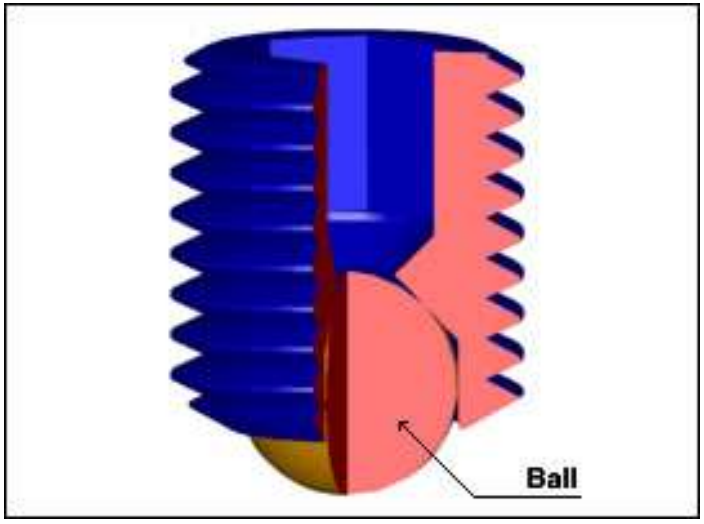
Flange Type Mounting

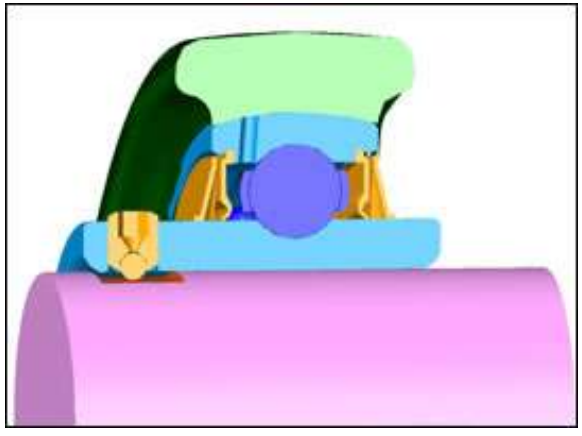
These types of bearing units are nearly always fitted with spherical self-aligning bearings

