

Bearing faults that can be detected with vibration monitoring

The information contained in this document is the property of Wilcoxon Sensing Technologies and is proprietary and/or copyright material. This information and this document may not be used without the express authorization of Wilcoxon Sensing Technologies. Any unauthorized use or disclosure may be unlawful.

Information contained in this document is subject to U.S. Export Control regulations, specifically the International Traffic in Arms Regulations and / or Export Administration Regulations. Each recipient of this document is responsible for ensuring that transfer or use of any information contained in this document complies with all relevant International Traffic in Arms Regulations and / or Export Administration Regulations.

Vibration:

The cornerstone of condition monitoring

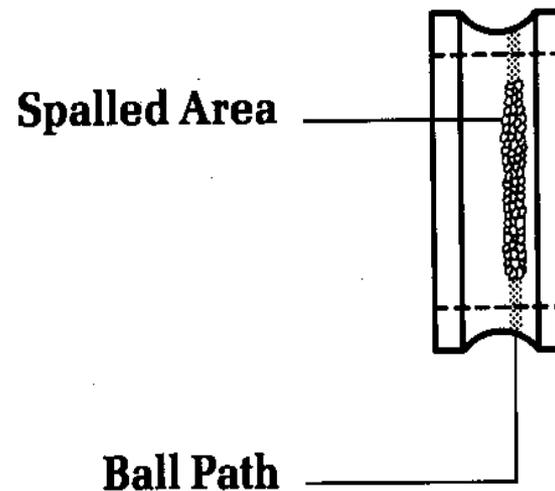
Bearing faults which can be detected with vibration analysis

- Excessive loads
- Overheating
- True brinelling
- False brinelling
- Normal fatigue failure
- Reverse loading
- Contamination
- Lubricant failure
- Corrosion
- Misaligned bearings
- Loose fits
- Tight fits



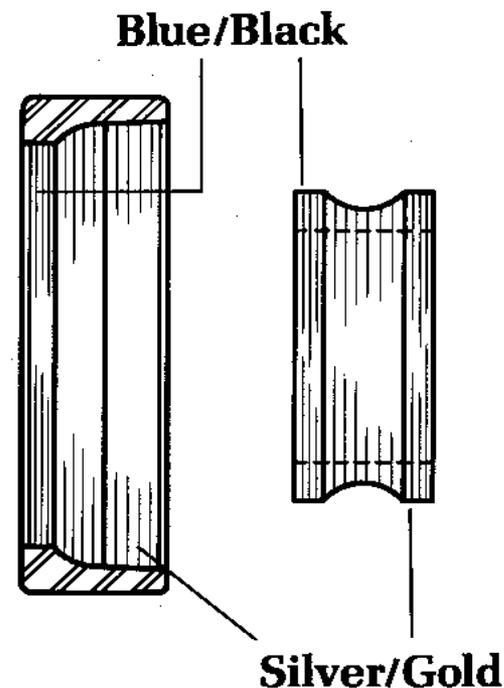
Excessive loads

- Usually causes premature fatigue
- Can be alleviated by reducing the load or redesigning with a bearing of greater capacity



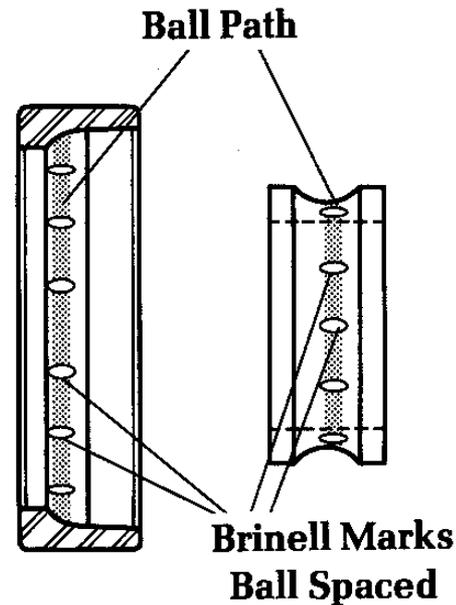
Overheating

- Symptoms are discoloration of the rings, balls and cages from gold to blue
- Temperature in excess of 400° F can anneal the ring and ball materials and degrade or destroy lubricant
- The resulting loss in hardness reduces the bearing capacity, causing early failure
- In extreme cases, balls and rings will deform



