

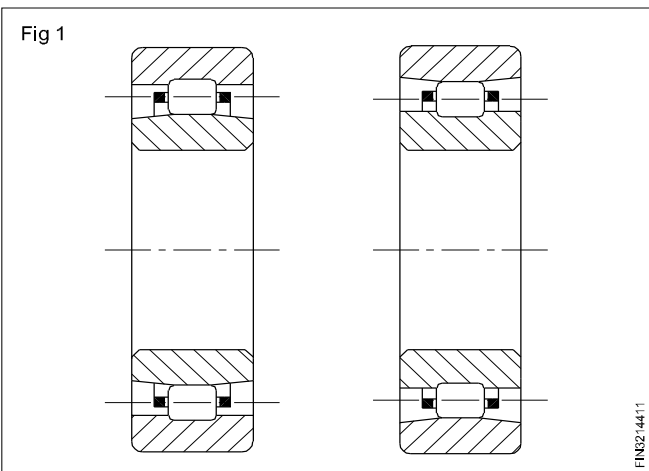
Roller & needle bearings

Objectives : At the end of this lesson you shall be able to

- describe roller & needle bearing
- state types of roller bearing
- state the method of fitting bearings.

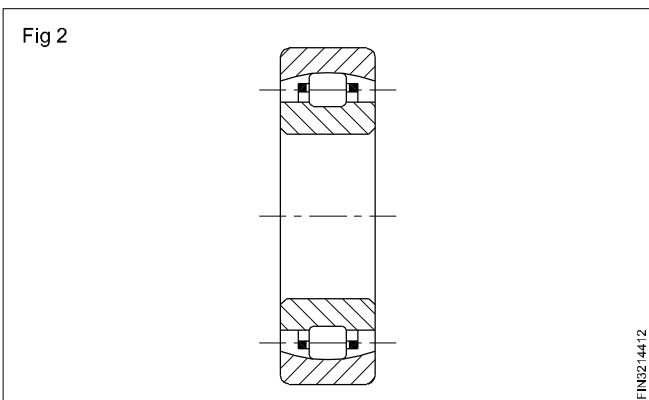
Roller bearings (Fig 1)

Roller bearings are available with the grooved race in the outer and inner members. Selection of this depends upon which race is required to be locked. Roller bearings are intended to carry radial journal loads and can carry greater radial loads than ball-bearings of the same size.



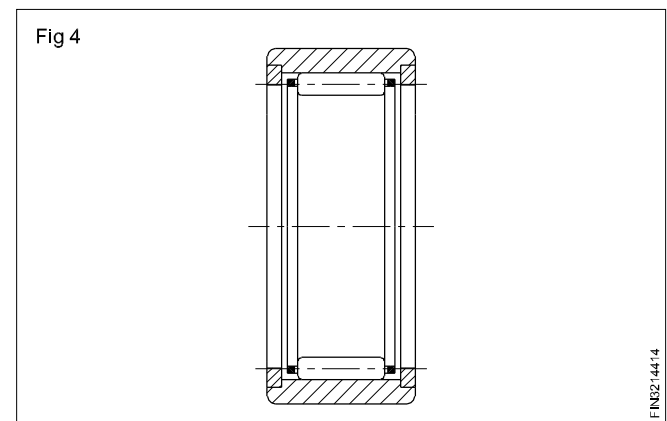
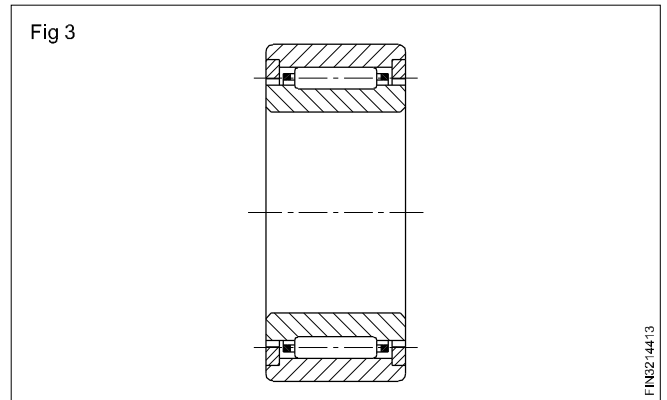
Self aligning roller bearings (Fig 2)

Self aligning roller bearings have barrel-shaped rollers and spherical bores in the outer race. For very heavy radial loads double row roller bearings are also available.



