

12 Bearing handling

12.1 Precautions

As rolling bearing is precise component, we should operate carefully according to relevant steps and specifications during mounting and dismounting, preferably the proper tools. Neither strong impact or direct hit upon the bearing nor pass pressure via rolling element is allowed. Keep the mounting environment clean, and no materials like cloth and fibre are allowed to clean the bearing because they influences the service life of bearings and performance characteristic. Improper mounting may result in premature failure of bearings.

1. Maintain bearings and surrounding environment clean

Even small dust that is invisible could bring harmful effect on bearings. Therefore, the surrounding environment must be kept clean to ensure that no dust penetrate into bearings .

2. Proper mounting

Strong impact could cause crack and brinelling on bearing. On severe occasions, bearing may have cracks or fractures, which are often the reason of accidents. Therefore, proper mounting tools must be used to avoid damage to bearing.

3. To avoid corrosion of bearing

During mounting perspiration from hands could result in rust. Thus it is advisable that workers put on gloves in operation.

12.2 Storage

When shipping, all bearings are coated with certain amount of anti-corrosion oil and wrapped in anti-tarnish paper. As long as the packaging is undamaged, its quality could be guaranteed. Yet long-term storage, it is appropriate that bearing should be shelved 30cm above the ground in circumstances when humidity is below 65% and temperature is around 20℃. Furthermore, avoid the storage in places exposed directly to the sun's rays or placing boxes of bearings against cold walls. If packed in good condition, the bearing can be stored for several years in proper circumstances.

12.3 Bearing mounting

Whether the mounting is correct has direct influence on the precision, life and performance of bearings. Therefore design and assembly department should conduct adequate research on bearing mounting. The bearing should be mounted according to right and scientific operation standard. The work flow can be as follows :

- 1.Clean up bearing and relevant components
- 2.Check dimension and precision of relevant components
- 3.Mounting operation
- 4.Inspection after mounting
- 5.Replenishment of lubricants

The packaging of bearing will only be removed when we need to mount it. Ordinary grease lubrication Bearing and oil lubrication bearing do not need to be cleaned. However, for instrument use or high speed application, anti-corrosion need to be removed using a clean detergent oil. After the removal of the anti-corrosion oil, bearings should not be left for a long time because they rust easily. Yet shielded/sealed bearing can be used directly without cleaning.

The mounting method of bearing varies with bearing structure, fitting and working conditions. If shaft rotates, the inner ring need to adopt interference fit. For bearing with cylindrical bore, we often use press tool for mounting or expand bearing by heating. Bearing with tapered bore is mounted directly on tapering shaft or use sleeves for mounting. Clearance fit is often applied to the housing. For bearings in which the outer rings is interference fit ,press tool is used for mounting or shrink fit method is applied to expand bearings. Anti-corrosion measure should be taken in situations which ice is used for coolant in thermal contraction method because the moisture in the atmosphere idheres to bearings.

12.3.1 Mounting of bearing with cylindrical bore

1. Press fits

Small bearings can be mounted by a mounting tool placed on the inner ring as shown is Fig. 12.1 and bearing is slowly pressed on the shaft with the press until the side of the inner ring rests against the shoulder of the shaft .The mounting tool must not be placed on the outer ring for press mounting, since the bearing maybe damaged.

Before mounting, applying oil to the fitted shaft surface is recommended. The mounting method using a hammer for smooth insertion should only be used for small ball bearings with minimally interference fits and when a press is not available. In the case of heavy interference fits or for medium and large bearings, this method should not be used.

When both the inner rings and outer rings of non-separable bearings(such as deep groove ball bearing) require interference fit ,a mounting tool is places on both rings as shown in Fig12.2 and both rings are fitted at the same time using hydraulic press. Since the outer ring of self-aligning ball bearings may deflect a mounting tool should always be used for mounting them.

