BEARING FAILURE: CAUSES AND CURES

BARDEN PRECISION BEARINGS

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PRECISION
BEARINGS

Identifying and correcting causes of bearing failure.

Precision ball bearings are designed to have a long and useful life. Assuming the application is correct to begin with, maximizing longevity means bearings must be properly installed, lubricated and maintained. Poor operating environments, particularly moist or contaminated areas, and improper handling practices invite premature bearing failure.

When a bearing does fail, it is important to determine the *exact* cause so appropriate adjustments can be made. Examination of the failure mode often reveals the true cause of failure. This procedure is complicated by the fact that one failure mode may initiate another. For example, corrosion in a ball race leaves rust—an abrasive—which can cause wear, resulting in loss of preload or an increase in radial clearance. The wear debris can, in a grease-lubricated bearing, impede lubrication, resulting in lubrication failure and subsequent overheating.

This guide will assist in properly identifying and analyzing 12 primary causes of bearing failure. Each characteristic is described in detail and is shown in diagram form, accompanied by a color photograph. Flaws, in most cases, are readily apparent. In some cases, the imperfections may be virtually invisible to the naked eye. Specific remedies for each situation are also suggested.

Your Authorized Barden Representative will be happy to provide you with additional assistance upon request.

EXCESSIVE LOAD
Premature spalled area in ball path.

4

OVERHEATING
Discoloration of rings, balls and cages.

5

FALSE BRINELLING
Elliptical wear marks at each ball position.

6

TRUE BRINELLING
Ball indentations in raceways.

7

NORMAL FATIGUE FAILURE
Spalling or flaking of metal from contact surface.

8

REVERSE LOADING
Balls show grooved wear band.

9

CONTAMINATION
Denting of bearing raceways and balls.

10

LUBRICANT FAILURE
Discolored (blue/brown) ball tracks and balls.

11

CORROSION
Chemical attack results in reddish/brown discoloration.

12

MISALIGNMENT
Raceway ball track not parallel to raceway edges.

