

Tapered Roller Bearing Damage Analysis

The most common types of bearing damage that may result in a reduction of bearing or application life are often caused by:

- insufficient maintenance practices
- mishandling
- improper installation and adjustment practices
- inadequate lubrication

The following offers a quick reference to the common causes of bearing damage.

Inadequate lubrication*



Roller end scoring — Metal-to-metal contact from breakdown of lubricant film.



Cone large rib face deformation — Metal flow from excessive heat generation.



Total bearing lock-up — Rollers skew, slide sideways and lock-up bearing.



Cone large rib face scoring — “Welding” and heat damage from metal-to-metal contact.

* **Excessive preload can cause damage similar to inadequate lubrication damage.**

Fatigue spalling



Inclusion origin — Spalling from oxides or other hard inclusions in bearing steel.

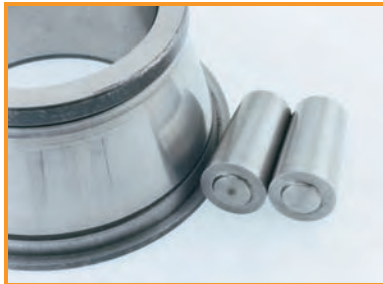


Geometric stress concentration — Spalling from misalignment, deflections or heavy loading.

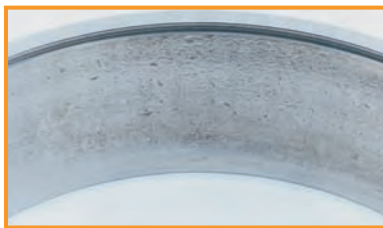


Point surface origin — Spalling from debris or raised metal exceeding the lubricant film thickness.

Foreign material



Abrasive wear — Fine abrasive particle contamination.



Bruising — Debris from other fatigued parts, inadequate sealing or poor maintenance.



Grooving — Large particle contamination imbedding into soft cage material.

High spots in cup seats



Localized spalling on the cup race from stress riser created by split housing pinch point.



Cage damage



Cage Deformation — Improperly installed or dropped bearing.



Rollers binding and skewing — Cage ring compressed during installation or interference during service.

Corrosion / etching



Etching — Rusting with pitting and corrosion from moisture/water exposure.

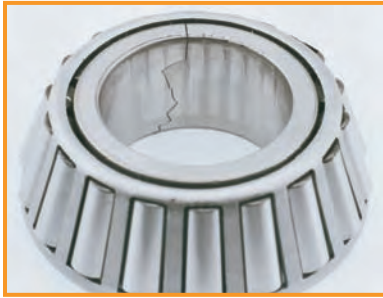


Staining — Surface stain with no significant corrosion from moisture exposure.



Line spalling — Roller-spaced spalling from bearings operating after etching damage.

Improper fit



Cone bore damage —
Fractured cone due to out-of-round or oversized shaft.



Cup spinning — Loose cup fit
in a rotating wheel hub.

Misalignment



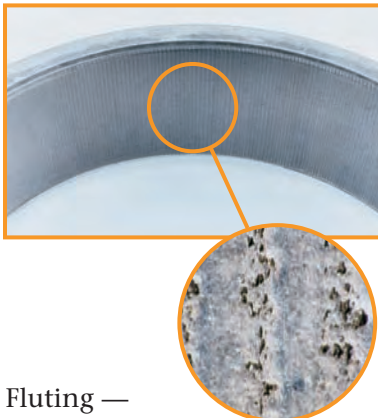
Irregular roller path from
deflection, inaccurate machining
or wear of bearing seats.



Electric current



Electric arc pitting — Small
burns created by arcs from
improper electric grounding
while the bearing is stationary.



Fluting —
Series of small
axial burns caused by electric
current passing through the
bearing while it is rotating.

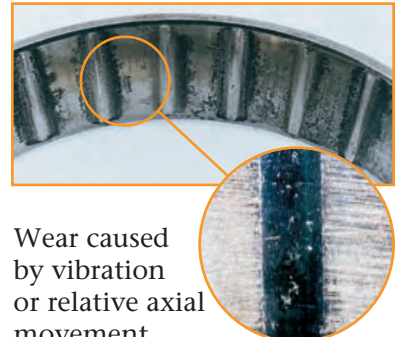
Peeling



Micro-spalling due to thin
lubricant film from high loads/low
RPM or elevated temperatures.



False brinelling



Wear caused
by vibration
or relative axial
movement
between rollers and races.

True brinelling



Damage
from shock
or impact.

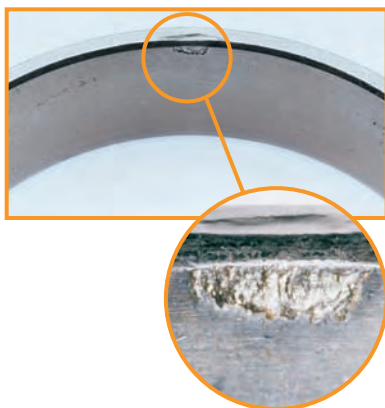
Handling damage



Roller spaced nicking — Raised metal on races from contact with roller edges.



Roller nicking/denting — Rough handling or installation damage.



Cup-face denting — Indentations from hardened driver.

Excessive preload or overload



Rapid and deep spalling caused by unusually high stresses. Full race width fatigue spalling is caused by heavy loads creating a thin lubricant film and possible elevated temperatures.



Excessive end play



Scalloping — Uneven localized wear resulting from excessive end play.



Cage pocket wear — Heavy contact between the rollers and cage pocket surfaces caused by bearing operating too loosely.

WARNING!

Never spin a bearing with compressed air. The force of the compressed air may cause the rollers to be expelled with great velocity, creating a risk of serious bodily harm.

Proper bearing maintenance and handling practices are critical. Failure to follow installation instructions and failure to maintain proper lubrication can result in equipment failure, creating a risk of serious bodily harm.

If a hammer and mild steel bar are used for bearing removal, fragments from the hammer, bar or the bearing can be released with sufficient velocity to create a risk of serious bodily injury including damage to your eyes.

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