Common Causes and Cures for Roller Bearing Overheating

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Maintenance technicians at a glass fabrication plant recently witnessed first hand how high temperatures can affect and potentially damage rolling bearings. Bearings in a fan used to evacuate superheated air during the glassmaking process began to overheat. Bearing temperatures, which normally hovered around 170°F (77°C), climbed to 195°F (91°C). While the fan continued to run, plant technicians consulted with a bearing engineer to devise a solution. But their efforts came too late: by the time the meeting ended, the grease inside the bearing had dried up and smoke had begun to emanate from the bearing, causing shutdown.

Failure analysis quickly pinpointed a cause: process temperatures of 1000°F (538°C) or more produced in the glassmaking process resulted in an ambient temperature of 220°F (104°C). The plant immediately took steps to shield fan bearings mechanically from the worst of this heat. In addition, the "floating" bearing in the fan arrangement was offset in the housing, providing it with more room to travel axially to accommodate shaft expansion.

Higher-than-normal operating temperatures, whether caused by ambient conditions or generated within the bearing itself, have the potential to harm rolling bearings. Normal operating temperatures differ, depending on the application. Maintenance technicians should be aware of this and know the common causes of, and remedies for, bearing overheating.

Electric Motors

The ball bearings used in most electric motors are pre-greased, shielded ball bearings. Normal motor bearing operating temperatures range from 140°F (60°C) to 160°F (71°C).

Overheating in electric motor bearings is generally lubricant-related. For example, when relubricating open bearings, users may inadvertently employ a low-temperature grease which does not provide adequate viscosity at the normal operating temperature. Or the user may over-grease the bearing, forcing bearing balls to push through excess grease as they rotate, leading to a sharp temperature rise. Another cause of overheating is mixing incompatible greases, which can reduce the consistency of the grease and possibly the overall viscosity.

Fans

Commercial fans generally utilize ball and roller bearings mounted in cast iron or pressed steel housings. Fans are exposed to a wide variety of ambient conditions, ranging from below-zero temperatures for rooftop fans to extremely high temperatures for fans used in industrial processes.

Normal bearing operating temperatures vary, depending on the environment and application. The standard grease in most fan bearings remains effective to an operating temperature of 180°F (82°C). If steady-state operating temperatures are higher than 180°F (82°C), consider using a grease with a synthetic base oil. Viscosity in a synthetic oil does not vary as much with temperature as in a standard mineral oil, and the rate of oxidation is much slower. For operating temperatures above 200°F (93°C), a circulating oil system may be needed. These systems pump clean, cool oil through a bearing arrangement.

In hot-gas fans, special measures must be taken to protect bearings from high temperatures. In virtually all cases, an aluminum disk or flinger placed on the shaft between the bearing and the fan casing can act as a heat shield. Often, a blower wheel or compressed air can be used to direct cooling air across the bearing housing or the shaft.

Pumps

Depending on the application, normal bearing operating temperatures in pumps range from 100°F (38°C) to 180°F (82°C), with most running between 140°F (60°C) and 160°F (71°C).

Although grease is used in some vertical pumps, oil is the preferred lubricant in the majority of pump applications. Standard bearing oils in pumps remain effective to approximately 180°F (82°C). If normal operating temperatures are higher than 180°F (82°C), a synthetic oil should be used; if temperatures exceed 200°F (93°C), a circulating oil system will probably be required.

As in other bearing applications, higher-than-normal operating temperatures in pumps can be caused by bearing overlubrication. Overheating can also be caused by bearing misalignment or ball skidding within the bearing. Specially designed bearings are available to eliminate ball skidding. Ideally, bearing temperatures in pumps, especially those in critical applications, should be regularly monitored.

Gear Drives

Bearings in gear drives normally operate at 160° (71°C)-180°F (82°C) and are lubricated with static oil systems. As improved technology permits reductions in the size of gear drives, there is a growing trend to transmit more power through a given size drive than ever before. This practice can cause bearings in gear drives to run hotter and may necessitate the use of alternative cooling methods.

In summary, proper bearing lubrication is the primary concern in all high-temperature applications. That concern is heightened by the trend of running industrial equipment at higher speeds than originally intended, further increasing bearing temperatures. The general rule is to provide the minimum viscosity required at the expected operating temperature: 100 SUS (20cst) for roller bearings and 70 SUS (13cst) for ball bearings. In addition, the increased thermal expansion of the shaft must be accounted for both axially (to ensure that high thrust loads are not induced) and radially (to ensure that radial internal clearance is adequate to avoid preload). The solution may also entail using a grease with a synthetic base oil or converting to a different lubricant delivery system, such as circulating oil.

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