

White Paper

Handling of Bearings

- **Precautions for Proper Handling of Bearings**

Bearings must be handled carefully as they are high precision machine parts and the small damage may affect the performance of the machine where bearings are installed.

Some important precautions to be taken in bearing handling are as follows:

(1) Clean Bearings and Surrounding Area of bearings

Bearings and the area surrounding the bearings should be kept clean as the small amount of the dust and dirt can be harmful to the performance of the high precision bearing.

(2) Careful Handling

Bearing should be handled with care as they are high precision machined parts. Small damage may cause bearing scratched, brinelling, and permanent deformation of raceways, breaking or cracking that may lead bearing failure and may not run to its full capacity. Proper training should be given for the handling of the bearing.

(3) Use Proper Tools

Proper bearing handling equipments should be used for handling the bearings

(4) Prevent Corrosion

The bearings should be prevented from corrosion. Dust on the hands, moisture and contaminants while handling the bearing may cause corrosion on the bearing surfaces. Wear gloves while handling the bearing. Bearing should not be stored in the atmosphere where there are the chances of the presence of the corrosive gases. Proper standard should be prepared and followed for the prevention of the corrosion on bearing while handling.

- **Mounting of Bearings**

The mounting of the bearing should be done very carefully, as the improper mounting may affect the performance of bearing and bearing could not achieve its desirable life before failure. Mounting tools should be used for proper mounting of the bearings. The standard bearing handling procedure should be designed by the design engineer and it should be strictly followed for the following conditions,

- (1) Cleaning the bearings and bearing related parts.
- (2) Checking the bearing as per the required dimensions and finish of bearing components.
- (3) Mounting of bearing.
- (4) Inspection of bearing after mounting.
- (5) Supply of suitable lubricants.

Bearings should be packed in the environment free from dust and other contamination which may damage the bearing. The grease should be filled in the bearing after the proper cleaning of the bearing. When the bearing is used in the high speed applications, then for better performance of the bearing without early failure bearing must be first cleaned with the filtered oil for removal of the anti corrosion oil applied to it while packing.

Factory pre-lubricated bearings must be used without cleaning. Bearing types and the bearing fit decides the method of the mounting of the bearings. The inner rings of the bearing require a tight fit, as mounting of bearing is done on the rotating shafts.

The cylindrical bore bearings are mostly press fitted or shrink fitted. In shrink fitting the diameter of the bearing is expanded by heating and then it is fitted on the shaft. In case of tapered bore bearing it is mounted on the tapered shaft or else the taper sleeve is used for mounting it on the cylindrical shaft.

When bearings is to be mounted in the housing it is fitted with loose fit, but when there is the interference fit in the outer ring then bearing is fitted with press fit. In the case of the interference fit, bearing is cooled for shrinkage with dry ice and then the proper anti runt treatment is given to the bearing for preventing it from the corrosion.

- **Methods of mounting of Bearings with Cylindrical Bores**

(1) Mounting with press fits

Small size bearings are usually press fitted. For press fit mounting tool is rested on the inner ring as shown in Fig.8.1. Then bearing is pressed slowly on the shaft with a press till the side of the inner ring is rested on the shoulder of the shaft. Care should be taken while placing the mounting tool, mounting tool should be placed on the inner ring. Placing the mounting tool on the outer ring may damage the bearing during mounting. Oil should be applied on the shaft for before mounting for the smooth placement of the bearing. Mounting the bearing with the hammer should be avoided. It can be occasionally done for the small size bearing when press fit in not possible and there is nominal interference. Hammer fitting should be avoided when there is tight interference fits and size of the bearing is medium or large.

In case of deep groove ball bearings where both inner ring and outer ring are not separable, then the mounting tool is to be placed in between the inner ring and outer ring of the bearing and then press fitted using a screw or hydraulic press.

When the inner ring and outer ring of the bearing are separable such as cylindrical roller bearings and tapered roller bearings, then the inner ring of bearing and outer ring of the bearing is mounted separately. The assembly of the inner ring of the bearing and the outer ring of the bearing should be aligned properly to avoid the mounting errors which may lead to bearing failures. Improper or forceful assembly may cause damage to rolling element and the raceways of both inner ring and outer rings.

