



Types of Bearing Damage
and Failures in Electric
Motors and Generators

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Bearings are an essential component of electric motors. They provide shaft support, facilitate even load handling, reduce friction between the shaft and stationary parts of the motor, and increase the longevity and reliability of rotating assets. Many types of bearings are used in electric motors including sleeve bearings, sealed bearings, shielded bearings, and many other varieties.

No matter which type of bearing is used, several types of damage can occur if they are not properly installed, operated, and maintained. This eBook will explain what types of bearings electric motors use, the functions they perform, and the types of bearing damage and failure commonly seen in electric motors and generators.

What Are Motor Bearings?

A motor bearing permits rotary motion and transmits power between machine parts. They feature outer and inner rings (one fixed and one moving) and are separated by rolling components, which work to enable the relative motion of two joined parts. Their purpose is to support the rotor, keep the air gap consistent, and transfer the loads from the shaft to the motor. To be effective, bearings must be able to operate at both low and high speeds while minimizing frictional losses. They should also be purpose-designed and require everything from no maintenance to regular interval maintenance.

Types of Motor Bearings and What They're Used For

There are many types of bearings. The kind used for any given application depends on factors such as the motor's design, load requirements, environmental conditions, and rotational speed. Before we discuss the types of bearing failures that can occur in motors, let's cover the types of motor bearings and the way they are used.



BASIC BALL BEARING

This type of bearing is used in direct coupled applications, such as in non-belted electric motors that are under 150 HP. This type of bearing can handle both axial and radial loads.



STANDARD ROLLER BEARINGS

Standard roller bearings can't handle axial loads and are specially designed for radial loads. They are most suited for use in belted motors with at least 150 HP.



ANGULAR CONTACT BALL BEARINGS

Angular contact ball bearings are made to withstand high axial loads. They operate smoothly at high speeds and can be configured in either single or double rows. Angular contact bearings are used in many types of cage designs.



CYLINDRICAL ROLLER BEARINGS

Cylindrical roller bearings are capable of withstanding extremely high axial loads. They operate efficiently at high and medium speeds and use numerous design configurations. Cylindrical bearings are most commonly used in belt or gear-driven electric motors.



DEEP GROOVE BALL BEARINGS

This type of bearing has a simple design, yet is one of the most versatile. Deep groove ball bearings are suitable for a wide range of uses, including high-speed operations with moderate radial and axial loads. Deep groove bearings are also available pre-lubricated, with shields and seals. They perform very well in environments prone to contamination.



SEALED BEARINGS

Sealed bearings are intended for use in smaller motors and are specifically designed to limit contamination exposure. Once they have been installed, these bearings cannot be re-lubricated. This means that their lifespan is shorter and they require regular monitoring so that they can be replaced when the first sign of problems occur.



SHIELDED BEARINGS

Shielded bearings are designed to limit contamination from entering the rolling elements during motor operation. They can be re-lubricated with packed grease, however, if the internal pressure is not relieved, it could cause problems, such as forcing the shield against the rolling elements or cage.



THRUST BEARINGS

Thrust bearings are designed to handle axial loads and provide support for rotating shafts in one direction. They can be found in applications like automotive transmissions and thrust reversers in aircraft engines.



SLEEVE BEARINGS

Sleeve bearings, also known as plain bearings or bushings, are cylindrical bearings that rely on a lubricant film between the bearing surface and the rotating shaft. They are often used in low-speed and high-load applications, such as in large electric motors and generators.



TILT PAD BEARINGS

Tilt pad bearings are specialized bearings used in high-speed rotating machinery, such as turbines and compressors. They consist of multiple pads that can tilt and adjust to accommodate shaft movements and provide stability and reduced friction.



MAGNETIC BEARINGS

Magnetic bearings use magnetic fields to suspend and position the rotating shaft without physical contact. They offer advantages such as high-speed operation, no lubrication requirements, and reduced vibration and noise. They are commonly used in applications like high-speed motors and turbomachinery.



FLUID BEARING

This special type of bearing relies on pressurized gas or liquid to carry the load and eliminate friction. Fluid bearings are used to replace metallic bearings where they would have a short life. In addition to high noise and vibration levels, these bearings are used in machines that work at high speeds and loads. While the initial costs are higher, the longer lifespan in tough conditions makes up for it in the long run.



BABBITT BEARINGS

Babbitt bearings are found in pumps, motors, fans, industrial equipment, and turbines. They support the weight of the shaft and provide a non-damaging surface to the high-speed shaft that rotates. The lining of a bearing is bonded with Babbitt, which is a soft alloy featuring a low-melting point. When contamination occurs or failure happens in the lubrication system, the softer alloy wears out instead of the shaft.

