

Bearing Fitment

Part 1: Mounting Methods

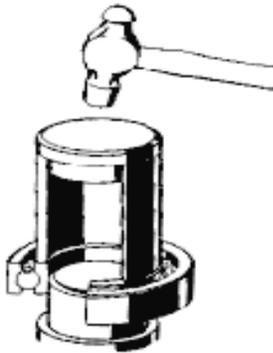


Figure 1

In order for a bearing to function properly it is important that the correct mounting method be used. The type of bearing used for a given application and the method of mounting and dismounting is determined initially at the design stage. Mounting should, wherever possible, be carried out in a clean and dust-free room and not where there are dust-producing machines.

Dirt and debris can affect the internal clearance of the bearing and the fit of the bearing on the shaft or in the housing. A small speck of dirt can pinch the outer ring outside diameter. Also, it can keep a split housing from being tight. This can cause an out-of-round housing bore in which the bearing's outer ring may turn. Dirt on a shaft at the seal contact area can cause seal wear which results in lubricant leakage. Dust and dirt mixes with the lubricant in the bearing and forms a lapping compound that causes wear in the bearing.

Do not remove a new bearing from its original package until immediately before it is mounted. New bearings are thoroughly coated with slushing compound to keep out air, moisture and rust. The slushing compound used by most bearing manufacturers are not normally removed since it is compatible with nearly all petroleum lubricants. When synthetic oils and greases with synthetic oils are used, the slushing compound must be removed. However, with synthetic hydrocarbon oils and greases, the slushing compound does not have to be removed. Bearings are wrapped in heavy duty, waterproof, poly laminate paper. Care should be taken not to drop bearings or handle them roughly. They should not be exposed to large temperature changes which might cause condensation to form. Do not handle the bearing any more than necessary. Fingerprints can become a starting point for rust.

Three basic methods to mount bearings are cold mounting, temperature mounting, and hydraulic mounting.

A. Cold Mounting

Bearings up to a 4" (10.16cm) outside diameter can be cold mounted using a sleeve and a hammer or a press (see figure 1). An ordinary hammer should be used. Hammers with soft metal heads are unsuitable as fragments of the metal may break off and enter the bearing. The end faces of the sleeve should be flat, parallel and burr free. It should about the ring with the press fit.

When a shaft is put in a vise in any assembly or disassembly operation, it is important to protect the shaft from the jaws with sheets of copper or brass. A replacement bearing must be an exact duplicate of the failed bearing. Bearings and shafts are designed for each other and you cannot make any changes unless a redesign of the machine is made.

If the bearing fits too loosely on a shaft, it can creep or slip. This causes the bearing to overheat and also results in abrasive wear to the bore of the bearing and the surface of the shaft. If the press fit is too tight, the inner ring of the bearing will be stretched so much that there will be no room for the balls or rollers to revolve freely.

An arbor press can be used for mounting small bearings. Place a sleeve between the bearing and the press. The end faces of the sleeve should be flat, parallel and burr free. It should be so designed that it abuts the ring, which is to be mounted with an interference fit, otherwise the rolling elements and raceways can be damaged leading to a premature failure.

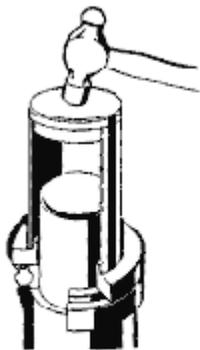


Figure 2

To facilitate mounting and also to reduce the risk of damage, the bearing seating on the shaft and in the housing should be lightly smeared with thin oil.

At times it is necessary to have a press fit on the inner ring since it rotates and also on the outer ring if there is some unbalance load that could cause the outer ring to creep. The pressing force then must go through both the inner ring and the outer ring at the same time, otherwise the bearing will be damaged (see Figure 2).

B. Temperature Mounting

Temperature mounting is the method of obtaining an interference fit by first introducing a temperature differential between the parts to be fitted, thereby making the assembly easier. The required temperature differential can be obtained as follows:

- a. Treating one part (this is, generally speaking, the most common method).
- b. Cooling one part.
- c. Simultaneously heating one part and cooling the other part.

The temperature differential method is suitable for any bearing size, both straight-bore and tapered bore. Because of the equipment required, the cold mounting method is used wherever possible for bearings under a 4"(10.16cm) outside diameter.

