**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 scoring** — “Welding” and heat damage from metal-to-metal contact.
- **Total bearing lock-up** — Rollers skew, slide sideways and lock-up bearing.
- **Cage pocket wear** — Heavy contact between the rollers and cage pocket surfaces caused by bearing operating too loosely.

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

### 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.
- **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.

### Excessive end play

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

### 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.

### 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.

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**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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- 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 riter 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.

**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.

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

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