Needle bearings

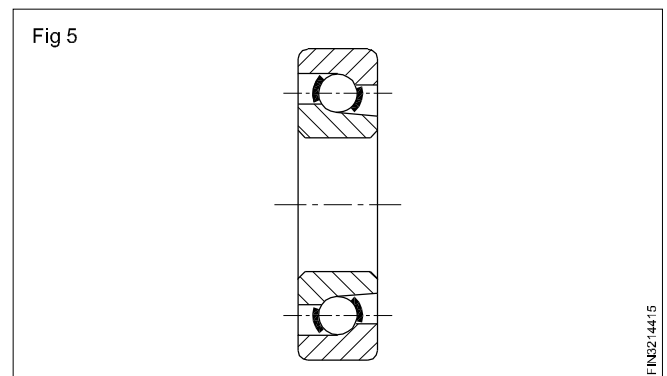
Rollers of very small diameter, called needle rollers, are shown in (Fig 3). This type of bearing is used where the outside diameter of the bearing is severely restricted because of the limited bearing space in the housing. Fig 4 shows the needles fitted in a circular cage which is push-fit in its housing.



In this design the needles are in contact with the shaft journal.

Angular contact ball-bearing

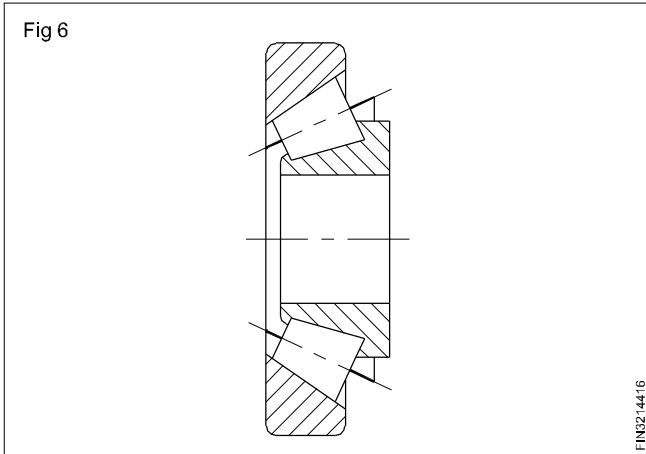
These bearings are designed to take an axial thrust as well as radial loads. (Fig 5) shows an angular contact ball-bearing (single row).



Tapered roller bearings (Fig 6)

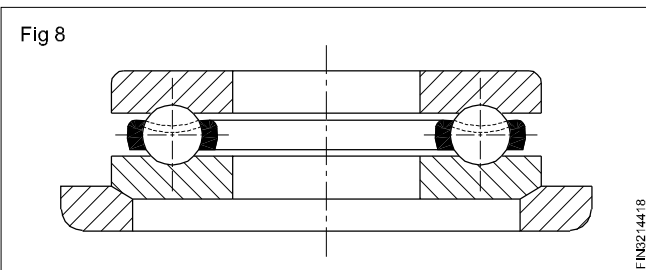
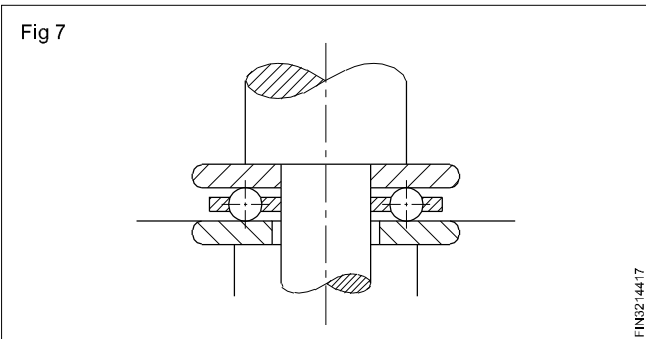
These are used for taking high axial thrust loads. Tapered roller bearings with slow tapered cones are used where the axial thrust is more than the radial load.