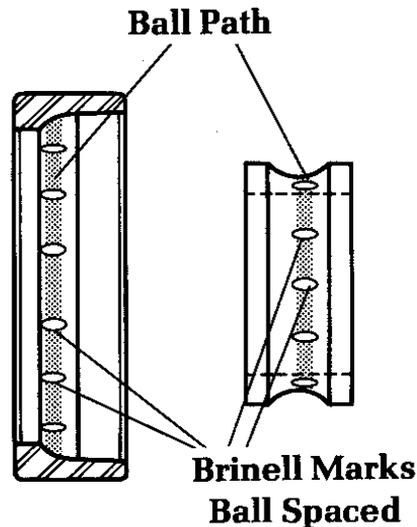
True brinelling

- Occurs when loads exceed the elastic limit of the ring material
- Creates brinell marks which show as indentations in the raceways and increase bearing vibration (noise)
- Caused by any static overload or severe impact



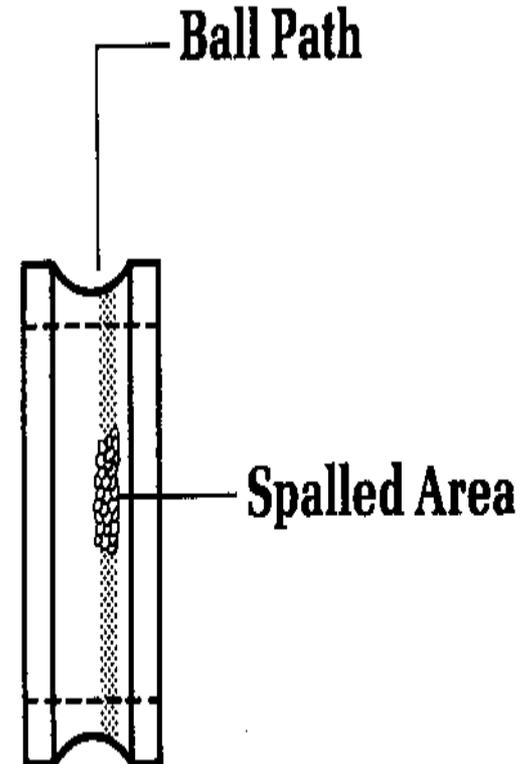
False brinelling

- Creates elliptical wear marks in an axial direction at each ball position with a bright finish and sharp demarcation, often surrounded by a ring of brown debris
- Indicates excessive external vibration
- Corrected by isolating bearings from external vibration, and using greases containing anti-wear additives



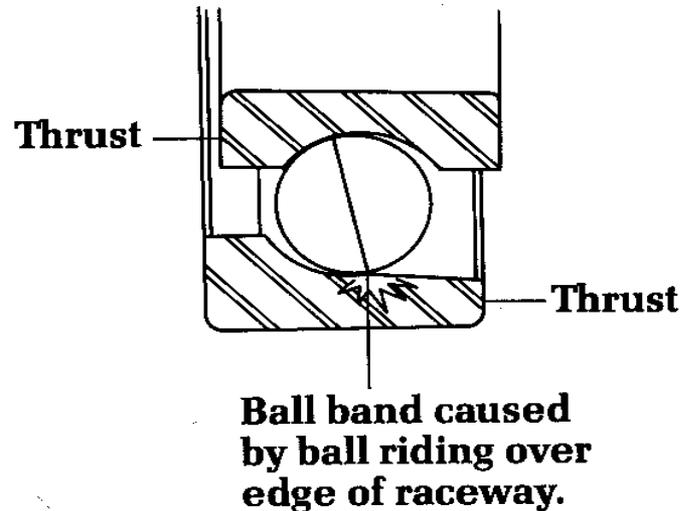
Normal fatigue failure

- A fracture of the running surfaces and subsequent removal of small discrete particles of material
 - Also referred to as spalling
- Can occur on the inner ring, outer ring, or balls
- A “progressive” failure
 - Once initiated, it will spread with continued operation
 - It will always be accompanied by a marked increase in vibration
- Remedied by replacing the bearing or redesigning with a bearing that has a greater calculated fatigue life



