

# A Crane's Critical Connection

## The importance of maintaining large slewing ring bearings in lifting equipment

In lifting equipment, the large diameter bearing serves as a joint between the upper structure and the undercarriage, providing a means of 360° rotation. Lifting devices typically have a complex load spectrum: the slewing ring bearing can simultaneously handle all combinations of thrust, radial, and tilting moment loading. The use of a slewing ring bearing provides yet another benefit. Its shaftless design eliminates the need for a spindle or kingpost. The center of the bearing remains open to allow passage of various hydraulic and control components.

Since the bearing is so critical, careful maintenance is necessary. More than 96 percent of slewing ring bearing failures are due to surface-originated lubrication problems, contamination, overloading, and improper installation and mounting. These surface failures occur much earlier than classical fatigue failures and are less predictable.

Inadequate lubrication is the most common cause of premature bearing failures. In slewing ring bearings, a heavy-duty, extreme pressure grease is required. When lubrication

is inadequate, surface damage in the form of roughening or waviness occurs. Later, fine cracks develop, followed by flaking. Contamination also causes failures. Dirt or other debris within the lubrication system acts as an abrasive, and accelerates the wear. Usually the bearing raceways are scratched or indented, again leading to fine cracking and, ultimately, spalling.

Slewing ring bearing life is calculated assuming infinitely rigid and flat mounting structures. A structure that distorts significantly under load, and/or one that is out-of-flat, applies loads to localized areas rather than evenly distributing them. This causes permanent deformation in the local area, leading to early failure.

The unique design of slewing ring bearings allows for combination loads to be handled efficiently. However, whenever a load that exceeds the bearing capacity is applied, permanent deformation could occur, again leading to a premature failure.

Safety is the primary goal in detecting turntable bearing problems. Excessive bearing clearance due to accelerated wear results

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in less overall stiffness in the entire system. This lack of stiffness is magnified tremendously at the bucket, causing a potential problem for the operator. Another safety concern relates to uneven work distribution. This is especially common among excavators and digger derricks where most of the work is done in the same general area. Poor work distribution leads to an uneven wear pattern usually causing excessive play.

The potential costs associated with a worn slewing ring bearing can be significant if the problem is not detected in a timely manner. A severely worn bearing can damage other components, such as the drive pinion and gear box.

While maintenance is critical to lengthening the life of large slewing ring bearings, the severity of use of heavy equipment means that eventually, any large slewing ring bearing will become worn. Detection of bearing wear makes repair a less costly alternative to replacement. If you practice proper maintenance and watch for common warning signs, a worn bearing is likely to be deemed repairable.

### Tips for Proper Maintenance

Preventive maintenance saves time, money, and extends the life of equipment. A regular schedule of raceway lubrication, torque checks on bolts, and gear lubrication is necessary even if the equipment has been idle.

**Bearing lubrication**—The bearing should be lubricated at regular intervals, with a heavy-duty, extreme-pressure grease. Slowly rotating equipment or oscillating applications, such as backhoes, excavators, and cranes, should be re-lubricated about every 100 hours of operation. More frequent lubrication—every day or every eight hours—may be needed on rapidly moving or continuously rotating equipment such as trenchers and boring machines.

While adding grease, the bearings should be rotated to spread the grease throughout, and enough grease added to purge the old grease out through the seals. This procedure helps to clean out contamination.

Over long periods of time, grease tends to dry out and condensation can form within a bearing. Therefore, grease should be introduced at least every six months, whether the equipment is operating or idle.

**Gear lubrication**—Most large bearings incorporate gear teeth and the gear lubrication requirements are not the same as for the bearing. Because

the meshing action of the teeth tends to squeeze out lubricant, the gears should be lubricated every eight hours on slow or intermittently rotating equipment, and more often on rapidly or continuously rotating equipment. Small amounts of grease should be introduced at the point of mesh between the gear and pinion.

**Bolts**—A check of bolt torque should be part of any routine maintenance procedure. The frequency of these checks depends on severity of service. Vibration and shock tend to loosen bolts, so periodic torque checks will ensure that the proper preload level is maintained.

Mounting bolts should be torqued to the proper level and checked periodically to ensure proper pre-tension. Improperly pre-tensioned bolts can fail, causing damage to equipment and, more important, injuries to workers. Additionally, tightened bolts tend to creep or elongate over a period of time, which reduces preload. Elevated temperatures will also increase bolt creep and this factor should be considered in developing a torque-check schedule.

**Seals**—Bearing seals should be visually inspected periodically to be sure they are fully intact. Insignificant as these seals may seem, they aid considerably in the prevention of bearing raceway contamination. ■