These bearings are made to take thrust from one direction only. Where there is opposing thrust then the bearings must be mounted as pairs in opposition.



Thrust ball-bearing

These bearings are useful for taking vertical thrust load (Fig 7) but cannot take any radial load. Special thrust bearings (Fig 8) are available which can also take horizontal end thrusts.



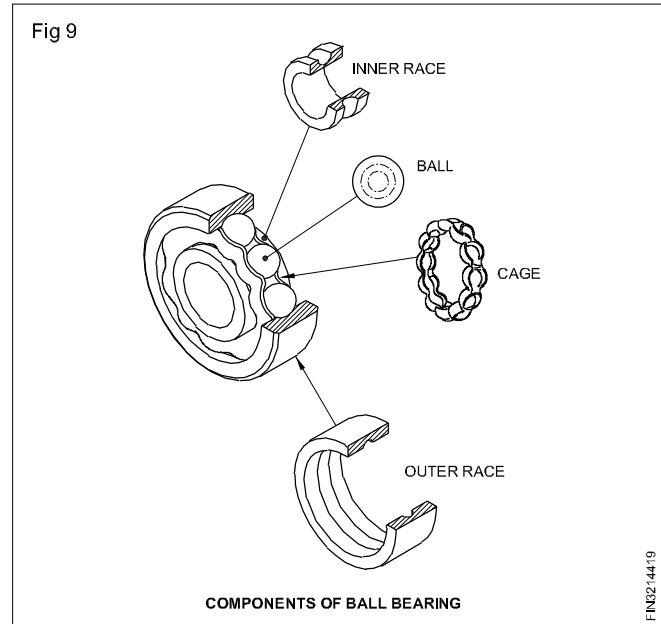
Bearings are the supporting members of a rotating shaft. They provide safe and reliable service when properly applied and maintained.

Rolling contact

Rolling contact bearing is also known as anti-frictional bearing. In this bearing, contacting elements have rolling friction which is much lesser than sliding friction. Bell

bearings have point contact while roller bearings have the contact.

Rolling elements (Fig 9)



A rolling element bearing consists of four basic parts.

- Inner race
- Outer race
- Balls or rollers
- Retainer or cage

The inner race, the outer race and the balls or rollers, support the bearing load. The fourth part, the bearing retainer, serves to position the rolling elements.

Materials

Selection of material and control of material quality are critical in the manufacturing of rolling element bearings.

Bearing steel must possess high strength, toughness, wear resistance, dimensional stability, excellent fatigue resistance and should be free from internal defects.

