

Preventive Measures and Repairing of Anti Friction Bearings

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Abstract: -In order to maintain the original performance of a bearing for as long as possible, proper maintenance and inspection should be performed. If proper procedures are used, many bearing problems can be avoided and the reliability, productivity, and operating costs of the equipment containing the bearings are all improved. Effective preventive measures enhance bearings life. However, they often fail prematurely due to avoidable mistakes.

In contrast to fatigue life, this premature failure is caused by improper mounting, handling, or lubrication, entry of foreign matter, misalignment or abnormal heat generation.

Keyword: Bearing, Friction, flaking, scoring

I. INTRODUCTION

Anti-friction 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^[1]. Poor operating environments particularly moist or contaminated areas. 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 reveals the true cause of failure. This procedure is complicated by the fact that one failure mode may initiate another^[1]. 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^[2].

II. IDENTIFICATION AND PREVENTIVE MEASURES FOR CAUSES OF BEARING FAILURE

Once the bearing is damaged it is very difficult to repair and reuse. It is desirable to service the bearing regularly to avoid permanent damage. Preventive measure should be taken to avoid permanent failure of bearings due to cracks, flaking, scoring, indentation, abnormal wear, and seizure type problems found in bearings. Before taking any remedial steps for anyone of such problems the main cause of the problem must be identified^[1].

Abnormal axial load may cause the flaking of one side of the race way of radial bearing. To avoid this problem loose fit should be used while mounting the outer ring of free end bearing. If the roundness of bearing housing is not proper then it will results in symmetrical flaking of the race way. To

avoid this problem faulty bearing housing should be repaired^{[1][3]}.

Prolonged nonuse of bearings causes flaking of race way with same spacing as rolling elements. Rust preventives should be applied if bearing operation is suspended for long period.

Selection of proper fit, clearance and lubricants prevent the premature flaking of race way and rolling elements^[1].

Preload must be adjusted properly to avoid premature flaking of duplex bearing.

Inadequate lubrication, excessively hard grease, rapid initial acceleration, large axial load and improper mounting generally cause scoring of bearing. Remedial actions such as use of soft grease, reduction in acceleration in starting, proper mounting, reduction in axial load should be taken only after identifying the main cause of scoring of the bearing^[1].

If cracks found in outer ring ,inner ring, rolling elements or cage the load condition on the bearing ,mounting method of the bearing, fit of the bearing and lubricant quality must be examined critically and if found necessary any one or all should be improved to avoid the problems of crack formation^[1].

Indentation of race way as well as rolling elements may occur due to any foreign matter like metallic chip ,sand ,or excessive shock load during mounting .Proper cleaning of housing ,use of clean lubricants and care taken during mounting may help in avoiding indentation.

Insufficient interference or insufficient tightening of sleeve, insufficient clearance generally causes abnormal wear and also some time cause discoloration and melting of race way, rolling elements, ribs known as seizure of bearing Improvement of internal clearance ,bearing fit ,lubrication quality can prevent the abnormal wear and seizure of the bearing^{[1][4]}.

Arcing, which produces high temperatures at localized points, results when an electric current that passes through a bearing is broken at the contact surfaces between the races and rolling elements. Each time the current is broken while passing between the ball or roller and race, a pit is produced on both parts. Eventually fluting develops. As it becomes deeper, noise and vibration result. Proper insulation of bearing prevents arcing

CAUSES	PROBLEM	CORRECTIVE MEASURE
Excessive loads	premature fatigue	reduce the load Or redesign using bearing with greater capacity
	Discoloration of the rings, balls, and cages from Blue - black 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	Thermal or overload controls, adequate heat paths, and supplemental cooling are effective cures.
False brinelling	Elliptical path 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. 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 anti wear additives such as molybdenum disulfide when bearing only oscillate or reverse rapidly & in actuator motors.
Contamination	Contamination is a leading cause for bearing failure. It results in denting of the bearing raceways and balls resulting in high vibration and wear.	Clean work areas, tools, fixtures and hands help reduce contamination failures.
Lubricant	Ball bearings depend on the continuous presence-of a very thin-millionths of an inch-film of lubricant between balls and races, and between the cage, bearing rings and balls. Failures are typically caused by restricted lubricant flow or excessive temperatures that degrade the lubricant's properties.	Use the most suitable lubricant. Steps taken to correct improper fit, control preload better, and cool the shafts and housings will reduce bearing temperatures and improve lubricant life.
Corrosion	Corrosion results from exposing bearings to corrosive fluids or a corrosive atmosphere. The usual result is increased vibration followed by wear, with subsequent increase in radial clearance or loss of preload. In extreme cases, Corrosion can initiate early fatigue failures.	Correct by diverting corrosive fluids away from bearing areas and use integrally sealed bearings whenever possible. If the environment is particularly hostile, the use of external seals in addition to integral seals should be considered.
Misalignment	Abnormal temperature rise of bearing , bearing housing and heavy wear in cage ball pockets	Inspect shaft and housings for run out of shoulders and bearing seats .Do proper alignment.

