

BEARING DAMAGE ANALYSIS

TIMKEN

FOREIGN MATERIAL

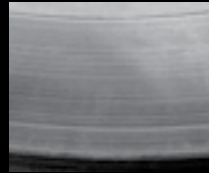
Typical causes include improper cleaning methods, poor oil filtration or seal wear which can lead to Point Surface Origin (PSO) spalls.



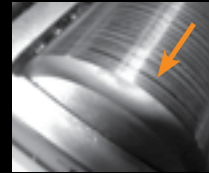
Fine particle contamination



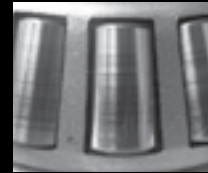
Hard particle contamination



Circumferential grooving



Circumferential grooving



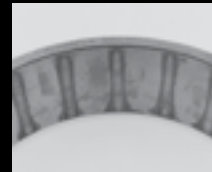
Circumferential grooving



Point Surface Origin (PSO) spalling

CORROSION/ETCHING

Typical causes include damaged packaging, improper storage and worn or damaged seals.



Light corrosion on the outer race



Advanced etching



Advanced corrosion and etching



Etching and corrosion



Roller-spaced spalling

INADEQUATE LUBRICATION

Typical causes include improper grease or oil viscosity, low lubricant flow rate, thin lube film from high loads/low RPM or high operation temperatures.



Peeling



Rib and roller end heat damage



Rib and roller end heat damage



Scoring damage on roller end



Race deformation from excessive heat generation



Cage damage from bearing lockup

EXCESSIVE PRELOAD AND OVERLOAD

Typical causes include high load, misalignment and stress concentration.



Fatigue resulting from heavy loads



Severely fatigued rollers from heavy load



Fatigue spalling from excessive preload



Severe peeling and spalling from heavy loads

MISALIGNMENT

Typical causes include high load, shaft or housing deflection, inaccurate housing or shaft machining, or misalignment during machinery setup.



Elliptical roller path caused by misalignment



Geometric Stress Concentration (GSC) spalling on inner ring



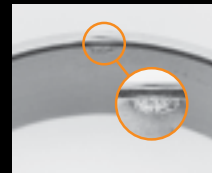
Geometric Stress Concentration (GSC) spalling on outer ring



Geometric Stress Concentration (GSC) spalling

HANDLING DAMAGE

Typical causes include improper tool selection (hardened drivers) and poor handling practices which can lead to Point Surface Origin (PSO) spalls.



Outer ring denting



Fractured inner ring rib



Roller spaced nicking



Nicks and dents caused by rough handling



Point Surface Origin (PSO) spalling

CAGE DAMAGE

Typical causes include improper handling, incorrect installation tools or poor installation procedures.



Cage deformation

IMPROPER FITTING PRACTICES IN HOUSING OR ON SHAFT

Typical causes include wrong size and poor form, shaft or housing stress risers and inaccurate machining.



Loose outer ring fit in a wheel hub



Fracture on inner ring



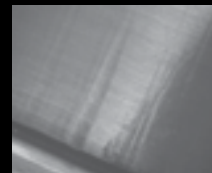
Loose fit resulting in stretched and broken cup



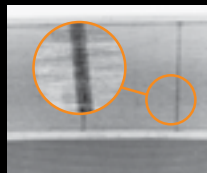
Fractured wide inner ring with locking collar due to undersized shaft

BRINELL AND IMPACT DAMAGE

Typical causes include rough handling and shock loads exceeding the material's limits.



Roller impact damage



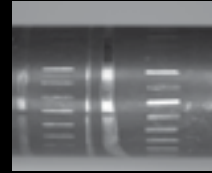
True metal deformation



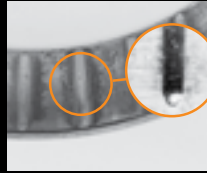
Shock loading

FALSE BRINELLING

Typical causes include excessive vibration during shipment or when the shaft is stationary.



False brinell on a shaft where a cylindrical bearing was mounted



Heavy false brinell on outer race



Heavy false brinell on outer race

HIGH SPOTS IN HOUSING

Typical causes include improper machining, grinding or repair methods.



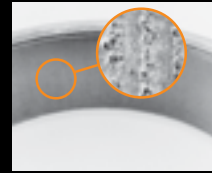
Witness mark from high spot in the housing



Resulting localized spalling in raceway

BURNS FROM ELECTRIC CURRENT

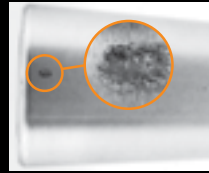
Typical causes include improper electrical grounding of equipment, welding damage or static discharge.



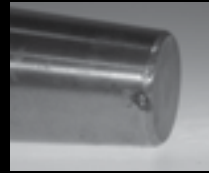
Electric arc fluting



Fluting caused by electric current



Electric arc pitting



Roller with electric arc burns



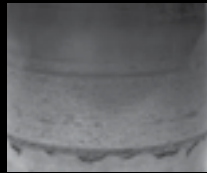
Burns from electric current

ADHESIVE WEAR

Typical causes include improper oil film, excess cage friction and gross roller sliding.



Roller flats, adhesive and skidding wear on raceway surface



Spherical roller bearing with adhesive wear



Roller end with adhesive wear



Adhesive wear on bearing inner ring

EXCESSIVE ENDPLAY

Typical causes are improper setting leading to excessive looseness and small operating load zone.



Wear at small ends of cage pocket and on roller bridges



Scalloping marks in the cup caused by excessive endplay



Cage pocket wear from excessive roller movement

TO LEARN MORE ABOUT EACH DAMAGE MODE, CONTACT YOUR LOCAL TIMKEN SALES OR SERVICE REPRESENTATIVE.

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 practices 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.