

# **Types of failure that are most common in Rolling**

## **Element Bearings**

### **Abrasive Wear**

Surface wear resulting from the lapping action of abrasive contaminants. The affected areas usually appear frosty gray; however, they may be highly polished if the abrasive particles are extremely small.

### **Brinelling**

Permanent deformation of the bearing surfaces where the rollers (or balls) contact the races. Brinelling results from excessive load or impact on stationary bearings. It is a form of mechanical damage in which metal is displaced or upset without attrition.

### **Corrosion**

Rust (corrosion) is the chemical attack of the bearing metal, almost always consisting of, or accompanied by, oxidation. It may cover a large or a small area, or be limited to a well defined line, such as the line of contact between a roller and a race in a stationary bearing.

### **False Brinelling**

False Brinelling of needle roller bearings is actually a fretting corrosion of their raceway surface. Although its appearance is similar to that of Brinelling, False Brinelling is characterized by attrition of the steel, and the load on the bearing is less than that required to produce the resulting impression. It is the result of a combination of mechanical and chemical action that is not completely understood, and occurs when a small relative motion or vibration is accompanied by some loading, in the presence of oxygen.

### **Flaking**

See Spalling.

### **Fretting, Fretting Corrosion, Friction Oxidation**

These terms all describe a type of service damage that occurs under the same conditions as False Brinelling.

Red and black oxides of iron are usually evident. In bearings, fretting usually takes place at the I.D. or O.D., but it may occur anywhere there is a close fit with some movement.

### **Galling**

See Scoring.

### **Heat Checks**

Surface cracks resulting from heat generated by sliding contact with another part. Heat checks are oriented normal to the direction of motion. Depending on the stresses present in the component, the cracks may remain small or become nuclei for a complete fracture.

### **Indentations**

The surface depressions caused by debris or foreign material.

### **Pickup**

The welding and transfer of metal between rollers and raceways during bearing operation. Pickup results from inadequate lubrication.

### **Pitting**

Small, roughly circular holes or craters resulting from corrosion, mechanical damage, or the passage of an electric current. Because these three types of pits have distinctly different causes, the word pitting should always be qualified.

### **Scoring, Scuffing, Seizing, Smearing**

All terms referring to transfer of metal from one component of a bearing to another under sliding contact. This process, which is also called galling, is caused by lack of adequate lubrication under extreme unit pressure.

### **Spalling**

A breaking away of metal from the raceway or rolling element in flakes or scale-like particles. Also called flaking.

## **Examples of Failure and Damage to Bearings**



### **Flaking**

Surface of the raceway and rolling elements peels away in flakes  
Conspicuous hills and valleys form soon afterward



### **Speckles and Discoloration**

Luster of raceway surfaces is gone;  
surface is matted, rough, and / or evenly dimpled. Surface covered with minute dents



### **Indentations / Dents and Scratches**

Scoring during assembly, gouges due to hard foreign objects, and surface denting due to mechanical shock.



### **Smearing and Scuffing**

The surface becomes rough and some small deposits form. Scuffing generally refers to roughness on the race collar and the ends of the rollers



### **Chipping**

Partial chipping of inner ring, outer ring, or rolling elements.



### **Wear**

The surfaces wear and dimensional deformation results. Wear is often accompanied by roughness and scratches



### **Spalling**

Score accompanying seizing. Mounting score in axial direction. Scores on roller end face and guide rib-cycloidal scores. Scratches in spinning direction on raceway surface and rolling contact surfaces



### **Peeling**

Patches of minute flaking or peeling. Innumerable hair-line cracks visible though not yet peeling



### **Cracking and Notching**

Localized flaking occurs. Little cracks or notches appear



### **Fretting and Fretting Corrosion**

There are two types of fretting. In one, a rusty wear powder forms on the mating surfaces. In the other, brinelling indentations form on the raceway at the rolling element pitch



### **Rust and Corrosion**

The surface becomes either partially or fully rusted, and occasionally rust even occurs along the rolling element pitch lines



### **Electrical Pitting / Electrolytic Corrosion**

Pits form on the raceway. The pits gradually grow into ripples.



### **Seizing / Seizure**

The bearing heats up and becomes discolored. Eventually the bearing will seize up



### **Rolling Path Skewing**

Abrasion or an irregular, rolling path skewing left by rolling elements along raceway surfaces



**Damage to Retainers /  
Cage Damage**

Rivets break or become loose resulting in cage damage.



**Creeping**

Surface becomes mirrored by sliding of inside and outside diameter surfaces. May be accompanied by discoloration or score