

# Bearing Damage Analysis

To learn more about each damage mode, reference the bearing damage analysis brochure, or contact your local Timken sales or service representative.

# TIMKEN

Where You Turn

**Hard particle contamination**  
**Contamination bruising**  
**Fine particle contamination**  
**Internal cage wear from fine particle contamination**

Typical causes include improper cleaning methods, poor oil filtration, or seal wear.

**Foreign Material**

**Roller-spaced spalling**  
**Corrosion on the outer ring race**  
**Etching and corrosion**  
**Advanced corrosion and spalling**

Typical causes include damaged packaging, improper storage, and worn or damaged seals.

**Corrosion/Etching**

**Race deformation from excessive heat generation**  
**Peeling**  
**Scoring damage on roller end**  
**Complete bearing lockup**  
**Rib and roller end scoring**

Typical causes include improper grease or oil viscosity, low flow rate, and high operation temperatures.

**Inadequate Lubrication**

**Fatigue spalling on a cylindrical roller bearing**  
**Point Surface Origin (PSO) spalling**  
**Fatigue spalling on ball bearing inner ring**  
**Geometric Stress Concentration (GSC) spalling**

Typical causes include high load, misalignment, and stress concentration.

**Fatigue Spalling**

**Roller fracture**  
**Peeling**  
**Rollout in bearing outer ring**  
**Outer ring subcase fracture**

Typical causes include excessive load, and/or misalignment, and improper mounting procedure.

**Excessive Preload, Overload and Rollout**

**Irregular roller path caused by deflection**  
**Geometric Stress Concentration (GSC) spalling**  
**Irregular roller path (180 degree opposite of above)**  
**Geometric Stress Concentration (GSC) spalling on bearing outer ring**

Typical causes include high load, shaft or housing deflection, inaccurate housing, or shaft machining.

**Misalignment**

**Outer ring denting**  
**Fractured inner ring rib**  
**Broken rib on outer race**  
**Roller spaced nicking**

Typical causes include improper tool selection (hardened drivers), and poor handling practices.

**Handling Damage**

**Cage deformation**  
**Roller binding and skewing**  
**Bent bridge**  
**Deep dent on cage**

Typical causes include improper handling, tools, and procedures.

**Cage Damage**

**Localized spalling**  
**Marks from high spot on the housing**  
**Metal tearing and wear**  
**Pinch point**

Typical causes include improper machining, grinding, or repair methods.

**High Spots and Fitting Practices**

**Loose outer ring fit in a wheel hub**  
**Fracture on inner ring**  
**Metal contaminant**

Typical causes include wrong size and poor form, shaft or housing stress riser, and inaccurate machining.

**Improper Fit in Housing or Shafts**

**Roller impact damage**  
**True metal deformation**  
**Shock loading**  
**True brinell on needle bearing drawn cup race**

Typical causes include rough handling, and shock loads exceeding the material's limits.

**Brinell and Impact Damage**

**Extreme vibration**  
**False brinell on a shaft where a cylindrical bearing was mounted**  
**Wear caused by vibration**  
**False brinell on outer race**

Typical causes include excessive vibration during shipment, or when the shaft is stationary.

**False Brinelling**

**Electric arc fluting**  
**Fluting caused by electric current**  
**Electric arc pitting**  
**Roller with electric arc burns**

Typical causes include improper electrical grounding of equipment, welding damage, or static discharge.

**Burns from Electric Current**

**Roller flats and adhesive wear**  
**Spherical roller bearing with adhesive wear**  
**Skidding, raceway surface**  
**Cylindrical roller end with adhesive wear**

Typical causes include improper oil film, excess cage friction, and gross roller sliding.

**Adhesive Wear**

**Roller lock-up**  
**Bearing stamping lip fracture**

Typical causes include improper tool design, tool positioning, poor roller alignment, and excessive force.

**Needle Bearing Installation Damage**

**WARNING**

- Never spin a bearing with compressed air. The rollers may be forcefully expelled creating 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, creating a risk of serious bodily harm.