Table 1: Problem, causes and preventive measures of bearing [5]

III. PROCEDURE FOR BEARING REPAIRING:

Despite taking proper precautions, bearings may become damaged either through improper storage and handling or through normal wear in use. Bearings that have been damaged or are no longer within specifications may still be returned to service after repair or refurbishment. Some bearings can be refurbished more than once [3]. If a bearing is damaged or worn beyond repair sooner than expected, it should not be discarded. The nature of the damage can provide valuable clues that can help analyze and identify possible causes, leading to corrective actions that will help ensure longer bearing life in the replacement [3].

IV. REMOVING BEARINGS FROM EQUIPMENT

Each type of bearing design has a unique removal process. Regardless of the bearing type, the bearing must be removed with extreme care. Otherwise will damage the bearings, shafts or housings, requiring expensive repairs. For smaller bearings, there are a variety of pullers available for bearing removal [6]. Large bearings can be lifted and moved using a variety of slings, hooks, chains and mechanical devices. Some large bearings are manufactured with tapped holes in the face of inner rings or outer rings. Eyebolts or other points of attachment can be inserted in these lifting holes [6]. Many large bearings have threaded lifting holes in the cage ring that can be used to lift the inner ring assembly.

V. BEARING CLEANING

While inspecting bearing, residual lubricant should be checked. After checking condition of residual lubricant using light oil or kerosene the bearings should be cleaned. Using brush or any other means any foreign matter, lubricant or other deposits on the bearing should be removed. Immersed the relatively clean bearing in clean rinsing oil and rotate it [7].

VI. REPAIRING

The sound of a bearing may be checked with a noise locator or other instruments. Abnormal conditions are indicated by a loud metallic sound, or other irregular noise, and the possible cause may include incorrect lubrication, poor alignment of the shaft and housing, or the entry of foreign matter into the bearing.

In the case of small non-separable ball bearings, hold the bearing horizontally in one hand, and then rotate the outer ring to confirm that it turns smoothly.

Separable bearings such as tapered roller bearings may be checked by individually examining their rolling elements and the outer ring raceway [7].

Large bearings cannot be rotated manually; however, the rolling elements, raceway surfaces, cages, and contact surface of the ribs should be carefully examined visually. Add grease to the little pockets in-between the balls such that all the balls should be lubricated.

Spread the grease around with finger and roll the bearing back and forth until all the balls adequately covered. Gently place the seal back on. It will "snap" into place. Then, since completely un-lubed it, run greasy finger around the outside of the rubber seal just enough to keep it moistened. Also get some grease on the metal surfaces to help keep the rust away. Small areas of damage on bearing races, and on the contact surface of the rolling elements, can sometimes be repaired by grinding out the loose metal ^[7].

Any raised or rough areas should be smoothed flat with grinding and polishing tools. Light rust or corrosion should be removed with emery paper (240 – 320 # grit). As much of the damage should be removed as possible to prevent it from contaminating the bearing when it is returned to service ^[8].

If balls fall out of the races, reassemble the bearing from scratch. Take a soft surface like a folded towel. And place the outer race and the balls. Make sure all the bearings are on one side like a crescent moon. Press down on the side of the outer race where all the balls are at. Angle in the inner race so the running surface of the inner race aligns with the balls and pull to the center of the outer race ^[8].

Reuse of bearing:

During inspection of bearing if any one of the following defects or irregularities found in bearing then that bearing cannot be reused. In such situation bearing must be replaced ^[9].

- a) When there are cracks in the inner or outer rings, rolling elements, or cage.
- b) When there is flaking of the raceway or rolling elements.
- c) When there is significant smearing of the raceway surfaces, ribs, or rolling elements.

- d) When the cage is significantly worn or rivets are loose.
- e) When there is rust or scoring on the raceway surfaces or rolling elements.
- f) When there are any significant impact on the raceway surfaces or rolling elements.
- g) When there is significant evidence of creep on the bore or the periphery of the outer ring
- h) When discoloration by heat is evident.
- i) When significant damage to the seals or shields of grease sealed bearings has occurred.

VII. CONCLUSION

Majority causes of premature failure of antifriction bearings are avoidable. Little care in mounting, bearing alignment, fit of bearing, clearance, lubrication and setting of load can reduced the chances of bearing failure before its predetermined life.

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