Importance of proper fit

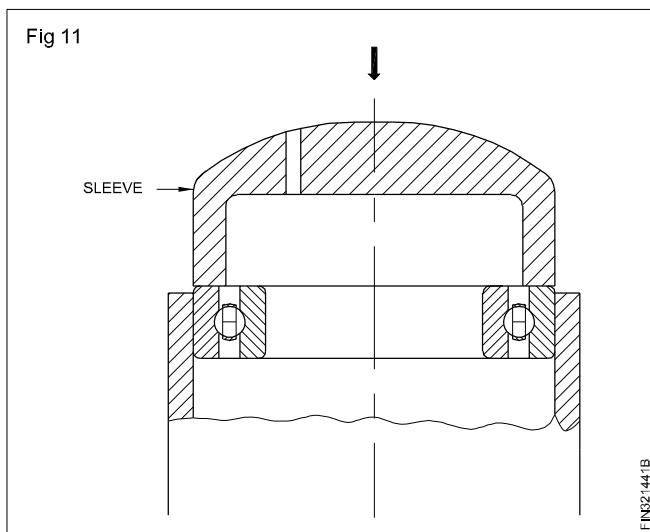
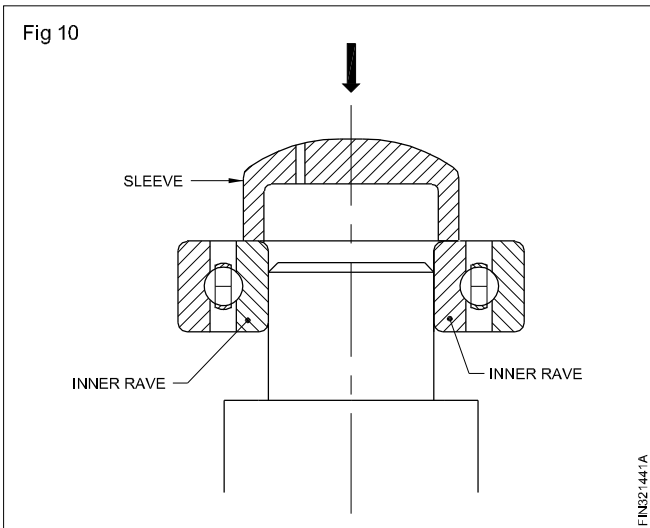
Proper fit in the rolling contact bearing ensures long service life. If the bearing is fitted too tight, the internal radial clearance will be reduced, and thereby, the rolling elements will get jammed. Consequently it will have premature failure. If the bearing is too loose, it will not take the load. So, a proper fit is very much essential.

In general applications, when the journal (spindle) is rotating, the inner face will have an interference fit with the journal and the outer race will have a close push fit. In the case of a stationary spindle, when the outer race is the rotating member, the interference fit will be with the outer race, and the hub and close push fit with the

inner race and spindle. The degree of tightness and looseness depends upon the load, speed, temperature and the type of the bearing.

Bearing mounting

Bearing mounting deserves great care. When the bearing is fitted tight into the spindle, pressure should be applied on to the inner race. (Fig 10) If the bearing is pressed into the housing, pressure must be applied on to the outer race. (Fig 11)

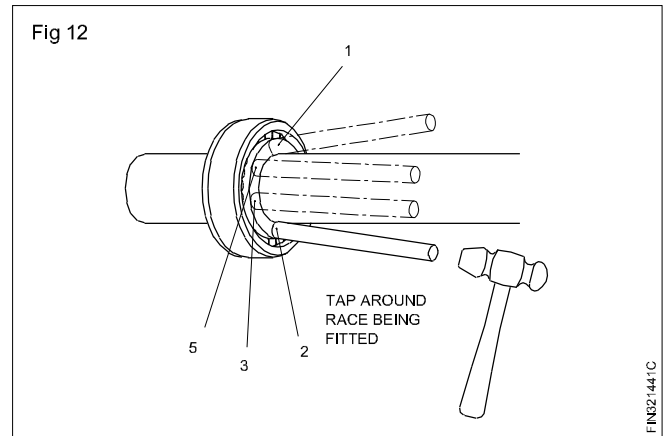


Smear thin lubricating oil on the shaft or housing where the bearing is to be fitted.

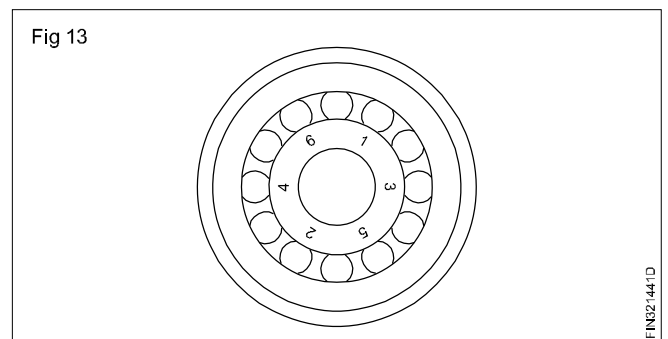
Small bearings can be fitted by using mounting sleeves and hammer (Fig 12) or using a copper drift and hammer.