The most usual bearing mounting is that in which the inner ring is mounted with an interference fit on the shaft, and the outer ring is mounted with a line-to-fine to loose fit in the housing. For non-separable bearings over a 4"(10.16cm) outside diameter, it is necessary to heat the entire bearing or just the inner ring, depending on the method of heating, so that the inner ring easily goes over the shaft. In the case of a separable bearing, it is only necessary to heat the inner ring. The bearing should be uniformly heated within a maximum temperature of 250°F(121°C). Methods for heating a bearing are: hot oil bath, hot plate, induction heater, and oven. A sealed bearing can never be put in a hot oil bath.

The hot oil bath is probably the most common method used. Both the oil and the container should be clean. Quenching oil having a minimum flash point of 300°F (149°C) should be used. The quantity of oil used in a bath should be large in relation to the volume of the bearing. An insufficient quantity heats and cools too rapidly, thus introducing the risk of in adequately or unevenly heating the bearing.

A wire rack should be installed 3"(7.62cm) from the bottom. This prevents direct contact of the bearing with the higher temperature at the bottom and also separates the bearing from any contamination that may have settled at the bottom. Alternatively, the bearing can be suspended in the bath from above.

After a bearing has been heated in oil, its bore should be wiped with a clean lint-free cloth before mounting.

Once the bearing is heated it should immediately be placed on the shaft and locked in place. If a locking device is not used as part of the mounting, or if it cannot be fitted until later, some mounting tool should be used to hold the inner ring against the shaft

shoulder until the inner ring has cooled sufficiently to be firm on the shaft. If this is not done, the inner will walk away from the shaft shoulder.

C. Hydraulic Mounting

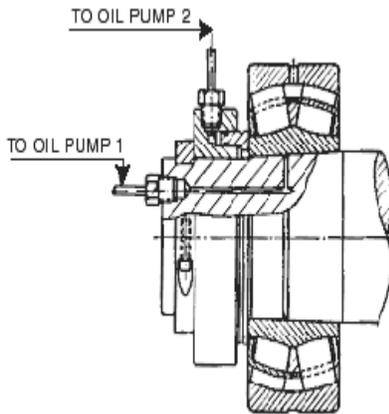


Figure 3

This is actually a simplified method for cold mounting a tapered bore bearing. It is based on forcing oil between the interfering surfaces, thereby greatly reducing the required axial force. The pressure is generally supplied with a manually operated pump with a maximum pressure of 10,000 psi.

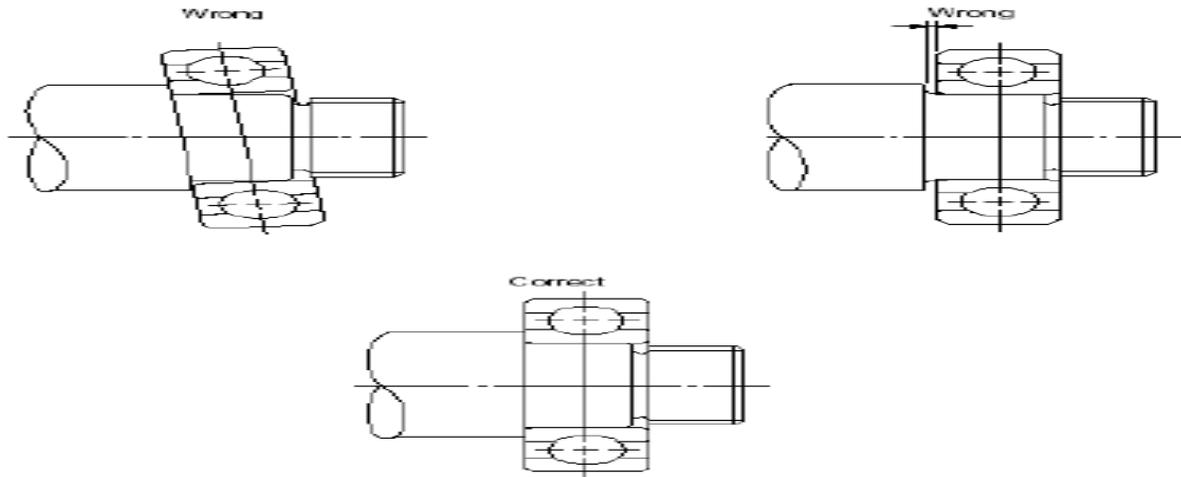
The oil used for oil injection mounting should be approximately SAE 20 or 30. It should be absolutely clean, not only to protect the bearing and seat, but also to avoid clogging the oil lines.