Reverse loading

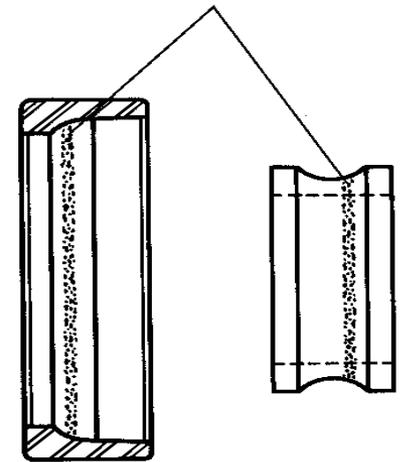
- Angular contact bearings are designed to accept an axial load in one direction only
- When loaded in the opposite direction, the elliptical contact area on the outer ring is truncated by the low shoulder on that side of the outer ring
- The result is excessive stress and an increase in temperature, followed by increased vibration and early failure
- Corrective action is to re-install the bearing correctly



Contamination

- A leading cause of bearing failure
- Symptoms are denting of the bearing raceways and balls, resulting in high vibration and wear
- Clean work areas, tools, fixtures and hands help to reduce contamination failures
- Keep grinding operations away from bearing assembly areas and keep bearings in their original packaging until you are ready to install them

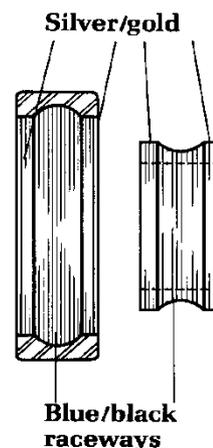
Irregular dents or material embedded in raceways.



Balls will be similarly dented, dull, or scratched.

Lubricant failure

- Ball bearings depend on the continuous presence of a very thin (millionths of an inch) film of lubricant between the balls and races, and between the cage, bearing rings and balls
- Insufficient or ineffective lubricant results in excessive wear of balls, rings and cages, leading to overheating and subsequent catastrophic failure
- Discolored (blue/brown) ball tracks and balls can occur
- Failures are typically caused by restricted lubricant flow or excessive temperatures that degrade the lubricant's properties



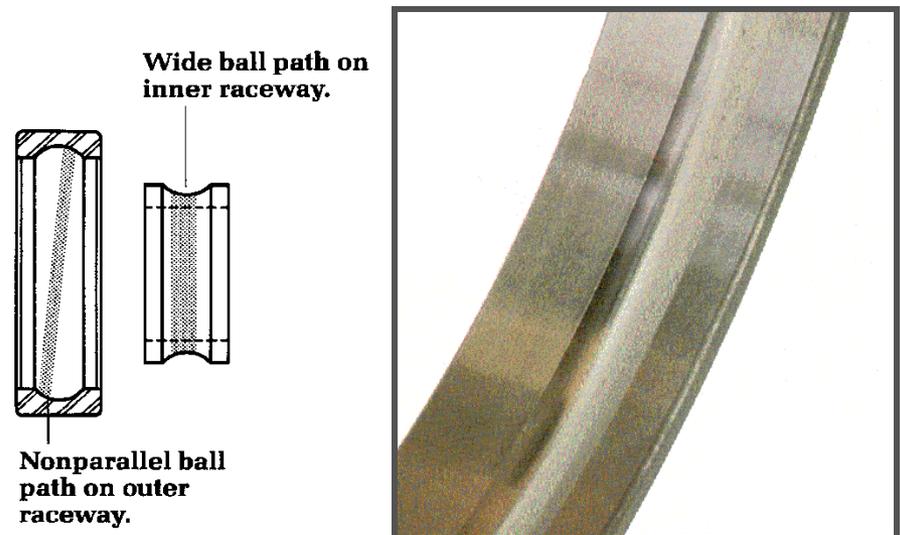
Corrosion

- Red/brown areas on balls, race-way, cages, or bands of ball bearings may be present
- Results from exposing bearings to corrosive fluids or a corrosive atmosphere
- In extreme cases, can initiate early fatigue failures
- Corrected by diverting corrosive fluids away from bearing areas and using integrally sealed bearings whenever possible



