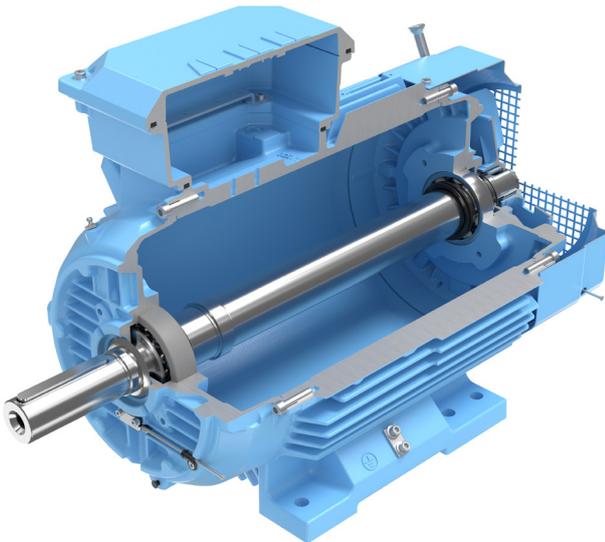


Bearing currents and their mitigation



On rare occasions, operators in the process industry may note that their low voltage motors experience a current flowing through the motor bearings, especially when they are used with a variable speed drive (VSD). Left unchecked, these bearing currents will inevitably result in premature failure.

What causes bearing currents?

When a voltage is present in the motor shaft it can overcome the insulating effect of the bearing lubrication film. This causes a current flow that results in electric discharge machining (EDM) of the bearing. This in turn causes premature wear and ultimately, early failure.

This voltage can be generated in three different ways according to the size of the motor, how its frame and shaft are grounded, the electrical installation and the specific electronic characteristic of the AC drive.

- Circulating currents in larger motors – above a frame size of 280
- Shaft grounding current – may exist when rotor is grounded
- Capacitive discharge current – below a frame size of 280

Portfolio of bearing current solutions

There is not one single technical solution that can be applied to cover all installations where bearing currents are considered an issue. Instead, it is a question of making an optimal choice from a range of potential solutions according to the details of their specific application. In this respect, motor size is the key consideration.

Solutions for actions

1. Insulated bearing at the non-drive end	An effective solution for motors with an IEC frame size of 280 and upwards is to substitute the bearing at the non-driven end with an insulated bearing that prevents circulating bearing current.
2. Common mode filter used in conjunction with a VSD	For larger motors with a nominal power greater than 350 kW (IEC 400 or larger frame size), a common mode filter will reduce common mode currents and thus decrease the risk of bearing currents.
3. Earthing and cabling of transformer, VSD, motor and load-train	For all installations, and especially motors with a nominal motor power over 30 kW, we recommend the use of grounding and motor connection cables with symmetric PE (Protective Earth) shielding across the entire system as this strongly attenuates motor shaft and frame voltages. This represents best practice even when bearing currents are not regarded as an issue. It should also be the first action taken prior to installing a common mode filter on larger motors.
4. Shaft grounding brush installed internally	Installing a motor shaft grounding brush that directs the current to the ground via the brush, rather than through the bearing. This protects the motor itself and the complete installation.
5. Insulated bearings at both the driven and non-driven ends	Using bearings installed at both ends of the motor with insulated races or rolling elements. This ensures that no current can flow to earth via the bearings.

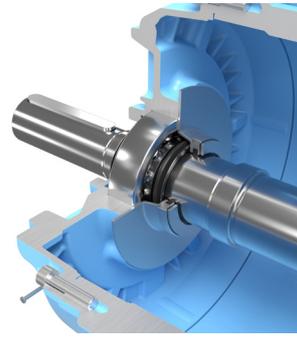
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01
Typical bearing exposed to bearing currents

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02
A motor shaft grounding brush

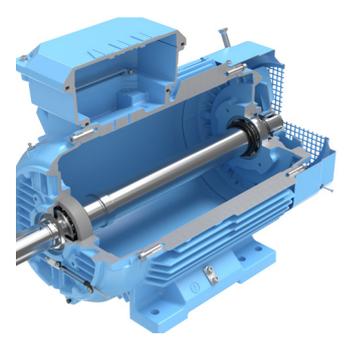
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03
Insulated bearing at both ends



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01



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02



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03

How can you measure bearing currents?

If bearing currents are suspected they can be detected using special equipment operated by experienced personnel. ABB Service has vast experience in carrying out these measurements on motor and drive installations in a variety of different applications worldwide.

Summary – bearing currents can be avoided

While it is important to recognize that bearing currents can be an issue, they are responsible for a very small number of motor bearing failures. The most common causes for bearing failures are due simply to mechanical problems, such as overly high axial or radial loads, insufficient or incorrect lubrication or foreign particles or moisture inside the bearing.

When a bearing current is present, there is no 'one size fits all solution'. It is vital for the customer and motor and drive supplier to work together to identify the most appropriate solution for the specific application. Ensuring the correct use of grounding and connection cables according to best practice will always be an important first step. New solutions in the form of shaft grounding brushes and hybrid bearings are now showing significant promise as a cost-effective way of eliminating the potentially harmful effects of bearing currents.