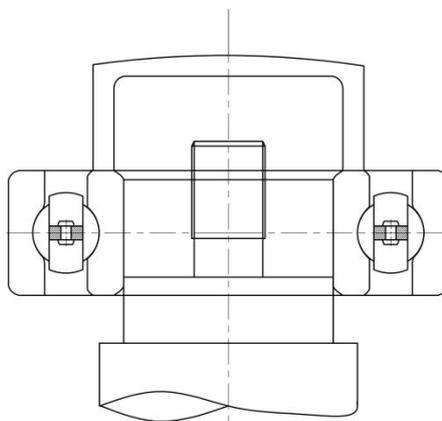


Fig.8.1 Press Fitting Inner Ring

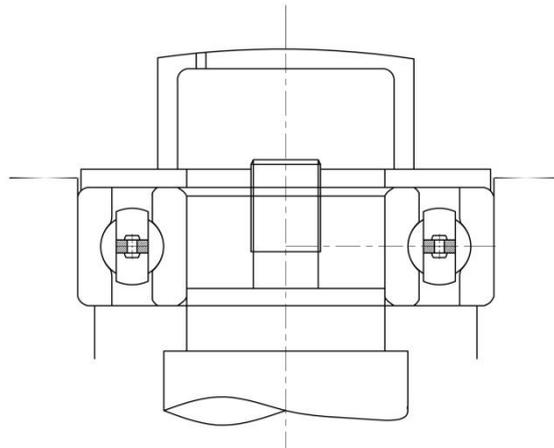


Fig.8.2 Simultaneous Press Fitting of Inner and Outer Rings

(2) Mounting with Shrink Fits

Large amount of force is required for press fitting of the large size bearing. To overcome this problem the shrink fitting is used. For shrink fitting the bearings are first heated in oil to expand the components before mounting, so that the less amount of force will be required for mounting of the bearing.

The fig 8.3 shows the temperature and thermal expansion of the inner ring.

Proper precautions should be taken while shrink fitting of the bearings as follows,

- A. The bearings should not be heated above 120°C .
- B. While heating the bearing in oil, bearing should not touch the bottom of the tank. It should be placed over the wire net or hang or suspended with the wire.
- C. The bearings should be heated to temperature 20 to 30°C than normal temperature for mounting without the interference..
- D. The bearing should be pressed properly with the mounting tool and there should not be any gap between the shaft should and the bearing after mounting.

- **Mounting of Bearings with Tapered Bores**

The tapered bores are mounted with the adapter sleeves or with drawl sleeves on cylindrical or else mounted on tapered shafts directly. The fig 8.4 and fig 8.5 shows mounting of tapered bore bearing with adapter sleeve and withdrawal sleeves. Mounting with the hydraulic pressure is used for the large size spherical roller bearings. In hydraulic mounting holes are drilled in the sleeve and oil is filled under pressure to the bearing seat. An adjusting bolt is used to fit the bearing

While mounting the spherical roller bearing, clearances should be maintained even after the mounting. Fig8.8 shows the clearance measurement method for the spherical roller bearings.

The clearance between both rows of rollers should be measured at once, and the difference between both the values of the clearance should be maintained to minimum.

