

Dodge® mounted bearings: comparing true brinelling to false brinelling

brinelling

Introduction

True brinelling, also referred to as simply brinelling, and false brinelling are common terms used to describe a mode of bearing failure associated with damaged raceways and rollers. Both types of brinelling are very distinctive, but the mechanism of failure for each is very different. False brinelling can be mistaken for true brinelling, and they can create similar wear patterns on a bearing race. In this report, we will explain the difference between true and false brinelling, and the events that cause them.

True Brinelling

True brinelling occurs when the rolling elements create indentations in the race ways. This is the result of a one-time event where the bearing experiences an excessive load which exceeds the material strength of the races and rollers. **Figure 1** shows a cup from a tapered roller bearing with indentations created by the rollers.



Figure 1. Roller indentations on taper bearing cup

This type of event usually occurs when a machine experiences an unplanned crash or lockup, instantly transmitting excessive loads through the shaft into the bearings. Bearings can also be damaged if hydraulically installed or removed incorrectly. The pattern of the indentations match the roller locations

and occur across the load zone created by the sudden force. For an axial over load, the indentations will be present on one side of race ways, leaving impressions around the full circumference of the inner and outer race. For a radial over load, the damage would only be seen on approximately 1/3 of inner and outer races. **Figure 2** shows a ball bearing exposed to an axial shock load.



Figure 2. Axial shock load on a ball bearing

Figure 3 shows a roller from a spherical bearing that has been damaged by true brinelling. It was driven into the race way with sufficient force to create a flat surface across the crowned edge. Since the roller is sandwiched between the outer and inner ring, it has two flat surfaces, 180 degrees apart.



Figure 3. Roller from spherical roller bearing damaged by brinelling

False Brinelling

False brinelling is a term used to describe a failure mode where the race ways are damaged by loads transmitted through the rollers. The damage to the race ways has similar characteristics as true brinelling, but the failure mechanism is very different. False brinelling occurs over an extended period of time, and is due to vibration. It is not unusual for machines to experience vibration both during operation, and while idle. The unloaded rollers will vibrate against the race ways, and over time, this metal to metal contact can wear away material. This type of damage appears as straight lines or striations in the race ways. **Figure 4** shows the outer ring of a spherical roller bearing showing the effects of false brinelling. The striations are smooth to the eye, but are actually microscopically rough. The rollers will continue to roll over these damaged areas, which will eventually initiate spalling and premature bearing failure.



Figure 4. Outer race showing false brinelling

Figure 5 shows an inner ring from a spherical roller bearing displaying prolonged effects of false brinelling. Notice the striations are formed closely together. This is caused by an extended exposure to vibration. The rollers constantly vibrated against the race way and, for every instance the bearing rotation ceased, the rollers damaged the surface. Since there are so many instances of false brinelling, the pattern presents as the washboard effect shown in the picture.





Figure 5: Inner ring showing damage from vibration

Conclusion

While it usually not possible to prevent unplanned shock loads, it is important to understand that this type of event can severely damage the bearings, and the bearings should be evaluated and possibly replaced to prevent a premature failure. Bearings are packaged and shipped so that they are not subjected to false brinelling during transit. Assembled equipment with bearings that is stationary for long period of times can also be prone to the effects of vibration. It is suggested to occasionally rotate shafts and bearings to redistribute the oil on the race ways and to reposition the rollers in the bearing.

Be sure to look for our next article where we will take a look at fluting. For questions regarding brinelling, false brinelling, or bearing failures in general, contact Dodge CO Engineering for bearings and PT components at (864) 284-5700 or email at Engineering@dodgeindustrial.com.