

Inadequate Grease Lubrication in Bearings

Inadequate lubrication can be classified into eight categories:

1. Overfilling
2. Underfilling
3. Incorrect grease
4. Mixing greases
5. Incorrect lubrication system intervals
6. Worn out grease
7. Water contamination
8. Debris contamination

Overfilling

Too much grease can cause churning of the grease during operation and high temperatures, resulting in overheating and leaking. As the operating temperature rises, the breakdown rate of the grease increases, doubling every 18° F (7.8° C).

Note: During initial start-up it's common for a properly lubricated bearing to leak a small amount of grease (Fig. 1). OEMs often recommend a small grease purge because it acts as a barrier against external debris. Always follow OEM recommendations for grease purging and correct replenishment amounts.



Fig. 1: Clean grease leaking slightly.

Overfilling can also cause leaking during initial startup. Over time and as temperatures rise, excess grease will continue to leak from an overfilled bearing and have a darkened color and burned smell (Fig 2).



Fig. 2: Heavily oxidized grease from an overfilled bearing.

Underfilling

Underfilling a bearing can cause excess heat or metal wear.

A sudden increase in bearing noise and/or increased temperatures can indicate excess wear is taking place.



Fig. 3: Grease from an underfilled bearing contaminated with metal debris.

Incorrect Grease

The thickness (viscosity) of the base oil in a specific grease may be different from the recommended grease for your application.

High viscosity grease may cause the rolling elements to skid, leading to grease breakdown and excessive component wear.

Low viscosity may cause elevated temperatures, creating thin lubricant film resulting in keeling (micro-spalling) and wear. The additives in grease can also

be incompatible with surrounding components in your system.

Mixing Greases

An incompatible grease mixture will either: 1) soften and leak out of the bearing or 2) become lumpy, discolored and hard in composition.



Fig. 4: Grease A and Grease B are not compatible. Mixed together they become lumpy, discolored and hard in composition (Grease C).

Incorrect Lubrication Systems and Intervals

If maintenance schedules are not followed, lubrication may deteriorate through excessive oxidation (breakdown).



Fig. 5: Records key bearing lubrication data on a maintenance sheet.

Worn-Out Grease

Grease combines oil, thickener and additives, that act like a sponge to retain and release the oil. Time can deplete the oil release properties. When this occurs, the grease is worn-out (Fig. 6).



Fig. 6: From left to right: 1) new grease, 2) heavily oxidized grease, and 3) worn-out (failed) grease – the thickener and additives have decomposed and the oil is breaking down.

Water Contamination

Fig. 7 compares fresh grease (left) to a grease emulsified with 30% water (right), which is visibly different. Water contamination of even 1% can have a significant impact on bearing life.

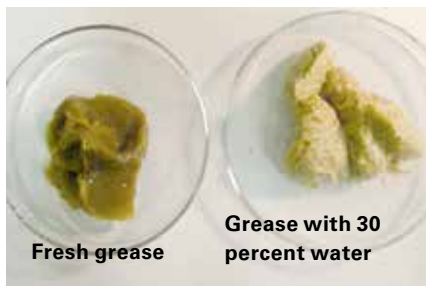


Fig. 7: Effect of water on grease.

Exposure to water may cause rusting with pitting and corrosion. This condition is called “etching”.

The Crackle Test to Determine Water in Grease

Place a sample of grease on a piece of aluminum foil (Fig. 8) and put a flame under the foil (Fig. 9). If the grease melts and lightly smokes, water is minimal or absent. If the grease crackles, sizzles and/or pops, the grease contains a considerable amount of water.

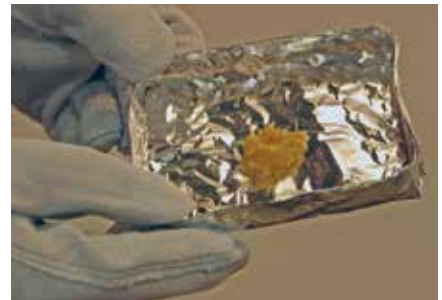


Fig. 8: Grease sample.



Fig. 9: Crackle test.

Debris Contamination

Common causes of external debris contamination are dirt, sand and environmental particles.

Common causes of internal debris contamination are wear from gears, splines, seals, clutches, brakes, joints and failed or spalled components. These hard particles travel through the bearing via its lubrication and eventually dent the internal surfaces. The dents form shoulders that act as surface-stress risers, causing premature surface damage and reduced bearing life.

Effects of Inadequate Grease Lubrication in Bearings

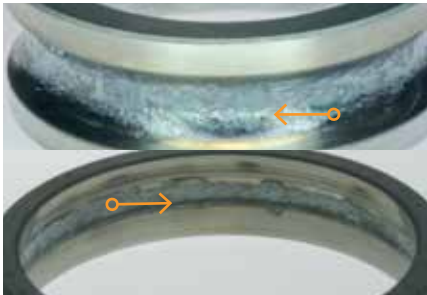


Fig. 10: Inner (above) and outer (below) race damage caused by metal-to-metal contact from breakdown of lubricant.



Fig. 11: Tapered roller bearing cone large rib face deformation, caused by metal flow from excessive heat.



Fig. 12: Cylindrical bearing outer race and roller peeling and wear caused by underfilling.



Fig. 13: Cylindrical roller flattened as a result of skidding.



Figs. 14 & 15: Peeling: Micro-spalling in a tapered roller bearing outer race (above) and inner race (below) due to thin lubricant film from elevated temperature.



Figs. 16 & 17: Etching: A tapered roller bearing cone and rollers and a ball bearing outer race and balls show rusting with pitting and corrosion from moisture/water exposure.

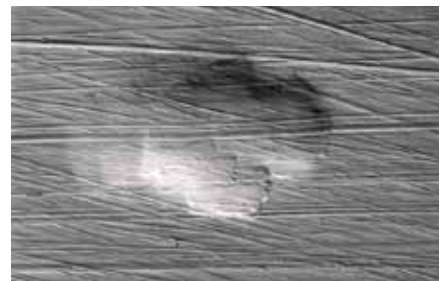


Fig. 18: A close-up shows a debris contamination bruise on a bearing race.



Fig. 19: A tapered roller bearing inner race (cone) with spalling from debris contamination bruises.



⚠ WARNING *Failure to observe the following warnings could create a risk of death or serious injury.*

Never spin a bearing with compressed air. The components may be forcefully expelled. Proper maintenance and handling procedures are critical. Always follow installation instructions and maintain proper lubrication.

CAUTION *Failure to follow these cautions may result in property damage.*

Use of improper bearing fits may cause damage to equipment.
Do not use damaged bearings.

TechTips is not intended to substitute for the specific recommendations of your equipment suppliers.

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