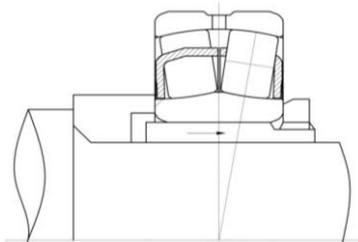


Fig.8.3 Mounting with Adapter

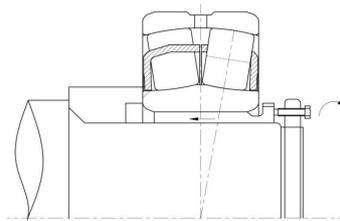


Fig.8.4 Mounting with Withdrawal Sleeve

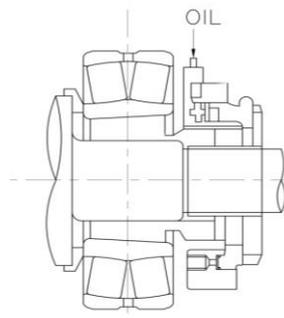


Fig. 8.5 Mounting with Hydraulic Nut

Irregularities		Possible Causes	Measures
Noise	Loud Metallic sound	<ul style="list-style-type: none"> Abnormal load Incorrect mounting Insufficient or improper lubricant Contact of rotating parts 	<ul style="list-style-type: none"> Improve the fit, internal clearances, preload, position of housing shoulder etc Improve the machining accuracy and alignment of shaft and housing accuracy of mounting method Replenish the lubricant or select another lubricant Modify the seal etc
	Louder Regular sound	<ul style="list-style-type: none"> Flaws , corrosions, or scratches on raceways Brinelling Flaking on raceway 	<ul style="list-style-type: none"> Replace or clean the bearing, improve seals and use clean lubricant Replace the bearing and use care handling bearings Replace the bearing
	Irregular sound	<ul style="list-style-type: none"> Excessive clearances Penetration of foreign particles Flaws or flaking on balls 	<ul style="list-style-type: none"> Improve the fit, clearance and preload Replace or clean the bearing, improve the seal and use clean lubricant Replace bearing
Abnormal Temperature Rise		<ul style="list-style-type: none"> Excessive amount of lubricant Insufficient or improper lubricant Abnormal load Incorrect mounting Creep on fitted surface, excessive seal friction 	<ul style="list-style-type: none"> Reduce amount of lubrication select stiffer grease Replenish lubricant or select a better one Improve the fit, internal clearance, preload, position of housing shoulder. Improve the machining accuracy and alignment of shaft and housing accuracy of mounting method Correct the seal, replace the bearing, correct the fitting or mounting.
Vibration (Axial run out)		<ul style="list-style-type: none"> Brinelling Flaking Incorrect mounting Penetration of foreign particles 	<ul style="list-style-type: none"> Replace the bearing and use when handling bearing Replace the bearing Correct the squareness between the shaft and housing shoulder or side of spacer Replace or clean the bearing, improve the seals
Leakage or discoloration of lubricant		<ul style="list-style-type: none"> Too much lubricant, penetration by foreign matter or abrasion chip 	<ul style="list-style-type: none"> Reduce the amount of lubricant, select stiffer grease. Replace the bearing lubricant or lubricant. Clean the housing and adjacent parts.

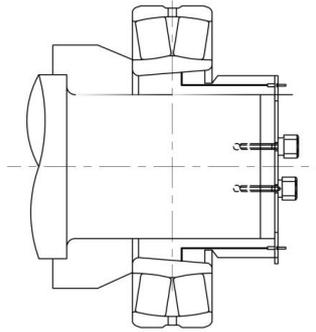


Fig.8.6 Mounting with Special Sleeve and Hydraulic Pressure

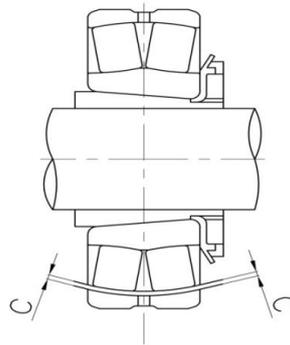


Fig.8.7 Clearance Measurement of Spherical Roller Bearing

- **Dismounting of Bearings**

A periodic inspection of the bearing is to be done, at that time the bearing is to be dismantled. For the reused of the removed bearings the bearings should be dismantled carefully with proper method. The bearings having tight fits are difficult to remove. Thus the parts of the machine where bearings are to be mounted should be designed such that the bearing mounting and dismantling would be easy. The proper dismantling procedure should be led with the proper knowledge of the bearing fits while dismantling the bearing.

