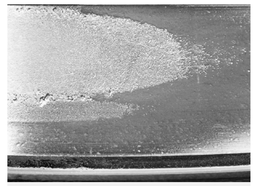
We pioneer motion

Rolling Bearing Damages

Symptoms, Causes, Remedies



Micropitting

Symptoms
Some sections of the raceway have a large number of very small, very flat material break-outs that make parts of the raceway look stained. This is also called grey staining.

Causes
Insufficient lubrication condition (type, amount, contamination, especially water) at moderate to low loads and with simultaneous sliding motion.

Remedies
Ensure a separating lubricating film; prevent contamination; suitable surface coatings.

Overheating

Symptoms
Discoloration of the rings, rolling elements and cages from gold to blue. Temperatures in excess of 150 °C can change the ring and rolling element material, reducing the bearing load carrying capacity and causing premature failure. In extreme cases, the bearing components will undergo deformation (hot run). Temperature increases can also degrade or destroy the effectiveness of the lubricant.

Causes
Tight fits, insufficient clearance; high electrical heat loads, inadequate heat dissipation, and insufficient cooling or lubrication under excessive loads and speeds.

Remedies
Thermal or overload controls, adequate heat dissipation, and supplementary cooling.

Ring Fracture

Symptoms
Cracks normally spread uniformly in a circumferential direction, often resulting in several fractured pieces. Under axial load, these fractures usually occur slightly outside the centre of the raceway. This is often triggered by fatigue damage. The outside surface of the outer ring normally exhibits an irregular load carrying pattern.

Causes
Poor support of the rings in the housing (selection of the wrong fit).

Remedies
Improvement in bearing mounting; adhere to Schaeffler mounting instructions and appropriate recommendations.

Misalignment

Symptoms
A track which is not located parallel to the raceway edges on the raceway of the non-rotating ring.

Causes
Bent shafts, burrs or contamination on shaft or housing shoulder, shaft threads that are not cut at a right angle to the shaft seats, or nuts with faces that are not at a right angle to the thread axis.

Remedies
Inspect shafts and housings for radial and axial runout of shoulders and bearing seats; use turned or ground threads on non-hardened shafts and ground threads only on hardened shafts; use precision grade locknuts.

Excessive Loads

Symptoms
Often starts with burnished tracks. In areas exposed to the highest loads, initial shell-shaped spalling occurs that may spread to the entire running surface if operation continues.

Causes
Excessive loads on the bearing; inadequate lubrication conditions.

Remedies
Reduce the load, or change the design and use a bearing with higher load ratings; use suitable lubricant; prevent contamination.

Rib Fractures

Symptoms
Ribs are partly or completely broken off or cracked.

Causes
Axial load unacceptably high; rib insufficiently supported; axial shock load; mounting errors.

Remedies
Ensure good rib support design, keep loads within specified limits; follow mounting instructions.

Fretting Wear

Symptoms
Brown and black stains on outside surface, bore or lateral faces of the bearing. These are oxidized wear particles. Results in uneven seat conditions and possibly in fatigue fractures and interference with non-locating bearing function.

Causes
Micro motion between fitted parts where the fits are too loose in relation to the acting forces.

Remedies
Follow mounting instructions and recommendations for accurate fit.

Corrosion

Symptoms
Red/brown stains or deposits on rolling elements, raceways or cages. Increased vibration followed by wear.

Causes
Exposure of bearings to corrosive media or atmospheres; formation of condensation caused by temperature changes.

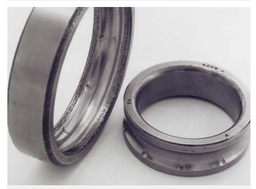
Remedies
Protect bearing from aggressive media; use bearings with integrated seals, and, if applicable, consider external seals for particularly rough environments.

Water Etching

Symptoms
Corrosion due to aggressive media, usually black etching pits at roller spaced intervals (standstill corrosion).

Causes
Water, humidity or other corrosive media in the bearing over a long period of time, sealing failure, unsuitable lubricant.

Remedies
Improve sealing, use lubricant with corrosion inhibitors, store bearings in dry conditions.

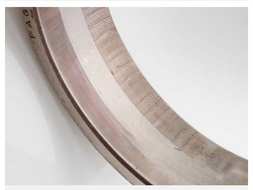


Mounting Error

Symptoms
Rolling element indentations appear as plastic deformations at the spacing of the rolling elements in the raceways, causing increased bearing vibration (noise). Severe indentations can cause premature fatigue failure or fractures.

Causes
Static overloading of the bearing or severe impact to the bearing, such as using a hammer to install the bearing, dropping or striking the assembled parts, or pressing a bearing onto the shaft by applying force to the outer ring.

Remedies
Observe static load ratings when selecting the bearing(s) and install bearings using the appropriate equipment and by only applying force to the ring which is being press-fitted.



