

## 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.

### Deformation



**Total bearing lock-up:** Rollers skew and slide sideways.

### Handling Damage



**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.

## Excessive End Play Damage .....

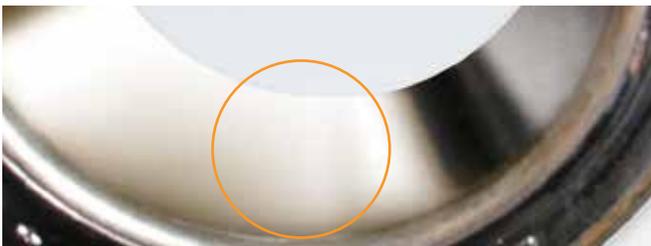


**Cage pocket wear:** Heavy  
contact between rollers  
and cage pocket surfaces  
caused by bearing operating  
too loosely.



**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).

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



**Full race width fatigue spalling:** caused by heavy loads  
creating a thin lubricant film and elevated temperatures.



## 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 Foreign Material 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** .....



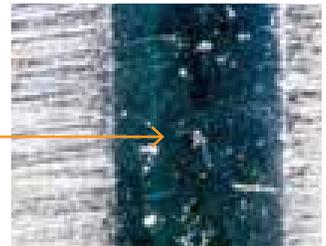
**Micro-spalling:** due to thin lubricant film from high loads and low RPM or elevated temperatures.



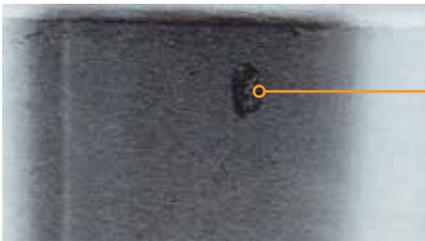
**False Brinelling** .....



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



**Electric Current Damage** .....



**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.





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**Corrosion/Etching Damage** ..... **True Brinelling** .....



**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.



Damage from shock or impact.

**Misalignment Damage** ..... **High Spots In Cup Seats** .....



**Irregular roller path** from deflection, inaccurate machining or wear of bearing 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. Every reasonable effort has been made to ensure the accuracy of the information contained in this writing, but no liability is accepted for errors, omissions or for any other reason.*



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