- **Dismounting of Outer Rings of Bearings**

Tightly fitted outer ring is removed by placing the bolts in the push out holes of the housing where bearing is mounted. The bolts are tightening simultaneously and the outer ring is pushed outside the mounting. The fig 8.9 shows the removal of the bearings with the tightening of the bolts from the push out holes. For the removal of the separable bearings, notches are made at several positions in the housing

shoulder, as shown in Fig8.10; to press out the outer ring using a dismantling tool or by tapping it.

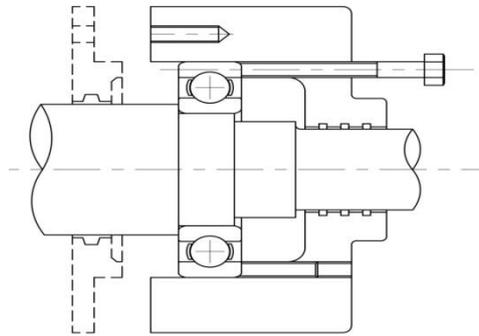


Fig.8.8 Removal of Outer Ring with Dismounting Bolts

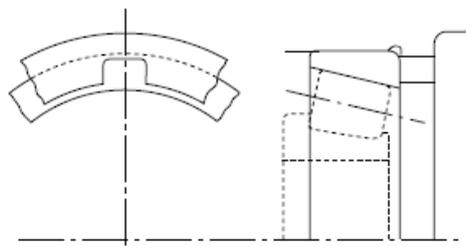


Fig.8.9 Removal Notches

Dismounting of Bearings with Cylindrical Bores

The dismounting of the bearings with the cylindrical bore is done using the withdrawal tools as shown in the fig 8.11, fig 8.12 and fig 8.13

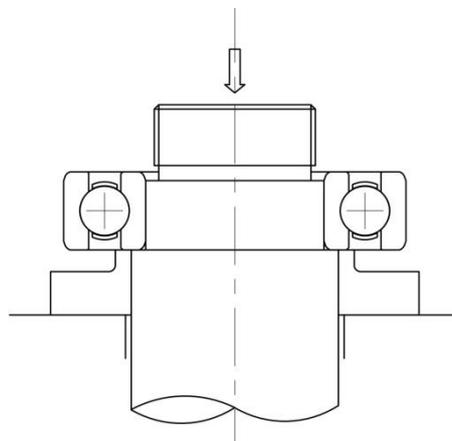


Fig.8.10 Removal of Inner Ring Using a Press

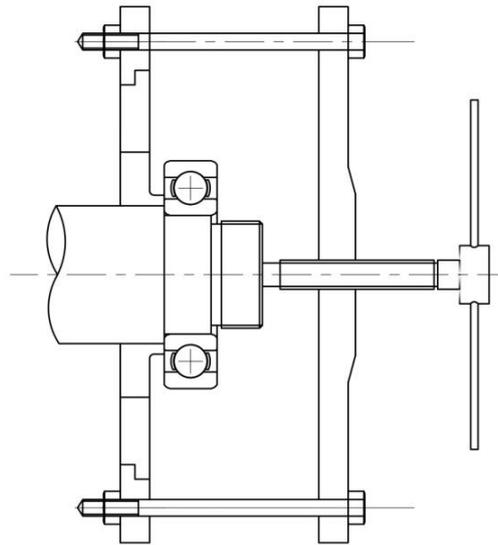


Fig.8.11 Removal of Inner Ring Using Withdrawal Tool (1)

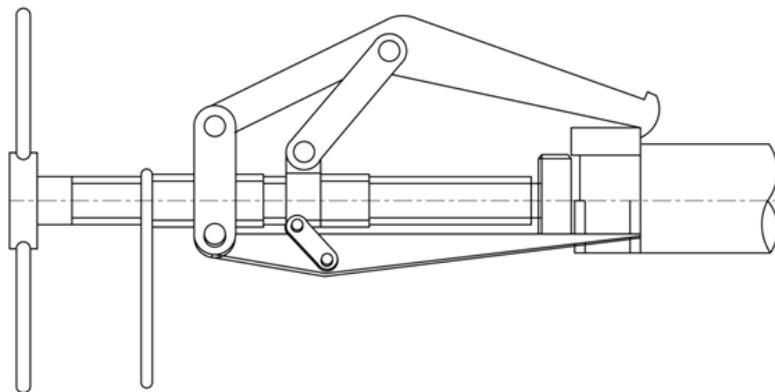


Fig.8.12 Removal of Inner Ring Using Withdrawal Tool (2)