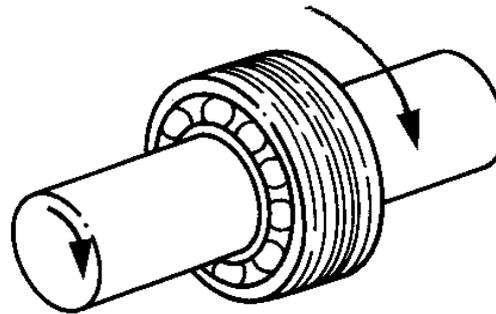
Misalignment

- Can be detected on the raceway of the non-rotating ring by a ball wear path that is not parallel to the raceways edges
- If it exceeds 0.001 in./in, will cause an abnormal temperature rise in the bearing and/or housing and heavy wear in the cage ball-pockets
- Appropriate corrective actions include:
 - Inspect shafts and housings for runout of shoulders and bearing seats
 - Use single point-turned or ground threads on non hardened shafts and ground threads only on hardened shafts
 - Use precision grade locknuts

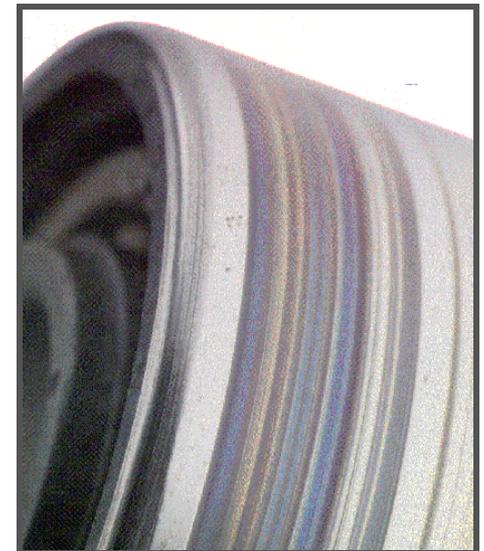


Loose fits

- Can cause relative motion between mating parts
- If the relative motion between mating parts is slight but continuous, fretting occurs
 - Fretting is the generation of fine metal particles which oxidize, leaving a distinctive brown color. This material is abrasive and will aggravate the looseness. If the looseness is enough to allow considerable movement of the inner or outer ring, the mounting surfaces (bore, outer diameters, faces) will wear and heat, causing noise and runout problems.

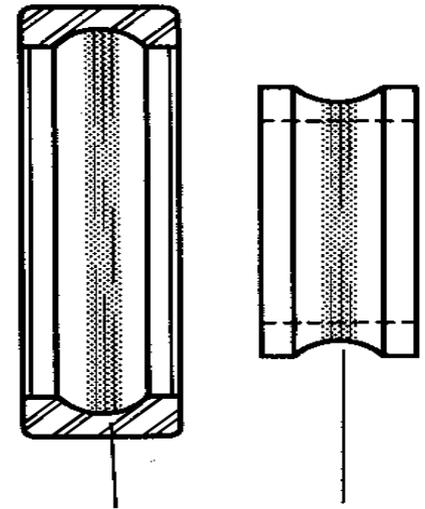


**Outer ring slippage
caused by improper
housing fits.**



Tight fits

- Indicated by a heavy ball wear path in the bottom of the raceway around the entire circumference of the inner ring and outer ring
- Where interference fits exceed the radial clearance at operating temperature, the balls will become excessively loaded, resulting in a rapid temperature rise accompanied by high torque
- Continued operation can lead to rapid wear and fatigue
- Corrective action is a decrease in total interference



Discolored, wide ball path at bottom of raceways.

Wilcoxon Sensing Technologies

 +1 (301) 330 8811

 info@wilcoxon.com

 www.wilcoxon.com

The information contained in this document is the property of Wilcoxon Sensing Technologies and is proprietary and/or copyright material. This information and this document may not be used or disclosed without the express authorization of Wilcoxon Sensing Technologies. Any unauthorized use or disclosure may be unlawful.

The information contained in this document may be subject to the provisions of the Export Administration Act of 1979 (50 USC 2401-2420), the Export Administration Regulations promulgated thereunder (15 CFR 730-774), and the International Traffic in Arms Regulations (22 CFR 120-130). The recipient acknowledges that these statutes and regulations impose restrictions on import, export, re-export and transfer to third countries of certain categories of data, technical services and information, and that licenses from the US Department of State and/or the US Department of Commerce may be required before such data, technical services and information can be disclosed. By accepting this document, the recipient agrees to comply with all applicable governmental regulations as they relate to the import, export and re-export of information.'