Electric Erosion

Symptoms
Brownish marks occurring parallel to the axis on a large part of the raceway, or covering the entire raceway circumference.

Causes
Constant passage of alternating or direct current; marks may occur even with low currents.

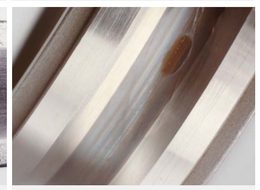
Remedies
Prevent currents from flowing through the bearing (grounding or insulating); use current-insulated bearings.

False Brinelling

Symptoms
Linear wear marks in axial direction on roller bearing raceways or ellipse-shaped ones at ball bearings, no raised edges as opposed to marks due to incorrect mounting. Frequently, indentations with brown discoloration (corrosion) and marked differentiation from the surrounding surface.

Causes
Vibrations in stationary machines leading to micro motion between rolling elements and raceways. No separating lubricating film is formed when the bearing is not rotating, making it impossible to prevent surface wear.

Remedies
Eliminate or dampen external vibration, and use lubricants containing anti-wear additives or surface coating.

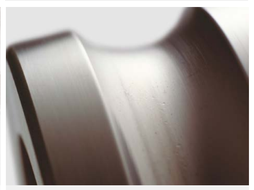


Radial Preload

Symptoms
A noticeable track on the bottom of the raceway due to restricted guidance. May cause overheating and result in the bearing jamming.

Causes
Excessive load on the rolling elements when the interference fit leads to a preload (negative operating clearance) of the bearing at operating temperatures. Continued operation under such conditions leads to high heat generation and may even cause the bearing to jam.

Remedies
Decrease total interference with better adjustment of the shaft and housing fits, taking into consideration operating temperatures; increased radial internal clearance in bearing selection.



Contamination

Symptoms
Indentations in the rolling elements and raceways, causing vibration.

Causes
Airborne dust, contamination or abrasive substances from contaminated work areas, dirty hands or tools, or foreign matter in lubricants or cleaning solutions.

Remedies
Filtration of the lubricant; clean work areas, tools, fixtures and hands reduce the risks, as does isolating the bearing assembly area from any grinding operations and leaving bearings in their original packaging until time of installation. For contaminated operating environments, additional sealing arrangements should be considered.

Slippage Tracks

Symptoms
Spotted smear marks, or roughening (micropitting) of rolling elements or raceways.

Causes
Rolling elements slide on the raceways when the load is low and lubrication is poor. Occasionally occurs if the rolling elements are accelerated on entering the load zone (especially with large masses). Fast changes in speed also generate relative speeds and lead to sliding with shear stresses on the surface that cause this damage.

Remedies
Select bearings with lower load carrying capacity; preload bearings; reduce bearing clearance; improve lubrication and coating.

Fatigue

Symptoms
Often referred to as spalling, and indicated by the fracture of the running surfaces and subsequent removal of small particles of material from the inner ring, outer ring or rolling elements. Spalling is progressive and, once initiated, will spread with continued operation. A noticeable increase in vibration (running noise) occurs simultaneously.

Causes
Bearing has remained in operation beyond its calculated rating life; overloading (including local overloading) and/or insufficient lubrication condition (type, amount, contamination) may all lead to premature fatigue.

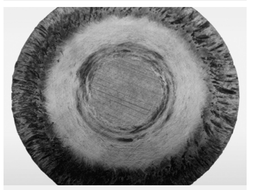
Remedies
Replace the bearing or consider redesigning to use a bearing with a greater calculated rating life; improve lubrication conditions.

Axial Cracks

Symptoms
Inner ring cracked in an axial direction. Slightly rounded and fractured edges indicate that fracture occurred during operation and underwent overrolling (crack edges may break off after prolonged operation). Sharp edged cracks indicate fracture during dismounting.

Causes
Bearing slippage; rotation of inner ring on shaft; insufficient lubrication; fit too tight (resulting in excessive stress in the material); notched shaft; out-of-roundness; grazing against surrounding parts.

Remedies
Improve lubrication with additives or increased oil quantities, reduce water content in oil; select suitable fits; avoid grazing; provide for better seating conditions; consider special heat treatment for rings (thermal stabilization).



Seizing

Symptoms
Partial or extensive cold welding and seizing marks in the rib and roller end faces. Lubricant coking also present in this area.

Causes
Inadequate lubrication with high loads and high speeds (quantity or operating viscosity of lubricant too low); inadequate lubrication with high loads and low speeds (when there is no hydrodynamic lubricating film between the roller face and rib); detrimental preload due to heat expansion; skewing of rollers, e.g. due to raceway wear or tilting of the rings; axial preload too high for out-of-square mating surfaces.

Remedies
Improve lubrication (increase viscosity, EP additives, increase quantity) and ensure correct alignment of the bearings.

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