The mounting sleeve should have its faces parallel and flat.

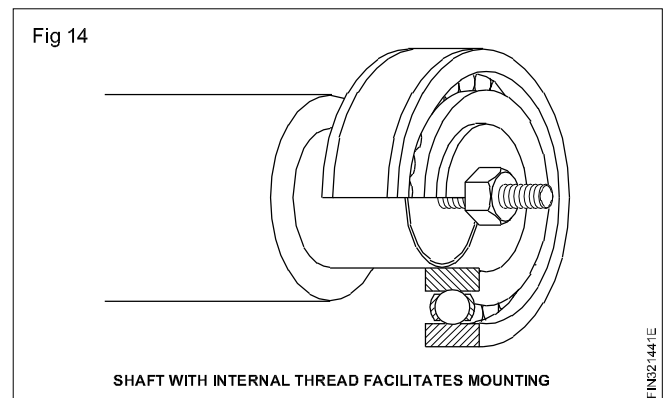
Check frequently that the bearing is driven parallel to the axis of the housing or at right angle to the axis of the shaft.



When a suitable bearing puller is not available, as soft metal drift may be used to drive the bearing into position. While striking the bearing on the inner race, it should be struck progressively on the opposite point of the race as shown in Fig 13.



If a shaft is having internal threads at the centre (Fig 14) or external threads, they can be utilised for mounting the bearings.

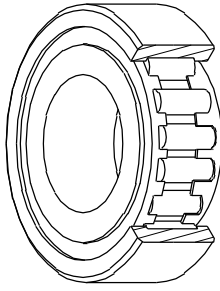


Separable parts of cylindrical roller bearing are more independently. Mount the inner ring first and the outer race with the roller and cage assembly after bit of oiling or greasing. (Fig 15)

When the shaft fit has more interference, one adopt shrinkage fit. For such a fit the inner race should heated up in an oil bath as shown in Fig 16 or by indicate heating process between 90° to 120°C depending the expansion requirement. (Fig 17)

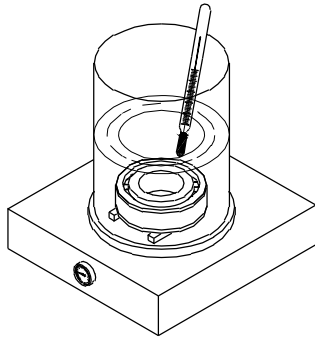
In no case should the rolling contact bearing be heated more than 140°C.

Fig 15



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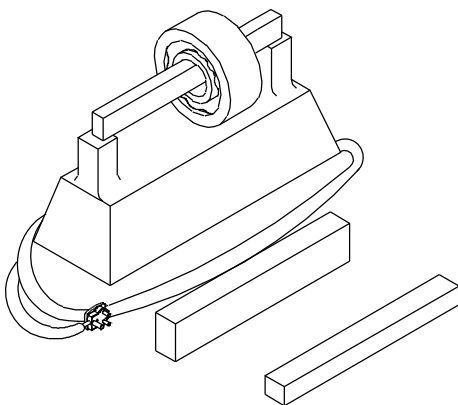
Fig 16



OIL HEATING OF BEARING

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Fig 17

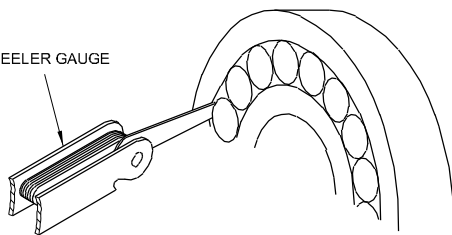


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Check the internal clearance of the bearing (Fig 18) after the bearing attains room temperature. When the bearing is having more interference in the housing, the bearing should be cooled in a freezing chamber (-5 to -20°C) and pushed inside the housing easily.