The shaft has to be designed with an oil groove on the outside diameter and for a feed line from the end of the shaft hydraulic nut can be used to easily mount and dismount spherical roller bearings with a tapered bore (see Figure 3).

1. Inspection Before Mounting

Inspect the shaft and the bearing housing to make sure that they have been finished to the dimensions specific in the drawing.

Check also that the corners and the right angle of the shaft and bearing housing fit the side of the bearing.



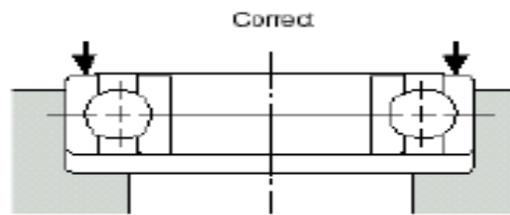
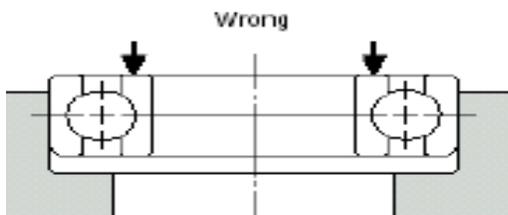
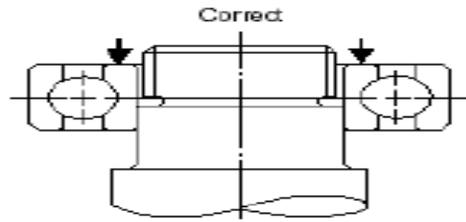
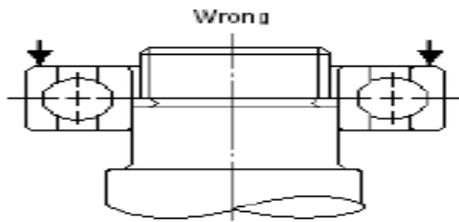
2. Preparations for Mounting

Make sure the fitting surfaces of the shaft and the bearing housing are free from scratches, burrs, dirt and that no moulding sand remains in the housing. Remove scratches and burrs no matter how small they are, using oilstone or fine sandpaper. Coat the area where the shaft and bearing housing meet with mineral oil to facilitate mounting of the bearing and prevent the area of contact from being scratched.



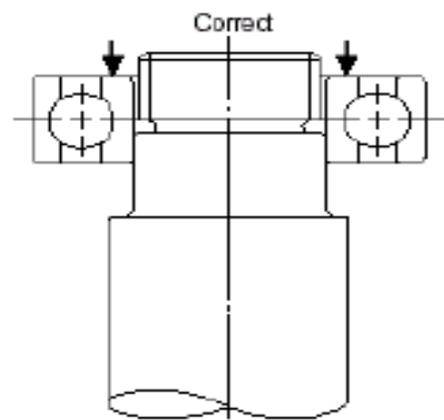
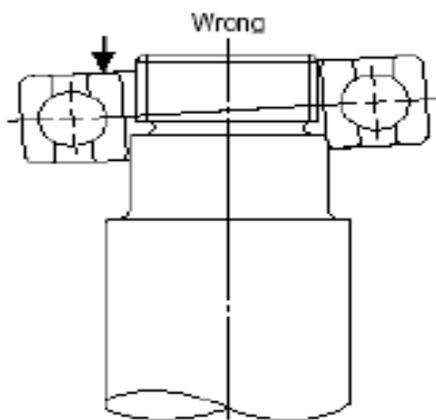
3. Bearing Mounting - Pressing Surfaces

Press the inner ring to mount the bearing on the shaft. Likewise, press the outer ring to mount it in the housing. DO NOT press the outer ring to mount the bearing on the shaft nor the inner ring to mount in the housing; the race way may be scratched and noise or early failure will result.