Cutaway of Bearing Unit

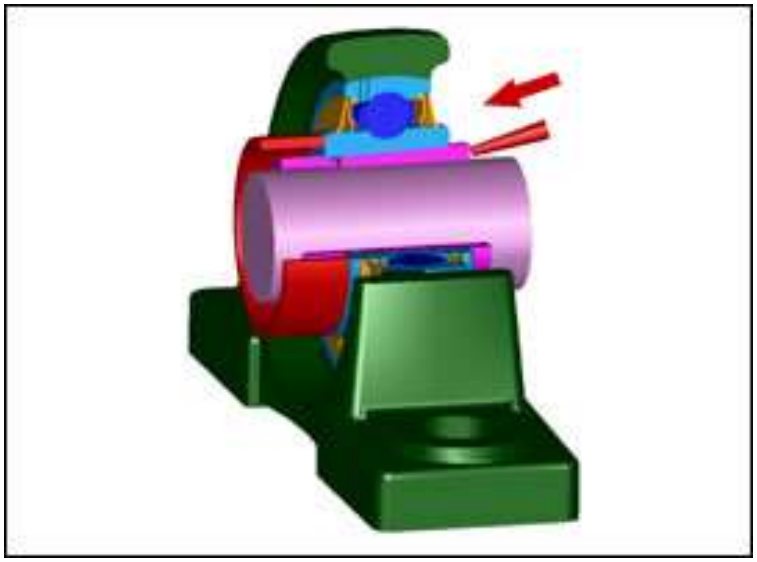


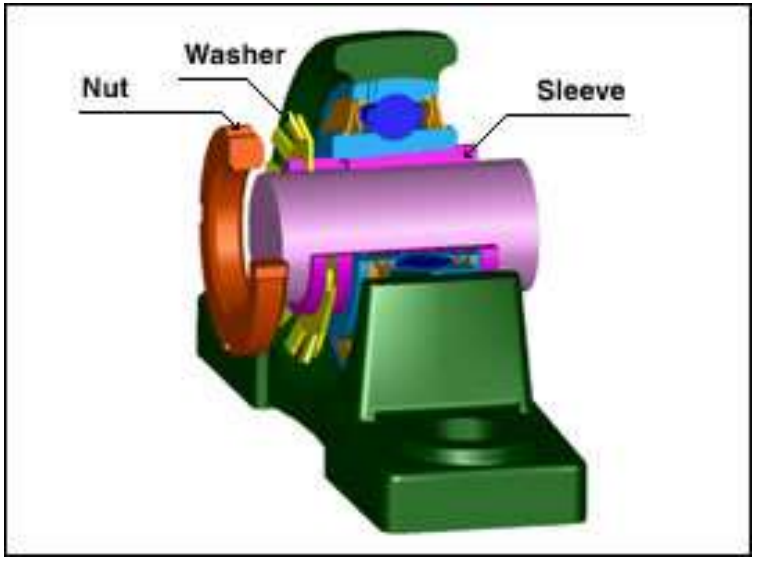

±2°
90°±2°


Ball



Tapered Sleeve Bearings



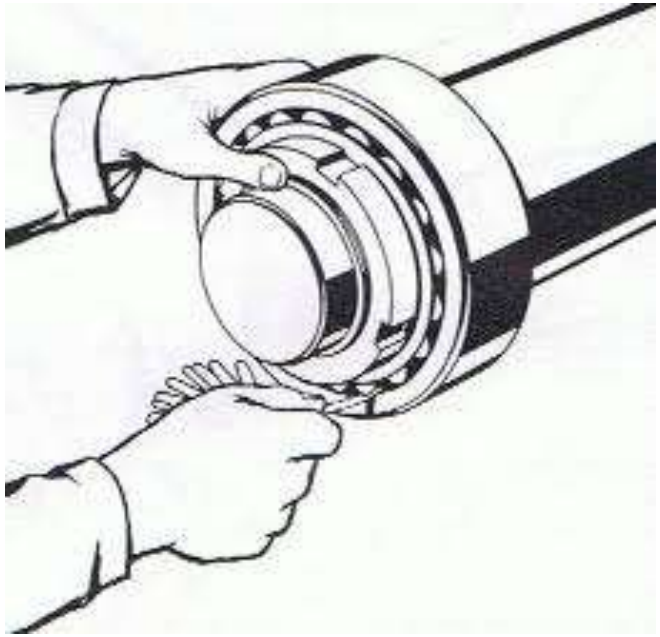


These are used when the axial position of the bearing on the shaft needs to adjusted

Tapered Sleeve Bearings

It is extremely important that the manufacturer’s instructions are followed as it is very easy to over tighten the inner track and damage the bearing

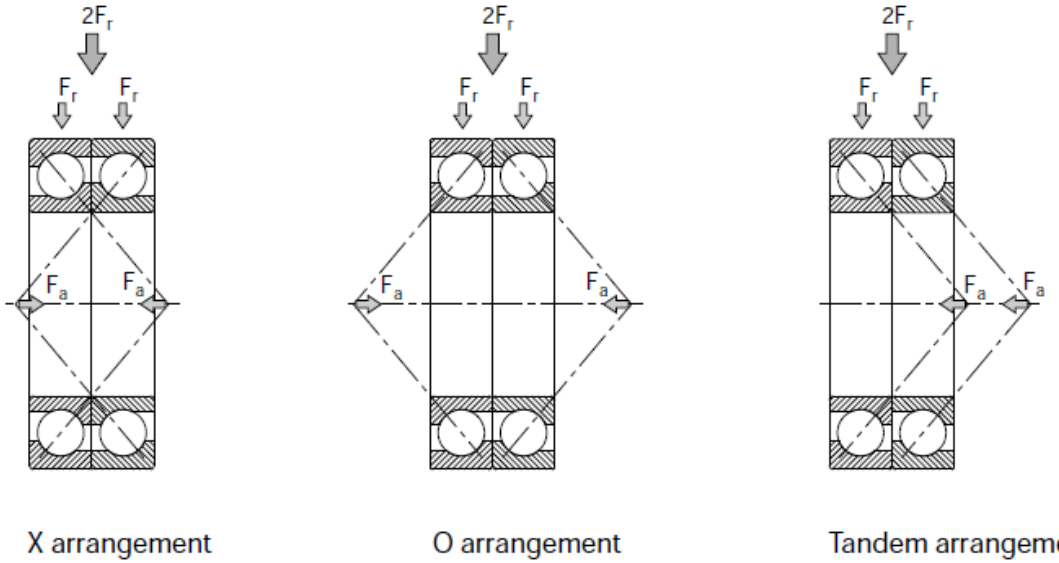
Installing the shaft and bearings, tightening them to the correct torque, and then inserting feeler gauges between the shaft and bearing to measure the gap (clearance).



