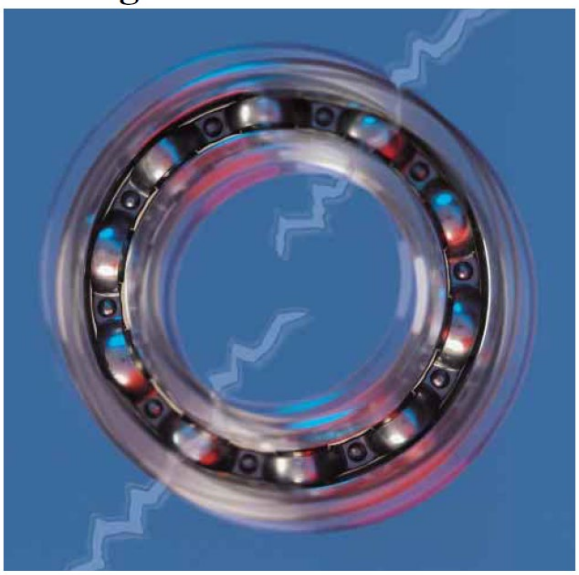
Bearings 101

Source: Excepts from "SKF Failures and their Causes Manual"

Bearing failures and their causes



Bearings are among the most important components in the vast majority of machines and exacting demands are made upon their carrying capacity and reliability.

… Therefore, it is quite natural that rolling bearings should have come to play such a prominent part and that over the years they have been the subject of extensive research. Indeed, rolling bearing technology has developed into a particular branch of science.

Among the benefits resulting from this research has been the ability to calculate the life of a bearing with considerable accuracy, thus making it possible to match the bearing life with the service life of the machine involved.

Unfortunately, it sometimes happens that a bearing does not attain its calculated rating life. There may be many reasons for this

- **Heavier loading than has been anticipated**
- **Inadequate or unsuitable lubrication**
- **Careless handling of bearing**
- **Ineffective sealing**
- **Fits that are too tight with resultant insufficient internal bearing clearance.**

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Each of the factors listed above produces its own particular type of damage and leaves its own special imprint on the bearing. Consequently, by examining a damaged bearing, it is possible, in the majority of cases, to form an opinion on the cause of the damage and to take the requisite action to prevent a recurrence.

Causes of Bearing Failure

Primary damage

- Wear
- Indentations
- Smearing
- Surface distress
- Corrosion
- Electric current damage

Secondary damage

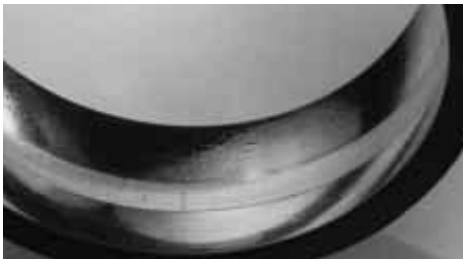
- Flaking
- Cracks

Wear

Wear Caused by "Inadequate Lubrication"

***If there is not enough lubricant*, or if the lubricant has lost its lubricating properties, it is not possible for an oil film with enough carrying capacity to form. Metal to metal contact occurs between rolling elements and raceways. In its initial phase, the resultant wear has roughly the same effect as lapping.**

Appearance	Cause	Action
Small indentations around the race-ways and rolling elements. Dull, worn surfaces.	Lack of cleanliness before and during mounting operation.	Do not unpack bearing until just before it is to be mounted. Keep workshop clean and use clean tools.
Grease discoloured green.	Ineffective seals.	Check and possibly improve the sealing.
	Lubricant contaminated by worn par-ticles from brass cage.	Always use fresh, clean lubricant. Wipe the grease nipples. Filter the oil.



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In normal cases there is no appreciable wear in rolling bearings. Wear may, however, occur as a result of the ingress of foreign particles into the bearing or when the lubrication is unsatisfactory. Vibration in bearings which are not running also gives rise to wear.

Wear Caused by "Vibration"

When a bearing is not running, there is no lubricant film between the rolling elements and the raceways. The absence of lubricant film gives metal to metal contact and the vibrations produce small relative movements of rolling elements and rings.

Appearance	Cause	Action
Depressions in the raceways. These depressions are rectangular in roller bearings and circular in ball bearings. The bottom of these depressions may be bright or dull and oxidised.	The bearing has been exposed to vibration while stationary.	Secure the bearing during transport by radial preloading. Provide a vibration-damping base. Where possible, use ball bearings instead of roller bearings. Employ oil bath lubrication, where possible.

As a result of these movements, small particles break away from the surfaces and this leads to the formation of depressions in the raceways. This damage is known as false brinelling, sometimes also referred to as wash-boarding. Balls produce sphered cavities while rollers produce fluting.

Bearings with vibration damage are usually found in machines that are not in operation and are situated close to machinery producing vibrations.

Examples that can be cited are transformer fans, stand-by generators and ships' auxiliary machinery. Bearings in machines transported by rail, road or sea may be subject to vibration damage too.

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Indentations

Raceways and rolling elements may become dented if the mounting pressure is applied to the wrong ring, so that it passes through the rolling elements, or if the bearing is subjected to abnormal loading while not running.
Foreign particles in the bearing also cause indentations.

Appearance	Cause	Action
Indentations in the raceways of both rings with spacing equal to the distance between the rolling elements.	Mounting pressure applied to the wrong ring.	Apply the mounting pressure to the ring with the interference fit.
	Excessively hard drive-up on tapered seating.	Follow carefully the SKF instructions concerning mounting bearings on tapered seating.
	Overloading while not running.	Avoid overloading or use bearings with higher basic static load ratings.

Indentations caused by fault mounting or overloading. The distance between the dents is the same as the rolling element spacing. Ball bearings are prone to indentations if the pressure is applied in such a way that it passes through the balls during the mounting or dismounting operations.

Self-aligning ball bearings are particularly susceptible to damage in such circumstances. In spherical roller bearings the damage originates as smearing and subsequently, if the pressure increases, develops into a dent. The same conditions apply in taper roller bearings that are unduly preloaded without being rotated.

Bearings that are mounted with excessively heavy interference fits, and bearings with tapered bore that are driven too far up the shaft seating or sleeve, also become dented.

Fig 27 Washer of a thrust ball bearing subjected to overloading while not running. The indentations are narrow and radially aligned, not sphered as in radial ball bearings

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For more information download “SKF Failures and Causes” at:

www.worldclassmaintenance.org

No emails or sign in required. All I ask is you train your maintenance techs in these techniques.