4. Bearing Mounting - Press Method

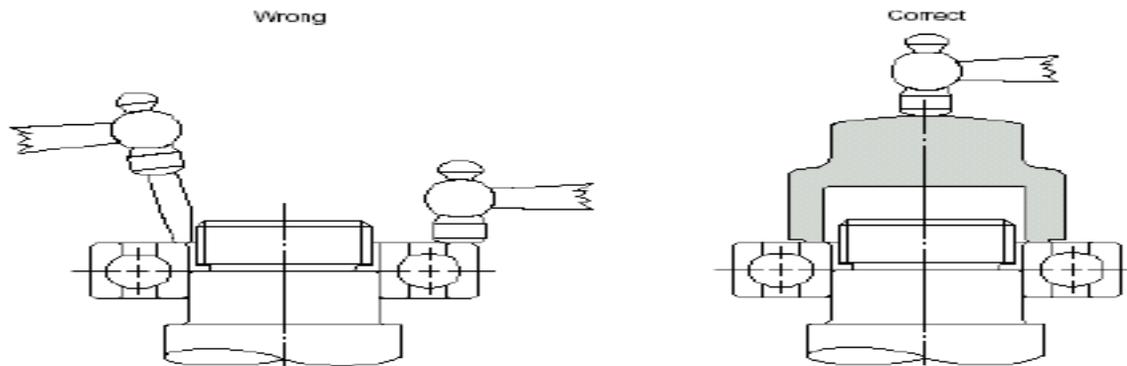
Apply even force to the bearing at a right angle. Avoid driving on only one side as this



can damage the bearing. NEVER apply force to the bearing retainer or seal.

5. Mounting with Hammer and Mounting Device

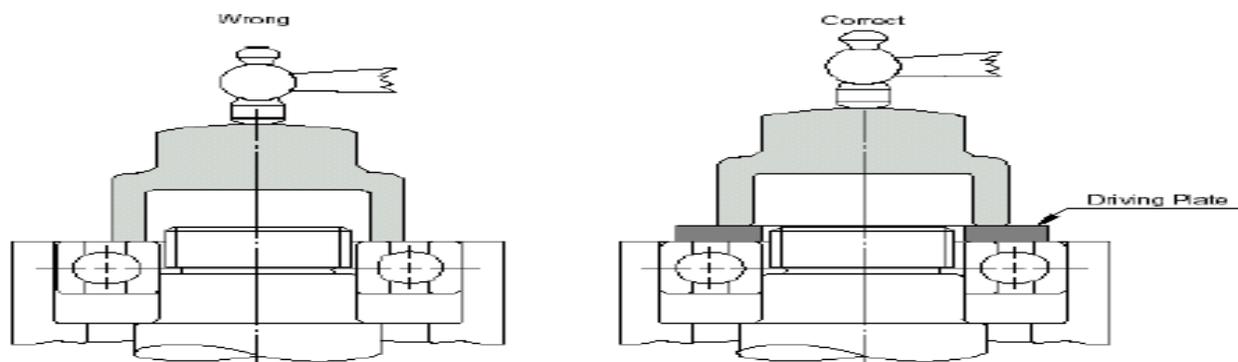
The bearing is frequently mounted with a hammer and mounting device. Do not strike the bearing directly; this can damage the bearing. Hit the mounting device with a hammer, as illustrated below. Tap the mounting device lightly, using many strokes.



6. Mounting Inner and Outer Rings Together

If both the inner and outer rings must be mounted in an interference fit because of machine construction, then use a driving plate as illustrated below.

The driving force must be applied uniformly to the inner and the outer rings. If force is applied only to the inner ring, then damage to the bearing can result.



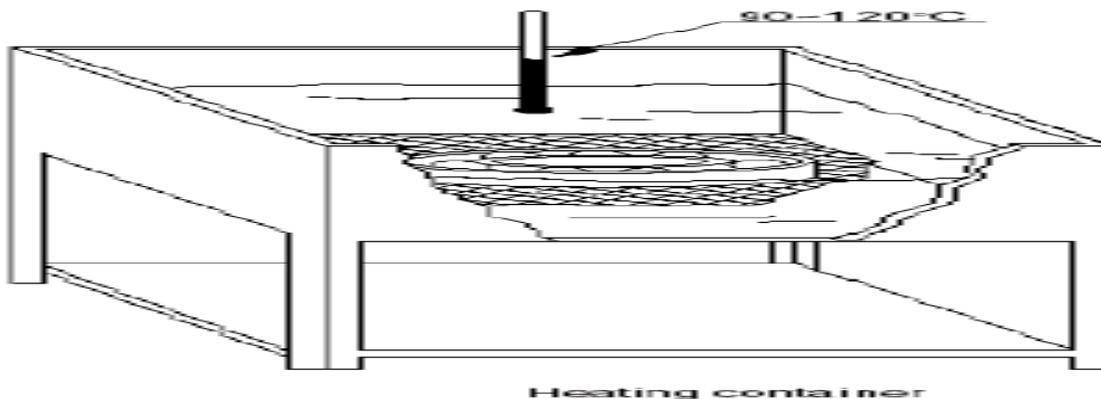
7. Temperature Mounting

A popular method of mounting bearings to obtain a high interference fit is to heat the bearing in clean mineral oil to between 90°C and 120°C. This will expand the bore diameter and facilitate mounting on the shaft.