Matched Sets of Bearings

If the load carrying capacity of one single bearing is not sufficient, several bearings can be mounted adjacent to one another to form a matched set.

Rolling bearings are matched together within a narrow tolerance and have a uniform a load distribution.

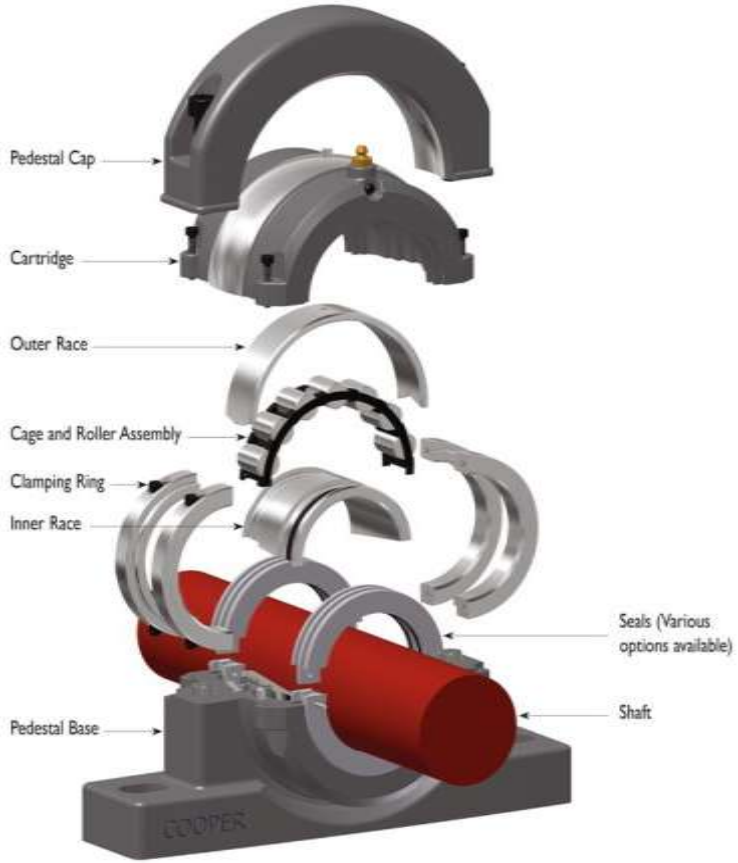


In accordance with technical specifications a specific clearance in the bearing set can be achieved, or zero clearance or preload. If they are fitted tightly then the axial clearance is reduced or the preload increased.

Split Rolling Element Bearing (Cooper-Split)

Cooper split bearings are used in-place off conventional rolling element bearings because of their unique ability to be fitted around a shaft instead of along the shaft

They are ideally suited in locations were poor access and larger heavy equipment is installed, such as conveyors, elevators, roof mounted fans and blower etc. Were the ability to transfer the equipment to a suitable maintenance work area would prove very difficult.

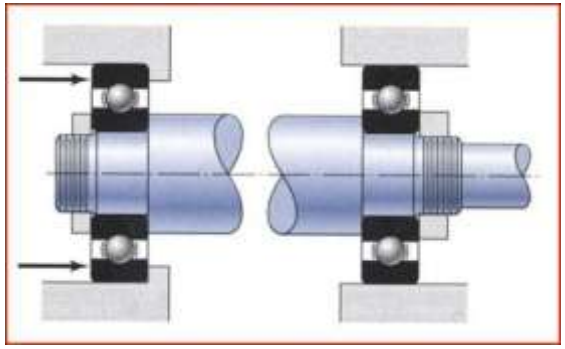


They are mainly setup in a plumber-block arrangement and can offer both radial and axial support, but the axial support can be some what limited because of the use rollers against inner track side walls in the most commonly used bearings.