Fig 18

FEELER GAUGE



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The inner ring of bearings with the tapered bore is always mounted with an interference fit, usually on a taper adaptor sleeve or a withdrawal sleeve. When the bearing

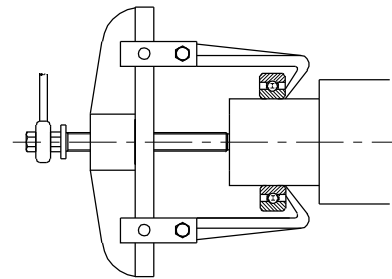
driven up the original radial, the internal clearance is reduced. The reduction in clearance required can be referred to in the table provided by the bearing manufacturer. The clearance is measured as shown in Fig 18.

Bearing dismounting

Dismounting of bearing should be done with proper care using proper tools. If proper tools are not used and right techniques are not adopted, the bearing is likely to be damaged and may lead to premature failure.

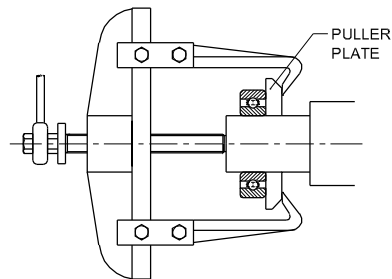
While using a puller, the pulling legs of the puller should be placed with the inner race. (Fig 19) In certain cases, we use a puller plate (Fig 20) to facilitate the placing of the pulling legs in position so that force is applied on the inner race. Special puller plates (Fig 21) are used along with a two-legged puller so that the pull is applied on the inner race alone.

Fig 19



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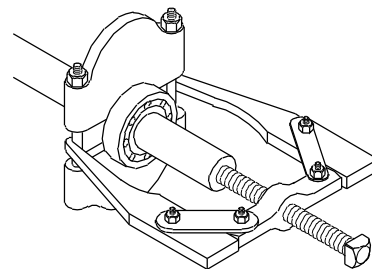
Fig 20



PULLER PLATE

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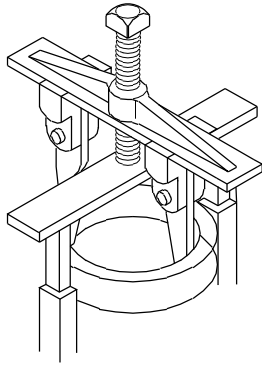
Fig 21



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For detachable inner ring type bearing, the puller legs can be placed with the outer ring as shown in Fig 22 for dismounting the bearing when the outer ring is having an interference fit in the housing.

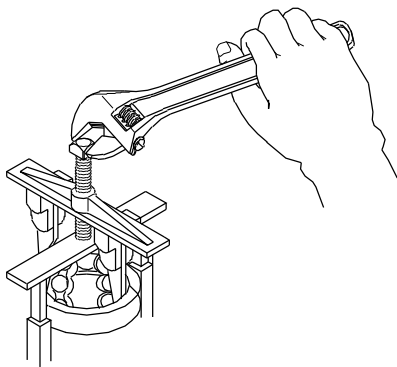
Fig 21



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A self aligning ball-bearing can be swivelled as shown in Fig 23 fixing the bearing puller to facilitate the dismantling process.

Fig 23



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Care and maintenance

- A good bearing should not be dismantled unless otherwise it is absolutely necessary.
- Bearings should be handled in a dirt/dust free environment. Bearing housing on the shaft should be free from burns or scratches.
- Proper mounting and dismantling tools, and correct techniques should be adopted. Provide proper support for the bearing and shaft during disassembly.
- Direct blows should be not given to the bearing.
- Bearing should not be heated with a naked flame. Before heating ensure that any grease or lubricant does not start a fire.
- Use only the recommended grade and quantity of lubricant for the lubrication of bearing.