

Water and debris contamination in bearings

TT 09-004

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Tech tip

The life of a bearing depends to a great extent on the proper lubrication of the bearing. Lubricants aid in carrying away heat, protecting bearing surfaces from corrosion and reducing friction. Statistics show that nearly 50 percent of all bearing damage can be attributed to inadequate lubrication. Although a very broad term, inadequate lubrication can be classified into eight basic categories: 1) overfilling, 2) under filling, 3) incorrect grease, 4) mixing greases, 5) incorrect lubrication systems and intervals, 6) worn-out grease, 7) water contamination, and 8) debris contamination. The following offers a quick reference to two of these eight basic categories: water contamination and debris contamination.

Water contamination

Figure 1 shows the effect of water on grease by comparing fresh grease (left) to a grease emulsified with 30 percent water (right). The fresh grease is smooth and buttery compared to the water laden grease, which is milky white in appearance. As little as 1 percent water in grease can have a significant impact on bearing life.

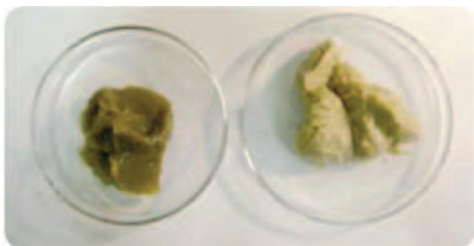


Figure 1

Figure 2 shows a tapered roller bearing and Figures 3 and 4 show a ball bearing outer race and balls rusting with pitting and corrosion from moisture/water exposure. This condition is referred to as etching.



Figure 2



Figure 3



Figure 4

Water and debris contamination in bearings – cont.

An easy, non-technical method of determining the presence of water in grease is known as the 'crackle test.' To perform this test, place a sample of grease on a piece of aluminum foil (Figure 5) and put a flame under the foil (Figure 6). If the grease melts and lightly smokes, the presence of water is minimal or absent. However, if the grease crackles, sizzles and/or pops, the grease contains a considerable amount of water.

Note: When performing this test, always wear safety glasses or goggles, and wear protective clothing. Ensure adequate ventilation.

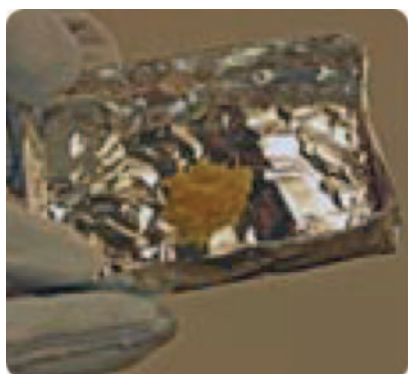


Figure 5



Figure 6

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Debris contamination

Common causes of external debris contamination include dirt, sand and environmental particles. Common causes of internal debris contamination include wear from gears, splines, seals, clutches, brakes, joints and failed or spalled components. These hard particles travel within the lubrication, through the bearing, and eventually bruise (dent) the internal surfaces. The dents form shoulders that act as surface-stress risers, causing premature surface damage and reduced bearing life. Figure 7 shows a debris contamination bruise on a bearing race (photo taken with a microscope) and Figure 8 shows the corresponding surface map of the dent.

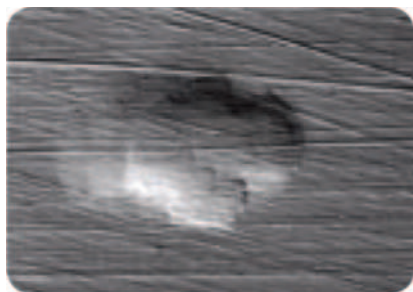


Figure 7

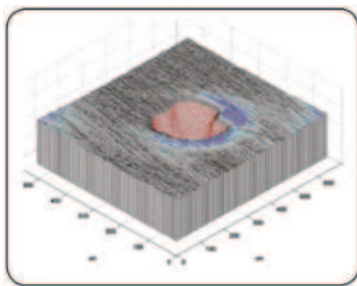


Figure 8

Figure 9 shows a tapered roller bearing inner race (cone) with spalling from debris contamination bruises.



Figure 9