

Dodge® mounted bearings: failures from electrical fluting

This paper covers a common bearing failure mode known as electrical fluting. The effect of fluting on bearings will be explained, along with sources or causes of fluting.

Electrical fluting occurs when an electrical current travels along the shaft and through the bearings. Electricity will follow the closest path to ground. Since bearings are attached to the framework of machinery, which is typically grounded, the bearings provide a direct path to the machine structure, and then to ground.

As the current passes through a bearing, electrical arcs are generated between the raceways and rolling elements. This arcing leaves a very distinct pattern on the races. **Image 1** shows the effect of electrical fluting on a tapered cone.

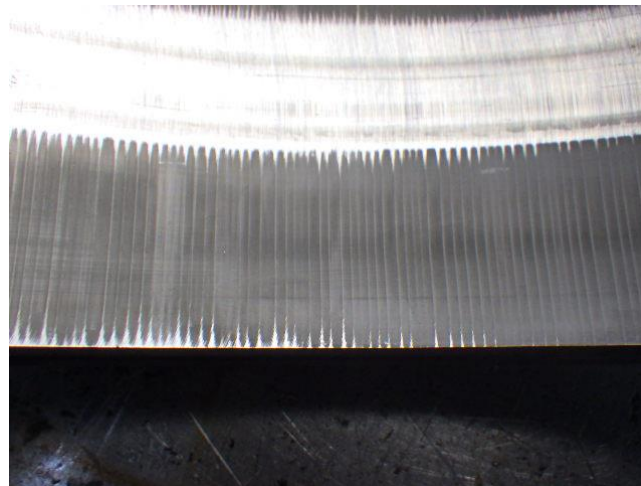
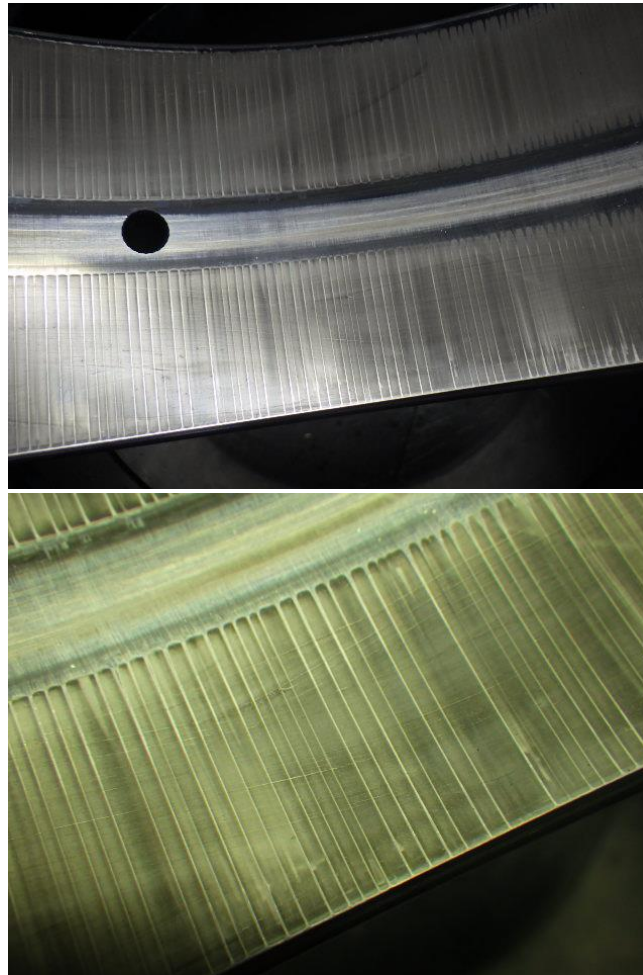


Image 1. Fluting on raceway of a spherical roller bearing

Unlike brinelling, fluting produces a very distinct, dense pattern on the raceways. This pattern will be visible on a large area or the entire circumference of the raceways. **Image 2** shows fluting damage on a spherical roller bearing. **Image 3** is a closer view of the same bearing.



