

Bearings
Maintenance and Replacement
by Scott Hills

Introduction

Rolling bearings are robust mechanical components which will give long service life, particularly if they are correctly mounted and well maintained. Correct handling when mounting and dismounting bearings should not present any difficulty. Cleanliness, accuracy and care are necessary, but these are not unusual requirements when dealing with machines. The maintenance of rolling bearings simply means that they should be protected from dirt and moisture and correctly lubricated. How efficiently they are protected depends on the design of the arrangement, the condition of the seals and the lubricant. Ideal lubrication means the right lubricant used correctly.

Machines are designed based on known and sometimes assumed factors regarding environmental conditions and operating requirements. Maintenance instructions must also be based on similar typical operating conditions. However, the user is well acquainted with the practical and local operating and servicing conditions. Applying this knowledge, together with the practical recommendations given in this guide regarding stocking of spares, what to look for during operation, what inspection to carry out when the machine is non-operational, dismounting and mounting, should mean that maintenance of the bearing arrangements will not present any problems.

Stocking of Replacement Bearings

To avoid lengthy production stoppages caused by possible bearing failure, it is advisable to make certain that replacement bearings are readily available. It is therefore prudent to make sure at an early stage which bearings are used in the machine and whether special tools are required for dismounting or mounting. Check with the bearing representative whether the bearings can be supplied at short notice. If long delivery times exist for any of the bearings involved it may be advisable to place an early order.

Rolling bearings are coated with a rust-inhibiting compound before being packaged and can be stored in their original package for many years. They should preferably be kept in a store where the relative humidity does not exceed 60 % and where the temperature is reasonably constant. Bearings with shields, suffix -2Z, should however not be stored for more than two years prior to use, and bearings with seals, suffix -2RS1, for not more than three years. Such bearings are "lubricated-for-life" but the grease will age and become too stiff if kept too long.

Ensure that bearings not in their original package are adequately protected against dirt and corrosion.

What to look for during operation.

Bearings mounted in machines where a stoppage would have serious consequences should be checked regularly. In less critical applications where they operate under less demanding conditions bearings can normally be left without attention except to see that they are well lubricated. This section deals with routine checks and is divided into four sub-sections under the headings:

- 1. Listen
- 2. Feel
- 3. Look
- 4. Lubricate

1. Listen

Place one end of a wooden listening rod, screwdriver or similar object against the bearing housing as close to the bearing as possible. Place the ear against the other end and listen. If all is well, a soft purring sound will be heard. A damaged bearing gives out a loud noise, often irregular and rumbling.

2. Feel

Check the temperature of the bearing arrangement by using a thermometer, for instance an SKF digital thermometer 729117, or often simply by placing a hand on the bearing housing. If the temperature seems unusually high or suddenly changes it is an indication that something is wrong. The reason may be insufficient or excess lubricant, impurities, overloading, bearing damage, insufficient clearance, pinching, high friction in the seals or heat supplied by an external source. Remember, however, that immediately after relubrication there will be a natural rise in temperature which may persist for one or two days.

3. Look

Ensure that lubricant does not escape through defective seals or insufficiently tightened plugs. Impurities generally discolour the lubricant, making it darker. Check the condition of the seals near the bearings to ensure that they will not, for example, permit hot or corrosive liquids and gases to penetrate the bearing arrangement. Any automatic lubricating devices should also be checked to see that they function correctly.

4. Lubricate

Relubrication the bearing arrangements according to the instructions provided by the machine manufacturer.

Wipe lubricating nipples clean before fresh grease is injected. If the bearing housing is not provided with nipples, requisite relubrication should be carried out during a planned stoppage of the machine.

The housing cap or end cover must be removed, the used grease taken out and fresh grease added.

Even where nipples are fitted on the housing, the used grease should be removed and replaced with fresh from time to time.

Check the oil level and replenish if necessary. Ensure that the air vent of the oil level gauge is not blocked. When the oil is to be changed, it is drained off and the bearing arrangement rinsed with fresh clean oil of the same type before refilling to the required level.

With oil bath lubrication it is generally sufficient to change the oil once a year providing the operating temperature does not exceed +50 0C and the oil does not become contaminated. The oil must be changed more frequently when operating temperatures are higher four times a year up to +100 0C, monthly up to +120 0C and weekly at +130 0C.

Inspection when the machine is non-operational.

Although rolling bearings are robust mechanical components which give long service life it is, however, wise to inspect them now and then. This can preferably be carried out during a planned stoppage of the machine or when the machine is to be dismantled for some reason, such as inspection or repair.

Commence operations by arranging the working area so that it is as clean and as dry as possible.

