Electro-erosion

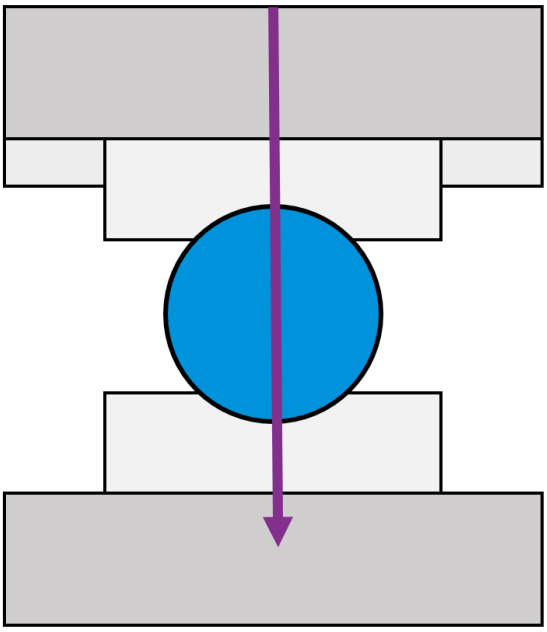
Summary

- Electro-erosion refers to a local structural change and removal of material from the contact surface, caused by electrical currents
- Electro-erosion is divided into two forms: Current passage and leakage currents
- Current passage occurs when the electrical voltage is very high and is identifiable as a series of craters on the rolling bearing components
- Creepage currents are characterised by grooves on the raceways

This article (based on ISO 15243) is all about electro-erosion – but what is it? Electro-erosion is understood to be a local structural change and removal of material from the contact surface. This structural change is caused by damaging electrical currents.

Electro-erosion is always the starting point for an increasing noise level of the machine and potentially causes early bearing failures and unplanned machine downtimes. It should not be confused with false brinelling because of the visual similarity. Overall, electro-erosion occurs particularly frequently with deep groove ball bearings because they are often installed in electric motors and generators. So, where does the current come from? Possible causes are, for example, an asymmetrical magnetic flux in

the motor, unshielded cabling or a fast-switching frequency converter. According to ISO 15243, there are two forms of electro-erosion: Current passage and leakage currents.



Here is a simplified illustration of a deep groove ball bearing with current flow.

Current passage

When the electrical voltage exceeds the insulation resistance of the rolling bearing components, an electric current is generated which flows from one ring, over the rolling elements and through the lubricating film onto the other ring. Usually a concentrated electrical discharge occurs. The localised heating that forms, which takes place within an extremely short period of time, leads to melting of the contact area and welding of the mating parts. The resulting connection is separated again shortly afterwards, as the bearing continues to rotate. This process happens continuously. Finally, the passage of current can be seen in the form of craters lined up on the surface. The craters can reach a diameter of up to 500 µm.

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Leakage currents

A leakage current is an uncontrollable and undesirable current flow that is permanently present. Leakage currents are typically characterised by the formation of craters on the raceway surface, which are close together and only have very small diameters of a few µm. These craters form grooves on both the raceways and rolling elements, because the current is transmitted over the entire contact area. This is referred to as a contact ellipse in ball bearings and a line in roller bearings. Balls show dark discolouration and the surface appears matt. If you then examine the balls under a microscope, you will find molten craters. In addition, the lubricant condition deteriorates.

In electro-erosion, a passage of current in the rolling bearing is responsible for causing damage, as you can see from this angular contact ball bearing.

Prevention of electro-erosion

The risk of electro-erosion can be reduced if the shaft, housing and/or bearing(s) are provided with appropriate insulation. One possibility is to use ceramic or plastic-coated bearings that are encased in one of the said materials, for example NTN's 7MC3 bearing series with ceramic-coated outer ring. Such coated bearings can then sometimes be used in generators in the wind power sector. In general, the use of ceramic rolling elements is also advisable in

order to avoid welding of the mating parts.

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