DO NOT HEAT THE BEARING ABOVE 120°C BECAUSE THIS MAY REDUCE THE HARDNESS OF THE BEARING.

Suspend the bearing in the oil with a wire, or support it on a screen; DO NOT place the bearing on the bottom of the container. When the temperature of the bearing reaches the desired level (120°C or less), mount it rapidly. The bearing will contract when cooled and a gap may occur between the shoulder of the shaft and the side of the bearing.

If this should occur, press the bearing against the shoulder using a mounting device.



8. Bearing Removal – Precautions

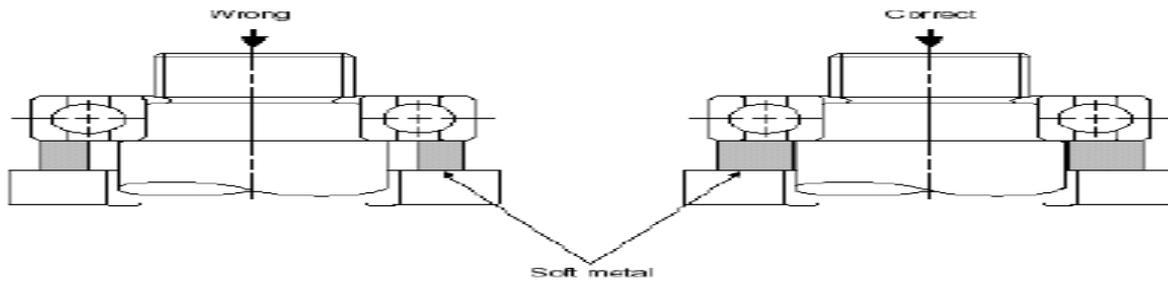
Apply the force for removal to the inner ring when removing the bearing from the shaft, and to the outer ring when removing it from the housing.

Apply even force around the side of the bearing ring at a right angle.

9. Removal with Hand Press

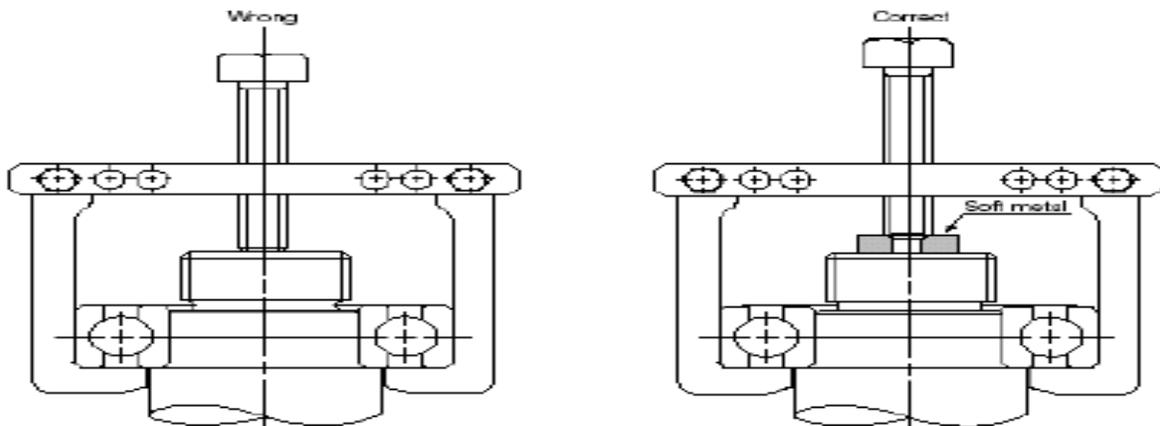
The most appropriate tool for removing a bearing is a hand press. When using the press, be sure that the arbor center and the bearing center are aligned; and that the inner ring is supported by a bearing support plate.

If the plate supports the outer ring only, a driving force passes from the outer ring to the inner ring through the balls, causing brinell dents on the outer ring, which will lead to premature failure.