The large size bearings are removed by using the oil injection method. The removal of the bearing is done by injecting the high pressure oil on the mounting shaft holes. When the width of the bearing is more it is removed with the combination of the injection oil and the withdrawal tool.

U and NJ type of cylindrical roller bearings are removed by using the induction heating as shown in the fig 8.14.

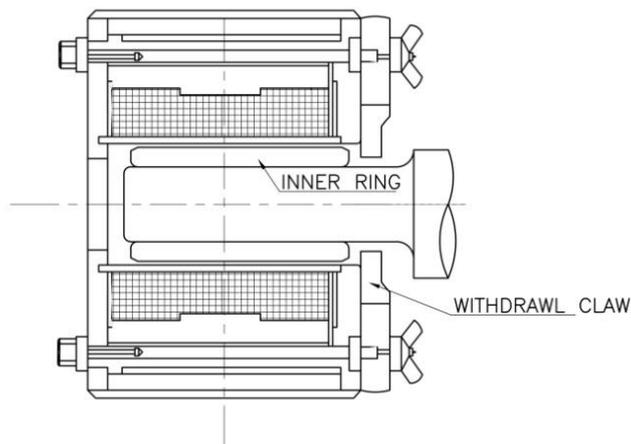


Fig.8.13 Removal of Inner Ring Using Induction Heater

- **Dismounting of Bearings with Tapered Bores**

The dismounting of the bearings with the tapered bore is shown in the fig 14.15 & fig 14.16 with the withdrawal nut. Fig 14.17 and fig 14.18 shows the removal of the tapered bore bearing using stop and axial pressure and hydraulic injection oil.

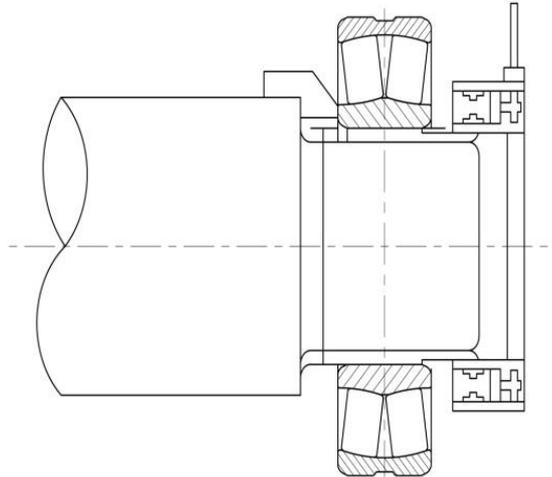


Fig.8.14 Removal of Withdrawal Sleeve Using Withdrawal Nut (1)