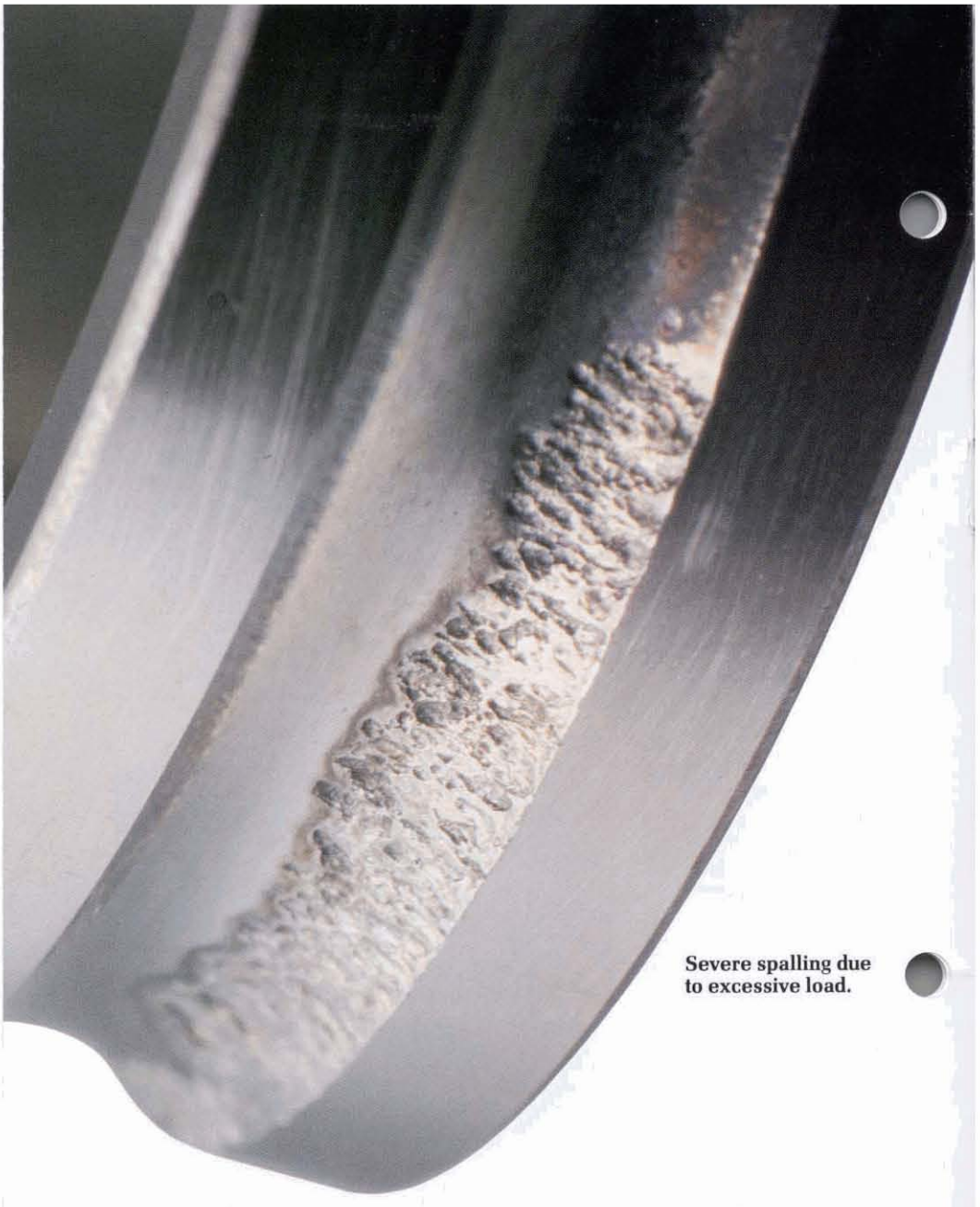
13

LOOSE FITS
Circumferential wear and/or discoloration of mounting surfaces.

14

TIGHT FITS
Heavy ball wear path at bottom of raceways.

15

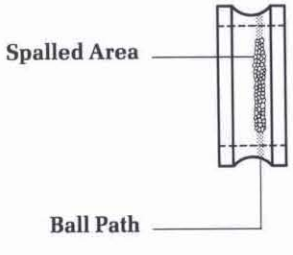


Severe spalling due to excessive load.

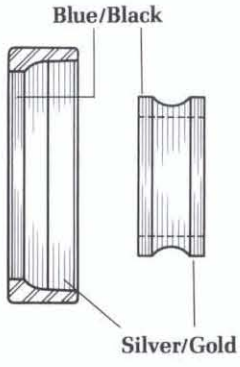
EXCESSIVE LOADS

Excessive loads usually cause premature fatigue. Tight fits, brinelling and improper preloading can also bring about early fatigue failure, (see Tight Fits, p. 15 and True Brinelling, p. 7). This type of failure looks the same as normal fatigue, although heavy ball wear paths, evidence of overheating and a more widespread spalling (fatigue area) are usually evident with shortened life.

The solution is to reduce the load or redesign using a bearing with greater capacity.



OVERHEATING

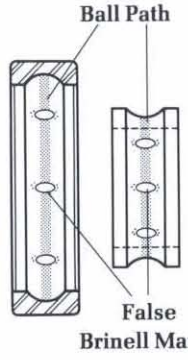


Symptoms are discoloration of the rings, balls, and cages from gold to blue. Temperatures in excess of 400°F can anneal the ring and ball materials. The resulting loss in hardness reduces the bearing capacity causing early failure. In extreme cases, balls and rings will deform. The temperature rise can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

Common culprits are heavy electrical heat loads, inadequate heat paths, and insufficient cooling or lubrication when loads and speeds are excessive. Thermal or overload controls, adequate heat paths, and supplemental cooling are effective cures.

Look for blue/black and silver/gold discoloration. Balls will usually be blue/black.

FALSE BRINELLING



False brinelling—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. A small relative motion between balls and raceway occurs in non-rotating ball bearings that are subject to external vibration. When the bearing isn't turning, an oil film cannot be formed to prevent raceway wear. Wear debris oxidizes and accelerates the wear process.

Correct by isolating bearings from external vibration, and using greases containing antiwear additives such as molybdenum disulfide when bearings only oscillate or reverse rapidly as in actuator motors.

False brinell marks are bright, well-defined, and surrounded by debris.