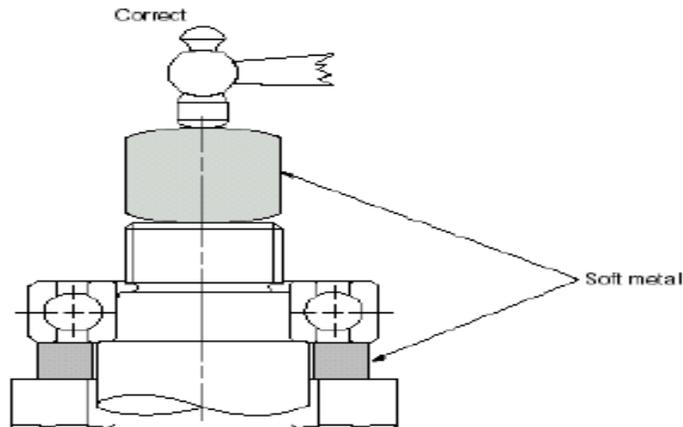
10. Removal using Bearing Puller and Soft Metal Device

When removing the bearing with a bearing puller, use a piece of soft metal to protect the shaft from being scratched.



11. Removal with Hammer and Soft Metal Protector

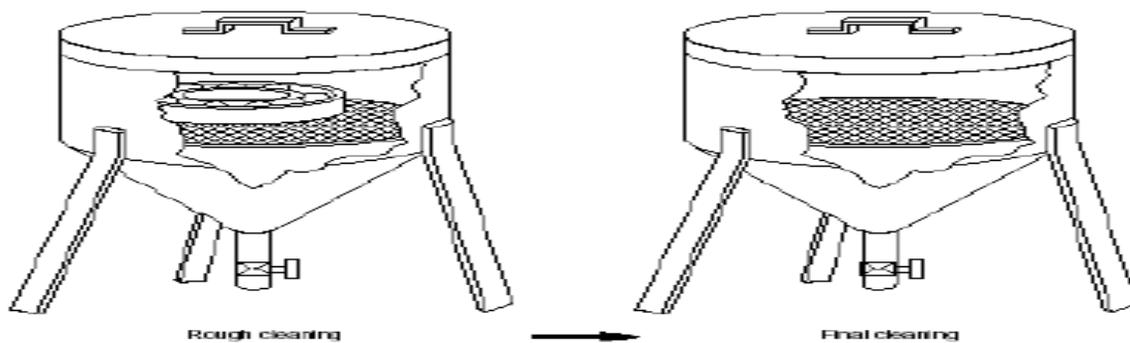
When removing the bearing with a hammer, use a soft metal protector, as illustrated below, to protect the shaft from being damaged.



12. Bearing Cleaning-Containers and Oil

Use separate containers for rough cleaning and final cleaning, and provide a screen to support a bearing in both steps. Containers like those illustrated below are desirable.

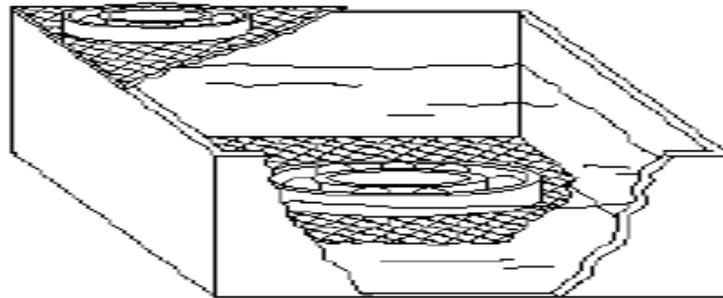
Clean paraffin is appropriate for cleaning bearings. If bearings are very dirty, gasoline may be used. Care should be taken, however, to prevent gasoline from igniting and to prevent rusting after cleaning.



13. Rough Cleaning

Do not revolve the inner or outer rings of a dirty bearing after immersing it in oil because the inside surfaces are easily scratched.

Leave it in the oil until dirt or grease separate from the bearing. If the oil is heated it cleans the bearing effectively. However, never heat the oil above 120oC.



14. Final Cleaning

After washing off the dirty grease in the rough cleaning process, place the bearing in the final cleaning container. While the bearing is submerged in clean oil, rotate the inner or outer ring so that the inside of the bearing will also be cleansed.

After cleaning, carefully wipe the bearing with a clean cloth, apply a coat of rust preventive oil to the bearing, and wrap it in rust preventive paper if the bearing will not be used immediately.

15. Inspections After Cleaning

To check the bearing after cleaning, hold the inner ring horizontally with one hand and spin the outer ring. If the bearing is faulty, a vibration will be felt in the hand.