## Bearing Mounting Methods

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 is 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, polylaminate 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

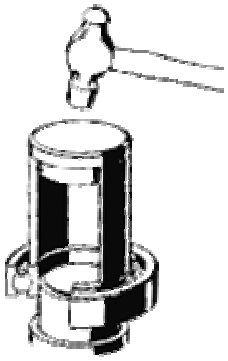

Figure 1

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 abut 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. 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.

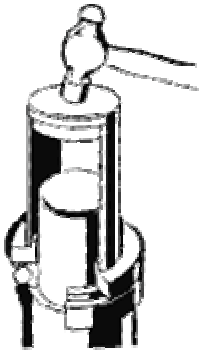

Figure 2

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).**

If a spherical roller bearing was used for inner ring rotation where there was an unbalance load, a pin could be put through one oil hole in the outer ring to prevent outer ring creep. With this arrangement a press fit of the outer ring would not be necessary.

### 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

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.

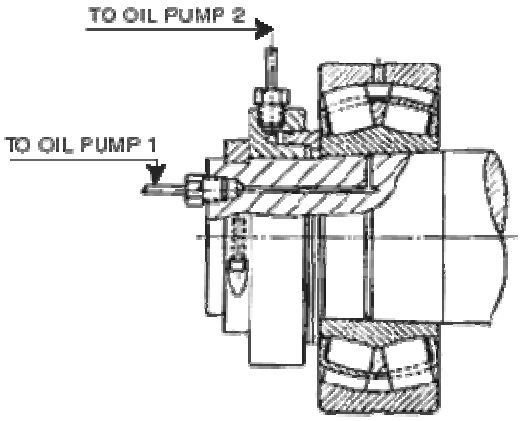


Figure 3

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)**.

## Part 2: Axial Location of Bearings

It is usually unnecessary for the shaft to be located axially by more than one bearing. In fact, this is usually undesirable because temperature variations may have a different effect on the length of the shaft than on the distance between the housing, possibly resulting in damage to the bearings. Therefore, one bearing usually locates the shaft and this bearing is called the fixed bearing. The other bearing is free to float on either the shaft or housing seat. The exception to this is when the span is short, in which case variations in shaft length, due to temperature, are usually negligible; or when a pair of angular contact ball bearings or tapered roller bearings are mounted opposed, in which case proper adjustment of the bearings is necessary.

When mounting a free bearing, it is important to ensure that there is sufficient axial clearance at the side where the bearing would be expected to move once the application is in operation. It is usually safe to center the bearing on the seating.

If an induction heater is used to heat the inner ring, care should be taken that no residual magnetism remains in the inner ring. A gauss meter can be used to measure to see if there is any residual magnetism.

**Caution: Never use a torch to heat a bearing. Hot spots can develop in the inner ring causing a softening of the raceway, which leads to an early bearing failure.**

## Part 3: Axial Adjustment

It is important to ensure full and proper seating of the rolling elements during adjustment so as not to introduce an error in the final adjustment. This is quite important for tapered roller bearings, in which it must be insured that the rollers are not skewed and for thrust ball bearings, whose washers usually have a radial clearance in the bearing housing. Proper seating of the rolling elements is insured by rotating the shaft during adjustment simultaneously pushing and pulling it.

The amount of axial looseness which is to be maintained in an adjustable mounting is determined on the basis of experience. Machine or vehicle manufacturers usually supply instructions based on their experience.

The proper axial adjustment is that which provides the necessary running accuracy without impairing the design life of the bearings. In most cases, a small residual axial clearance must be

left to allow for shaft expansion during operation.

**IMPORTANT: When tightening all sizes of locknuts, never use a chisel or drift and a hammer. A spanner wrench should be used as shown in Figure 4, or an impact spanner wrench as shown in Figure 5.**

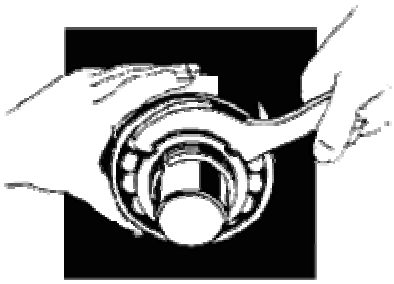

Figure 4

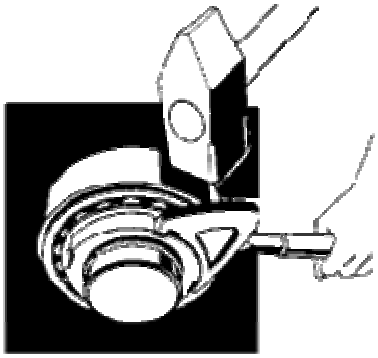

Figure 5

If a chisel or drift and a hammer is used a small chip from the locknut could get into the bearing and ultimately be the reason for a premature bearing failure.

**CAUTION: Whenever mounting or dismounting bearing always use safety glasses.**

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