

Automotive TechTips

TIMKEN
Where You Turn

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Maximizing bearing performance and life remains an objective throughout The Timken Company, from design teams and manufacturing associates to our field sales team and distributors. TechTips help you install and maintain Timken® bearings, seals and components to maximize their life and performance and the systems in which they operate. For more information regarding Timken automotive products and services, visit www.timken.com or contact your local Timken distributor.

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.

FATIGUE SPALLING



Geometric stress concentration:

Spalling from misalignment, deflections or heavy loading.



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



Point surface origin: Spalling

from debris or raised metal exceeding the lubricant film thickness.

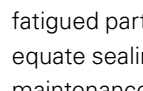
FOREIGN MATERIAL



Abrasive wear: Fine abrasive particle contamination.



Bruising: Debris from other



fatigued parts, inadequate sealing or poor maintenance.



Grooving: Large particle contamination embedding into soft cage material.

INADEQUATE LUBRICATION*



Roller end scoring: Metal-to-

metal contact from breakdown of lubricant film.



‘Welding’ and heat damage from metal-to-metal contact.



deformation: Metal flow from excessive heat generation.



Total bearing lock-up:
Rollers

skew, slide sideways and lock-up bearing.

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

CORROSION/ ETCHING



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



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



Line spalling:
Roller spaced

spalling from bearings operating after etching damage.

FALSE BRINELLING



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

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.

CAGE DAMAGE



Cage Deformation:
Improperly installed or dropped bearing.



Rollers binding and skewing:

Cage ring compressed during installation or interference during service.

MISALIGNMENT



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

PEELING



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

HIGH SPOTS IN CUP SEATS



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

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.

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 elevated temperatures.

TRUE BRINELLING

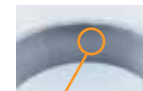


Damage from shock or impact.

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.

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 Failure to observe the following warnings could create a risk of serious bodily harm.

Proper maintenance and handling practices are critical. Failure to follow installation instructions and to maintain proper lubrication can result in equipment failure.

Never spin a bearing with compressed air. The rolling elements may be forcefully expelled.

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

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