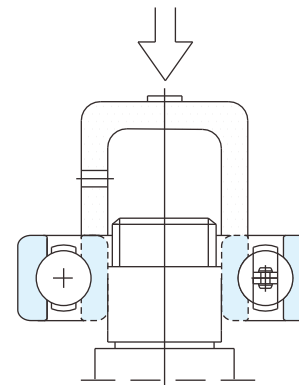


Fig. 12.1 Force mounting of inner ring

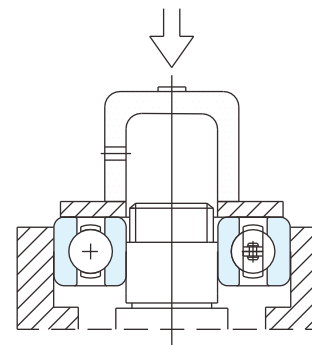


Fig. 12.2 Force mounting of both inner and outer ring

In the case of separable bearings (such as cylindrical roller bearings and tapered roller bearings)the inner ring and outer rings maybe mounted separately. Assembly should be done carefully to align the inner and the outer rings correctly. Careless or forced assembly may cause scratches on the rolling contact surface.

2.Shrink fits.

Since press fitting large bearings requires a large force, a shrink fit is widely used. The bearings are first heated in oil tank or oven to expand them before mounting. This method prevents an excessive force from being imposed on the bearings and allows mounting them in a short time .The heating temperature of bearings are determined by size, interference required for mounting. The precautions are as follows.

Generally the heating temperature is not exceed 100℃ , 80℃~90℃ is good, seals deformation, second tempering and grease leakage will happen if the temperature over high.

Heat the bearings to a temperature 20℃ to 30℃ higher than the lowest temperature required for mounting, using metal nets or a lifting device to prevent bearings from resting directly on the bottom of the oil container, to avoid the inner ring will cool a little during mounting. After mounting, the bearings will shrink in the radial direction as well as axial direction while cooling, down fix the inner ring and shaft shoulder tightly with the shaft nut or other locating methods before shrinking, so that no clearance is left between the baring and shoulder.

Besides heating in oil, electromagnetic induction or over heating are widely used.

Electromagnetic induction heaters, electricity in a coil produces a magnetic field that induces a current inside the bearing that generates heat.

Consequently, heating in a short time is possible, Making bearing shrink fitting efficient and clean. In the case of relatively frequent mounting and dismounting such as cylindrical roller bearings for roll necks of rolling mills and for railway journal boxes, induction heating should be used for mounting and dismounting inner rings.

12.3.2 Mounting bearings with tapered bore

Bearings with tapered bores are mounted on the tapered shaft and on cylindrical shafts with adapters and withdrawal sleeves, as shown in Figure 12.3, 12.4.

Large spherical roller bearings are mostly mounted by using hydraulic pressure. Spherical roller bearings should be mounted while checking their clearance reduction. When a large bearing is mounted on a shaft, the outer ring may be deformed into an oval shape by its own weight. If the clearance is the lowest part of the deformed bearing, the measured value may be bigger than the true value. If an incorrect radial internal clearance is obtained in this manner and the values in clearance is obtained in this manner and the values are used, then the interference fit may become too tight and the true residual clearance may become too small.

When a self-aligning ball bearing is mounted on a shaft with an adapter, be sure that the residual clearance does not become too small. Sufficient clearance for easy alignment of the outer ring must be allowed.

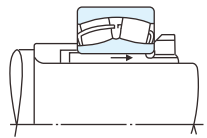


Fig. 12.3 Mounting with adapter

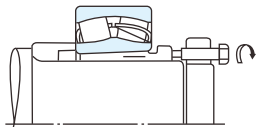


Fig. 12.4 Mounting with withdrawal sleeve

12.4 Operation inspection

After the mounting has been completed, a running test should be conducted to determine if the bearing has been mounted correctly. Small machines may be manually operated to assure that they rotate smoothly. Items to be checked include sticking due to foreign matter, visible flaws, brinelling uneven torque caused by improper mounting or an improper mounting surface, and excessive torque caused by an inadequate clearance, mounting error, or seal friction. If there are no abnormalities, powered

operation may be started.