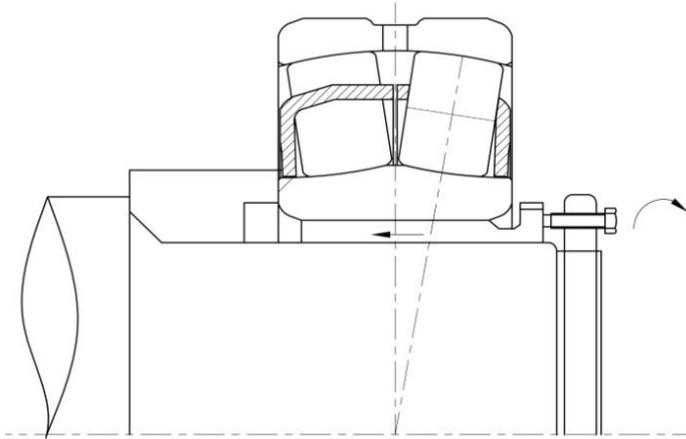


Fig.8.15 Removal of Withdrawal Sleeve Using Withdrawal Nut

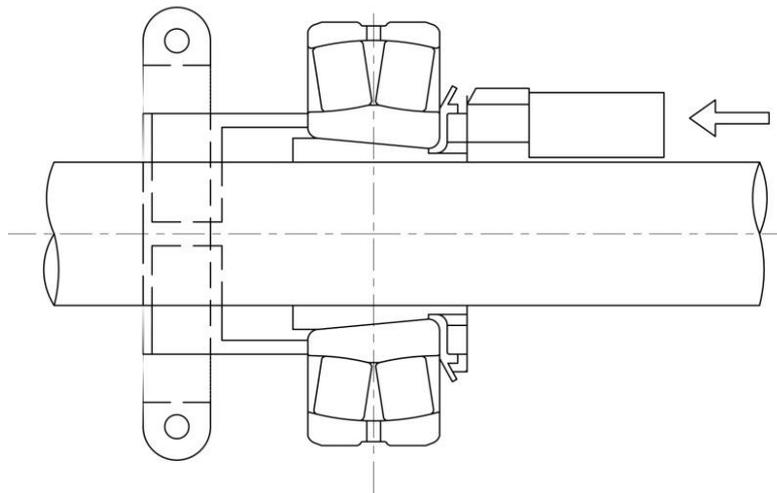


Fig.8.16 Removal of Adapter with Stop and Axial Pressure

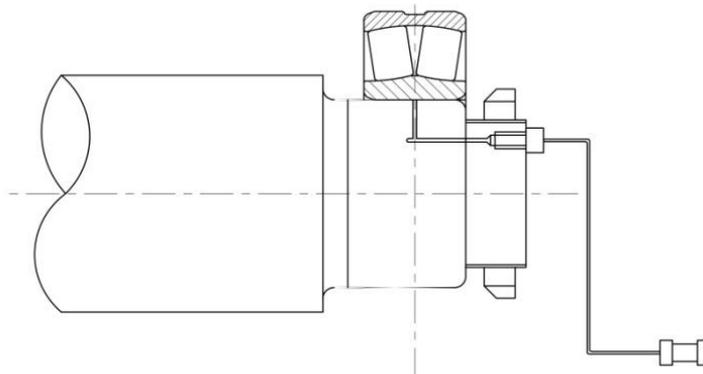


Fig.8.17 Removal Using Oil Injection Hydraulic Pump

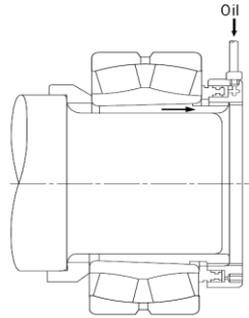


Fig.8.18 Removal Using Hydraulic Nut

- **Inspection of Bearings**
- **Inspection and Evaluation of Bearings**

The condition of the raceways and the external surfaces, internal clearance, condition of rolling element and cages etc should be examined after the cleaning of the bearing. Also the possibilities of the damaged and any abnormalities in the bearings should be thoroughly examined after cleaning.

The rolling elements, raceway surfaces, cages, and contact surface of the ribs should be carefully examined of the large bearings as they cannot be rotated with hands easily. If any of the following defects exist, reuse is impossible and replacement is necessary.

- a. When there are cracks in the inner or outer rings, rolling elements, or cage.
- b. When there is flaking of the raceway or rolling elements.
- c. When there is significant smearing of the raceway surfaces, ribs, or rolling elements.
- d. When the cage is significantly worn or rivets are loose.
- e. When there is rust or scoring on the raceway surfaces or rolling elements.
- f. When there are any significant impact or brinelling traces on the raceway surfaces or rolling elements.
- g. When there is significant evidence of creep on the bore or the periphery of the outer ring.
- h. When discoloration by heat is evident.
- i. When significant damage to the seals or shields of grease sealed bearings has occurred.