Types of Bearing Damage and Failures in Motors

No matter which type of bearing a motor or generator uses, several types of damage can occur. While some types of damage are caused by user errors, such as improper installation, other types occur due to normal abrasive wear. No matter what the cause, identifying early signs of bearing damage is important for preventing more significant issues from occurring later, as well as costly unscheduled downtime.

The following are the most common types of bearing damage and failures in motors.

ELECTRICAL EROSION

Also referred to as arcing, electrical erosion occurs when a current travels from one ring to another via its rolling elements. The severity of the damage that occurs depends on the amount of energy that was passed as well as its duration. Electrical erosion causes several problems, including pitting damage to the raceways and rolling elements, lubricant degradation, and premature bearing failure. To prevent these issues, mitigation at the source is best and is discussed more thoroughly in our eBook, “Avoid Motor Shaft Voltage & Bearing Current Damage”. Additionally, it’s common practice to use an electrically insulated bearing at the non-drive end and shaft grounding brushes.



INSUFFICIENT LUBRICATION AND CONTAMINATION

Insufficient lubricant and contamination are two other common causes of bearing damage. When the lubricant film between raceways and rolling elements is too thin, metal-to-metal contact occurs, resulting in excessive friction and damage. Thin lubricant film can be caused by either inadequate viscosity, contamination, exceeding normal operating temperatures, and electrical current passing through the bearings.



To investigate this issue, first check to ensure the appropriate lubricant is being used and that you are using the proper quantities and re-greasing intervals for your application. If the lubricant is contaminated, determine the source of the contaminants and check the seals to determine whether they need to be upgraded or replaced. In some applications, simple solutions like a higher viscosity lubricant may be required to increase film thickness during different times of the year or under specific operating conditions.

VIBRATION DAMAGE

When a motor is transported with the rotor shaft insecurely held, excessive vibrations can occur within the bearing clearance, causing damage. Motors at a standstill can also be subjected to external vibrations over time, also causing damage. To prevent these issues, it's best to secure bearings for transport by locking the shaft axially using a flat piece of steel bent into a U-shape while preloading the bearing carefully at the non-drive end. Then, radially load the bearing at the drive end using a strap. For periods of prolonged standstill, turn the shaft at regular intervals.

DAMAGE FROM INCORRECT INSTALLATION AND SET-UP

Numerous installation mistakes can result in bearing issues. The most common mistakes are:

- Excessive belt tension
- Imbalance
- Incorrect mounting, resulting in overloading or impact
- Using an improper tool to mount a belt pulley or coupling half onto the shaft
- Misalignment or excessive shaft run-out



To prevent these issues, it's best to use a precision alignment tool and vibration analyzer to ensure proper installation and set-up. Be sure to also use the correct tools and techniques when mounting your bearings and ensure proper run-out tolerances during repair or set-up.

INADEQUATE BEARING LOAD

To function optimally, bearings must always have a minimum load. When an insufficient bearing load is used, damage will appear as smearing on the raceways and rolling elements. To prevent this, it's essential to apply an adequately large external load to the bearings. This is particularly important when using cylindrical roller bearings, as they are typically chosen for their heavy load accommodation capabilities. It should also be noted that this issue does not apply to preloaded bearings.

Electric Motor Preventative & Repair Services from Renown Electric

No matter which type of motor bearing an application uses, any amount of damage can result in costly problems. To prevent issues, it's best to keep any type of bearing appropriately lubricated and protected from excessive vibrations. Performing regular motor maintenance is another crucial task for safeguarding your equipment's longevity and reducing the costs associated with electric motor upkeep. A proper inspection of bearings to review the obvious reasons for failure can go a long way in increasing bearing life, and it's important to modify maintenance practices to prevent the issues from recurring.

For nearly 40 years, Renown Electric has served a diverse customer base with rotating assets [preventative and predictive services](#) designed to prevent equipment failure and avoid replacement costs. If you're currently experiencing a motor or generator issue, our ISO 9001:2015 certified facility is equipped to handle a wide range of [diagnostic and repair services](#). For maximum convenience, we also offer a [range of field services](#). If you have questions or would like to learn more, [contact our team](#) today.



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Renown Electric Motors & Repair Inc. is a privately owned company that has been dedicated to providing our customers with the highest quality electric motors and motor repair services for nearly four decades. Renown is an authorized dealer and service representative for most major manufacturers, so our customers are assured the highest-quality products and repairs. Our engineering expertise and production capability allows us to remanufacture all major AC & DC motors up to 50,000 hp.

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