Large machines which cannot be turned by hand, can be started after examination with no load, and the power immediately cutoff and the machine allowed to coast a stop. Confirm that there is no abnormality such as vibration, noise, contact of rotating parts, etc.

Powered operation should be observed carefully until it is determined that no abnormalities exist, then gradually increase the speed, load, etc. to their normal levels. Items to be checked during the test operation include the existence of abnormal noise, excessive rise of bearing temperature, leakage and contamination of lubricants, etc. If any abnormality is found during the test operation, it must be stopped immediately and the machine should be inspected. If necessary, the bearing should be dismantled for examination.

Although the bearing temperature can generally be estimated by the temperature of the outside surface of the housing, it is more desirable to directly measure the temperature of outer ring using oil holes for access.

The bearing temperature should rise gradually to the steady state level within one to two hours after the operation starts. If the bearing or its mounting is improper, the bearing temperature may increase rapidly and become abnormally high. The cause of this abnormal temperature may be an excessive amount of lubricant, insufficient bearing clearance, incorrect mounting, or excessive friction of the seals.

In the case of high speed operation, an incorrect selection of a bearing type or lubrication method may also cause an abnormal temperature rise. The sound of a bearing may be checked with a noise locator or other instrument. Abnormal conditions are indicated by a loud metallic sound, or other irregular noise, and the possible cause may include incorrect lubrication, poor alignment of the shaft and housing, or the entry of foreign matter into the bearing. The possible causes and countermeasures for irregularities are listed in Table 12.1.

Table 12.1 Reasons and countermeasures for abnormal of bearings

Running order	Reasons detected	Countermeasure
Abnormal sound	Abnormal load	Amendment fitting, bearing internal clearance, modulate preload quantity, amend position of low-necked housing block
	Improper mounting	Processing precision of axle and housing, improve accuracy and method of mounting
	Unsuitable lubricant	Supply lubricant, select proper lubricant
	Contact of rotate accessory	Modify the sealed contacting section of loops
	Rolling surface generate indentation, rust and scar due to impurity	Replace bearing, clean relevant accessory, improve sealing device, and use pure lubricant
	Surface deformation(after steel carbonizing)	Replace bearing
	Raceway fracture	Replace bearing
	Over-size of internal clearance	Study fitting and bearing internal clearance, modify preload quantity
	Impurity penetration	Replace bearing, clean relevant accessory, improve sealing device, and use clean lubricating oil
	Spherical injury, fracture	Replace bearing
Exceptional temperature rise	Superabundance of lubricant grease	Re-running after venting superabundant lubricant grease
	Insufficiency and unsuitable lubricating grease	Supply lubricating grease, select appropriate lubricating grease
	Abnormal load	Modify fitting, study internal clearance of bearing, modulate preload, and modify position of low-necked block.
	Improper mounting	Improve processing precision of axle and housing, improve accuracy and method of mounting
	Creep of fitting surface and over-size of sealing device friction	Replace bearing, study fitting, modify axle and housing, change seal form
Large vibration (jump of axle)	Surface deformation fracture (after steel carbonizing)	Replace bearing, pay attention to operation
	Fracture	Replace bearing
	Improper mounting	Improve precision of bearing housing and amend method of mounting
Much lubricant leakage, large discoloration	Impurity penetration	Replace bearing, clean relevant accessory, improve sealing device
	Superabundant lubricant, friction powder generated by impurity penetration	Use right amount of lubricant, investigate to change selection of lubricating
Accelerate or decelerate (start or stop)	Mechanical resonance	Improve rigidity of shaft

Remarks:

For medium & large-sized cylindrical roller bearing, ball bearing, and grease lubrication, especially when in environmental condition of low temperature, there will be the problem of rolling sound. Normally, the temperature of bearing will not rise even rolling sound occurs, which will not influence its fatigue life and lubricating life duration. The bearing can be used as usual. If you have any enquiries about rolling sound, please contact the technical center of C&U group.