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WHITE PAPER

BALL BEARING GREASE LUBRICATION

by Steve Wilson

One of the major causes of pump failure is bearing failure. While the symptoms of bearing failure may express themselves as seal failure, vibration, noise, or even a broken shaft, these problems are often just the symptoms of a failed bearing.

In this White Paper, we will present a brief overview of grease – lubricated ball bearings – by far the most prevalent type of bearing used in the pump (motor) industry. This paper is ***not*** intented to replace any individual pump or motor's Installation, Operation, or Maintenance Manual.

BALL BEARING OVERVIEW

While there are many types of bearings used in pumps and motors, we will discuss ball bearings. A generalized ball bearing is illustrated in *Figure 1*. In a pump or motor, the outer ring is typically fixed in place and does not rotate, and the inner ring turns with the shaft. The loads are transmitted through the balls from the inner race to the outer.

Since the ball is a sphere, its point of contact is small, which helps the machine spin smoothly. Depending on the clearances, there are several grades of bearings available, but this is of no concern to the user, in general. The engineering staff from the pump or motor's manufacturer will choose the correct grade to ensure long life of the pump.

TYPES OF GREASE LUBRICATED BEARINGS

OPEN BEARINGS (SINGLE SHIELDED, OPEN SHIELDED)

These bearings are essentially open to the environment around them and will require some lubrication. The bearing in *Figure 1* is an open bearing. If a cover was put on one side, the bearing would be called a single shielded or open shielded bearing.

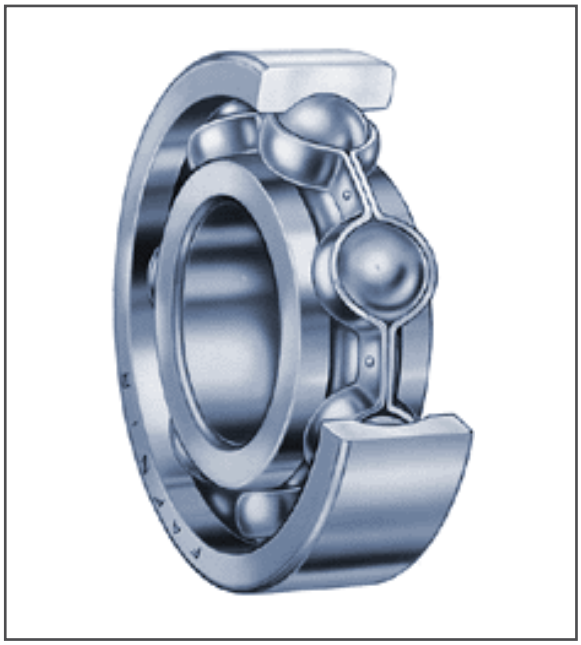

Figure 1. *Ball Bearing*

DOUBLE SHIELDED BEARINGS

In this type of bearing, a cover is placed on both sides, essentially isolating the bearings from the surrounding environment to a large extent. The shields do not actually touch the balls. These bearings are commonly known as simply "shielded," but the term can be misleading given the single shielded bearing discussed above. They are also known as "greased for life" because the shields retain the grease and re-greasing is not required.

SEALED BEARINGS

A sealed bearing has a soft, contacting cover on both sides (usually rubber or another soft material). These bearings do not require re-lubrication.

Functions of Lubrication

Lubrication of a bearing has four main functions:

- To lubricate the sliding contact which exists between the retainer and the other parts of the bearing.
- To lubricate that part of contact between the races and the rolling element that is not truly rolling.
- To protect the highly finished surfaces of the rolling element (balls) and the rings from corroding.
- To help seal the housings against foreign matter.

GREASE AND LUBRICATION BASICS

Bearing greases are usually a mixture of a thickener base emulsified with a lubricating oil. The base merely acts to keep the oil in suspension, but the type of base is very relevant.

The two most common types of base are: lithium and polyurea. Lithium-based grease is brown in color; polyurea typically blue or blue-green. Lithium grease is often called “axle grease” and has high availability. Polyurea-based greases have a better resistance to water and condensation.

When moving parts of the bearing come in sheer contact with the grease, a small quantity of the oil will adhere to the bearing surfaces. The oil that is picked up by the bearing (and thus removed from the grease) is gradually broken down by oxidation or lost by evaporation, centrifugal force, etc.

The bearing cannot funtion properly unless the supply of oil keeps up with the demand as the oil in the grease is depleted or oxidized.

Grease life cannot be accurately measured or predicted as all factors – such as speed, load, humidity, type of service, frequency of lubrication, contaminants, etc. – need to be considered.

In applications where elevated temperatures, high speed, severe dirt, high humidity, or other extreme conditions are encountered (particularly in open bearings), accelorated deterioration of the grease may occur. Such duties are normally spelled out in the IOM, and lubrication periods adjusted.

LUBRICATING THE BEARINGS

Prior to any lubrication, the owner’s manual should be consulted and ***only one*** of the recommended greases should be used. Depending on the manufacturer, the types of greases may vary. Motors typically use polyurea-based grease, which most pump manufacturers now use as standard. However, some manufacturers still use a lithium-based greased bearing.

Do not mix the greases.

Mixing the greases, or lubricating a bearing full of one grease with the other grease, will cause the greases to come out of suspension and liquify or turn to wax; complete loss of all lubricity is also common. Failure of the machine is likely.

All grease should be clean and free from dirt, abrasive matter, moisture, acid, or alkali. If grease appears dirty, it should not be used. Lubricate the bearings in accordance with the manufacturer’s recommendations of course, but generally

- Old grease should be replaced with new grease during an overhaul.
- For equipment that is furnished with a grease fitting and drain, the recommendation is to force out the old grease by injecting the new grease.
- Always lubricate the equipment while it is in operation, so temperatures are normalized (be careful of rotating parts).
- Leave the drain plug out for a short period of time after flushing to allow excess pressure build-up to purge itself.
- If there is no drain, follow the manufacturer’s recommendations on how to add grease and how much.

- Equipment which is idle must be set in motion periodically, even by hand, to spread the lubricant over all bearing surfaces as no grease resists the effect of time, even if left on a shelf.

Manufacturers will usually recommend intervals of one to three months for lubrication.

CONCLUSION

Ball bearings are precision machines within themselves and may require maintenance in accordance with manufacturer's recommendations. They must be given proper care to promote reasonable life. Lack of knowledge and failure to follow the manufacturer's recommendations may result in either premature, slow failure and symptomatic noise and vibration, or in complete catastrophic failure.

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Thinking ahead makes it possible
Innovation is the essence

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