Tapered Roller Bearing Damage

Recognizing causes and types of bearing damage can help you prevent further damage resulting in improved bearing life and performance.

**Fatigue Spalling**

- **Geometric stress concentration (GSC):** Misalignment, system deflections and heavy loading.
- **Point surface origin (PSO):** Debris and raised metal exceeding the lubricant film thickness.
- **Inclusion origin:** Oxides or other hard inclusions in bearing steel.

**Deformation**

- **Bearing cone (inner race) large rib face deformation:** Metal flow from excessive heat generation.

**Handling Damage**

- **Total bearing lock-up:** Rollers skew and slide sideways.
- **Roller spaced nicking:** Raised metal on races from contact with roller edges.
- **Roller nicking and denting:** Rough handling or installation damage.

- **Bearing cup (outer race) face denting:** Indentations from hardened driver.
### Cage Damage

- **Cage deformation:** Improperly installed or dropped bearing.
- **Rollers binding and skewing:** Cage ring compressed or interfered with during installation or service.
- **Cage pocket wear:** Heavy contact between rollers and cage pocket surfaces caused by bearing operating too loosely.

### Excessive End Play Damage

- **Scalloping:** Uneven localized wear resulting from excessive end play.

### Excessive Preload or Overload Damage

- **Bearing cone (inner race) bore polishing:** Contact wear and creeping on shaft caused by lack of lubrication and cone bore contraction from excessively tight setting (preload).
- **Full race width fatigue spalling:** caused by heavy loads creating a thin lubricant film and elevated temperatures.

*Damage caused by excessive preload can appear similar to damage caused by inadequate lubrication.*

### Scoring

- **Roller end scoring:** Metal-to-metal contact from breakdown of lubricant film.
- **Bearing cone (inner race) large rib face scoring:** ‘Welding’ and heat damage from metal-to-metal contact.

### Improper Fit Damage

- **Bearing cone (inner race) bore damage:** Fractured cone due to out-of-round or oversized shaft.
**Improper Fit Damage**

- **Bearing cup (outer race spinning:** Loose cup fit in a rotating wheel hub.
- **Abrasive wear:** Fine abrasive particle contamination.
- **Bruising:** Debris from other fatigued parts, inadequate sealing or poor maintenance.
- **Grooving:** Large particle contamination embedding into soft cage material.

**Peeling**

- **Micro-spalling:** Due to thin lubricant film from high loads and low RPM or elevated temperatures.

**Foreign Material Damage**

- **False Brinelling:** Wear caused by vibration or relative axial movement between rollers and races.
- **Electric arc pitting:** Burns created by improper electric grounding while bearing is stationary.
- **Fluting:** Series of axial burns caused by electric current passing through the bearing while rotating.
Corrosion/Etching Damage

- **Staining:** Surface stain with no significant corrosion from moisture.
- **Etching:** Rusting with pitting and corrosion from moisture.
- **Line spalling:** Roller spaced spalling from bearings operating after etching damage.

True Brinelling

- Damage from shock or impact.

Misalignment Damage

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

High Spots In Cup Seats

- **Localized spalling** on the bearing cup (outer race) from stress riser created by split housing pinch point.

**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.
- A bearing/component should not be put into service if its shelf life has been exceeded.

**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.

TechTips is not intended to substitute for the specific recommendations of your equipment suppliers.

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