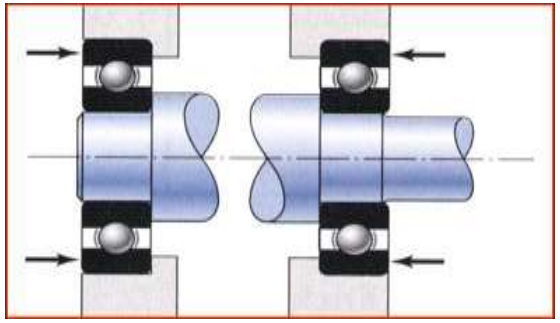
Another drawback of using this style of bearing is because both the outer and inner tracks have two join’s each it can be difficult to condition monitor the equipment

Mounting Bearings

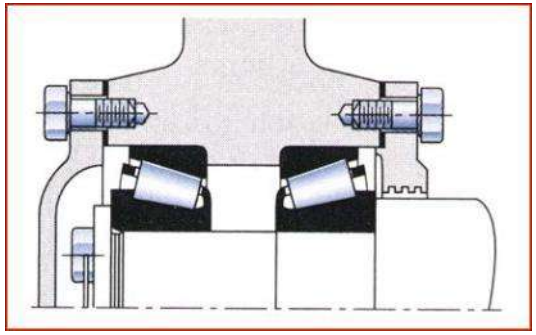
Common mounting, inner track held in position by shaft nut

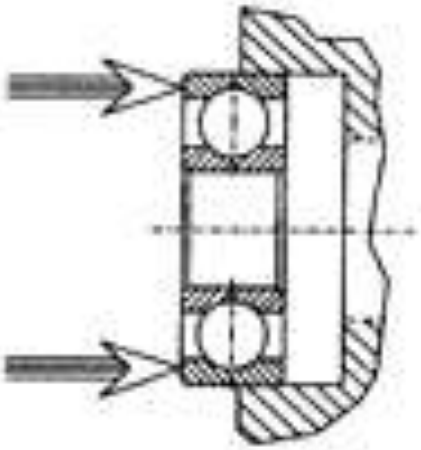


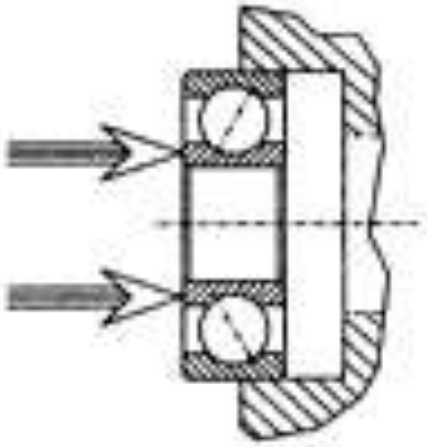
Alterative method, inner track is pressed on to the shaft.



Two-bearing back to back with or without separating space

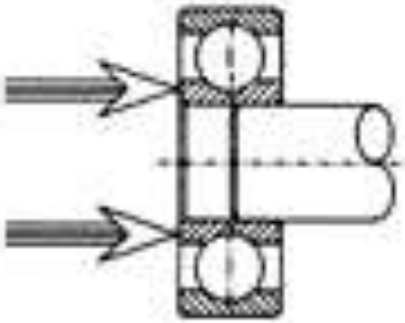


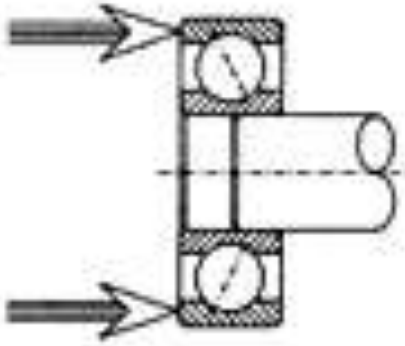




DO

DON'T





Bearing Failure Graph

The End
Any Questions ?