Images 2 & 3. Fluting on spherical roller bearings

The electrical arcing creates pitting in the races and rolling elements and generates intense heat which changes the microstructure of the steel raceways. The outer surface of the bearing race becomes very hard and brittle. Fragments from the pitting mix with the bearing lubricant which accelerates wear and eventually causes premature failure. **Image 4** shows a microscopic view of a bearing race damaged from electrical fluting. The hardened surface is shown by the white line.

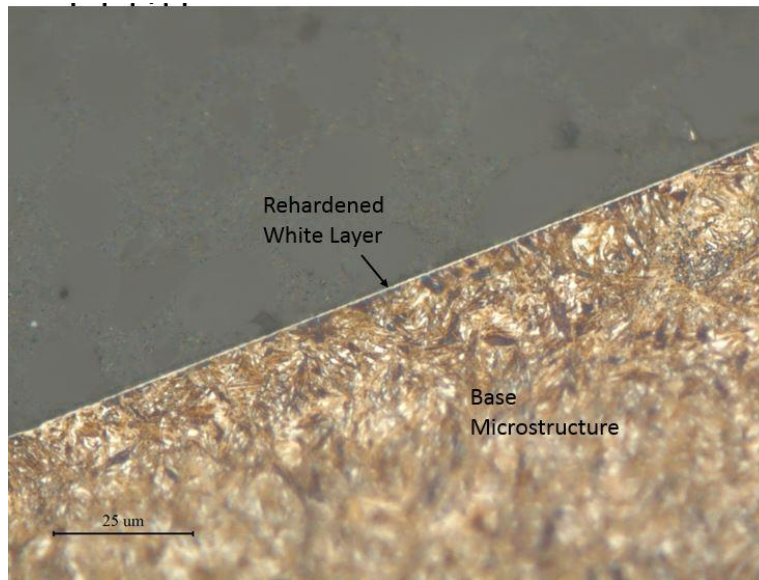


Image 4. Microscopic view raceway surface

As the rolling elements continue to roll through the damaged areas, the hardened, brittle surfaces continue to fragment, and raceway damage progressively worsens. **Image 5** shows the wash board effect caused from bearing operation after fluting damage.



Image 5. Wash board pattern from rolling elements passing through damaged raceways

Electrical fluting can come from several sources. It may come from the discharge of an electrically isolated or insulated motor or from external sources such as a VFD or welding. Grounding rings or brushes can be used to prevent electrical currents from reaching bearings. This type of device can be external or internal to the motor and diverts shaft currents to ground instead of continuing down the

shaft. They consist of a metallic ring lined with conductive fibers. They attach to the motor so that the fibers contact the shaft. Electricity will travel through the fibers and into the metallic ring. The ring will either provide an electrical path to the motor casing, or directly to ground. **Image 6** is an illustration of a grounding ring diverting electrical charges to the exterior motor housing.

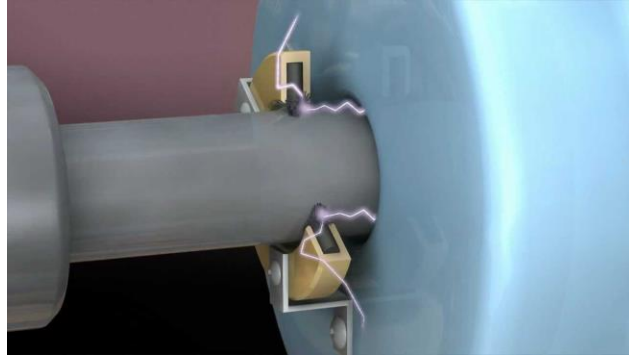


Image 6. Illustration of an Inpro/Seal current Diverter Ring (CDR)

Image 7 shows electric motors with external and internal grounding rings.



Image 7. Dodge motor with external grounding ring and a motor assembled with an internal grounding ring

Be sure to look for other articles regarding bearing failures. For questions regarding electrical fluting, or bearing failures in general, contact Dodge Application Engineering for bearings and PT components at (864) 284-5700 or email at engineering@dodgeindustrial.com.