Check that replacement bearings are readily available in case they are needed. If drawings are available they should be studied thoroughly before maintenance work is begun. Clean the external surfaces. Note the order in which the machine components are removed and also their relative positions. Care should be taken not to crack, for example, labyrinth seals as they are removed. Excessive force should never be used when removing a seal. Inspect the seals and other components of the arrangement. Check the lubricant. Impurities of various kinds can usually be felt if a little of the lubricant is rubbed between the fingers; or a thin layer may be spread on the back of the hand for inspection against the light.

Ensure that dirt or moisture cannot enter the machine after the covers and seals have been removed. Cover the machine, exposed bearings and seating with waxed paper, plastic sheeting or similar material if work is interrupted. Do not use cotton waste! Wash the exposed bearing where it is possible to carry out inspection without dismantling. Use a paint brush dipped in white spirit and dry with a clean lint-free cloth or compressed air (taking care that no bearing components start rotating). Sealed bearings, however, cannot be washed and should therefore be replaced if necessary.

A small mirror and probe, of the dental type, are useful when inspecting raceways, cage and rolling elements of the bearing.

If the bearing is undamaged it should be lubricated according to the instructions provided by the machine manufacturer or to the recommendations given by your supplier before remounting. Carefully replace the seals and covers. **Dismounting bearings**

This section contains advice and instructions on how best to dismount bearings. It is divided into sub-sections entitled as follows:

- Interference fit on the shaft
- Interference fit in the housing
- Bearings mounted on sleeves
- Inspection of dismantled bearings

Never dismount an undamaged bearing unless it is necessary!

If a bearing is to be dismantled, it is advisable to mark it to show its relative mounted position, i.e. which section of the bearing was 'up', which side was 'front' etc. The bearing should be remounted in the same position.

Start dismantling by selecting the correct tools for the job - examples of suitable tools supplied by SKF can be found on pages 50 to 55. SKF representatives will be pleased to provide additional information to cover the whole range of tools.

Remember to treat all bearings carefully. Arrange for a suitable stop or support for the shaft, otherwise the bearings may be damaged by the dismantling forces normally occurring during the operation.

If the bearing has an interference fit on the shaft, a puller should be used. This should normally engage on the inner ring face. Larger bearings may be dismantled more easily by using hydraulic tools. If it is not possible to get a purchase on the inner ring face, the puller may be applied to the outer ring face. However, it is very important that the outer ring should be rotated during dismantling to prevent any bearing component being damaged by the dismantling force. Arrange a suitable stop for the handle of the spanner for the withdrawal screw, grip the puller legs and rotate.

Use a soft metal drift with rounded point or another similar tool if there is an integral shoulder between the bearings.

The inner ring assemblies of self-aligning ball bearings and spherical roller bearings can generally be swiveled so that a puller can be used.

Self-aligning ball bearings and spherical roller bearings are often mounted on adapter or withdrawal sleeves. The advantages of using a sleeve are that the shaft seating does not need such accurate machining and that mounting, and dismounting are considerably facilitated. The figure shows, from left to right, a lock nut, a locking washer, a bearing and an adapter sleeve. **Adapter sleeve**

Dismounting is commenced after the position of the sleeve on the shaft has been marked. Then disengage the bent tab of the locking washer from the lock nut slot.

Withdrawal sleeve

For small and medium-size bearings, the sleeve may be removed using a similar lock nut to that used for adapter sleeves. Remember to lubricate the thread and the lock nut face adjacent to the bearing with say, molybdenum disulphide paste. Tighten the nut using a hook or impact spanner until the bearing becomes loose. If the sleeve protrudes from the end of the shaft a suitable support must be provided. Larger bearings can easily be dismantled from their sleeves by using a hydraulic nut.

Unscrew the lock nut a few turns. Place a mounting dolly or a length of tubing against the nut and apply sharp, evenly distributed blows until the bearing becomes loose.

If the bearing is mounted on a smooth shaft or if there is no spacer sleeve between the bearing and the shaft shoulder, the tool should be applied to the inner ring of the bearing instead.

If the sleeve is small, a soft metal drift may be used instead of a hook spanner.

When the bearing has been dismantled, it should be inspected. First wash it in white spirit and then dry carefully using a clean lint-free cloth or compressed air (taking care that no bearing components start rotating). The bearing raceways and rolling elements should be inspected for any signs of damage.

However, sealed or shielded bearings should not be washed on any account; for obvious reasons they cannot be inspected.

Spin the outer ring and ascertain whether the bearing noise is normal. A bearing which is undamaged, i.e. has no marks or other defects on the ring raceways, rolling elements or cage, and runs evenly without abnormally large radial internal clearance, can be remounted without risk. If the bearing designation is not shown in any machine instructions, it should be recorded for future reference. The designation will usually be found on the side face of either the inner or outer ring of the bearing.

Above article was submitted by Scott Hills, Technical Sales of James Electric Motor Services Ltd. and is part of SKF's Bearing maintenance and replacement guide. If you like to get more information regarding this subject you can reach Scott at 403-252-5477.

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