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Roll bearings and productive papermaking

IF YOU ARE READING THIS COLUMN, there is absolutely no need to explain the importance of reliably performing paper machine roll bearings. Since the major cause of bearing failure is due to inadequate lubrication of those critical bearings, we will discuss a current and innovative method to improve reliability of the roll bearings and the means for improved lubrication.

A history of limitations

There was a time when paper machine roll bearings were essentially unprotected and short lived. Simple labyrinth seals, specially formulated lip seals, and even felt seals were woefully inadequate for keeping contaminants out of the bearing environment.

Elaborate constant circulation filtration systems separated some water and debris from the lubricating oil and then attempted to furnish proper lubricant to the bearings. Oil with as little as 0.002% moisture content reduces the fatigue life expectancy of the bearings by 48%. Dried mineral oil in a moist air environment reduces the fatigue life by 80%, according to a study by tribologists Ciruna and Szieleit.

A continuous supply of grease, with water washout properties, was routinely recommended to purge moisture, dirt, and other contaminants from the bearing locations. Grease as a seal has its limitations, even if automatically supplied through a central system to each bearing location.

As a result, bearing failures were commonplace. Roll bearings were routinely changed out as frequently as every two months. Even then, some bearing failures occurred, sometimes with disastrous results. For example, a fire on one paper machine, due to a failed bearing, cost in excess of eight million dollars just to repair the machine.

Intense competition in the global paper industry makes it absolutely necessary to avoid unnecessary production costs such as those associated with inadequate lubrication and premature bearing degradation. Only the most productive papermaking companies survive. Futile attempts at solving bearing lubrication problems after they occur aren't the answer. Even the best oil retention and recirculation tanks only remove a portion of the entrained moisture, and constant purge grease systems used to eliminate contaminants do not solve chronic lubrication deficiencies.

A non-contact, non-wearing alternative

To enhance the reliability of the papermaking process, a workable method must be found that will keep machine roll bearings and their lubricants contaminant-free and prevent the contamination from entering the system in the first place. It is much more efficient to prevent contamination from entering the bearing environment than to deal with it after it has been established there.

In addition to contaminant elimination, the strategy should be to contain lube oil and/or grease within the bearing housing so as not to degrade the paper as it passes through the machine. There must be no contact within the device while it is in use, so that it will not wear or heat in use. There must be no limitation to the useful life of the bearing protection, nor should there be any frictional drag.

One such solution has been developed and has been in place in paper machine roll bearings around the world, in some instances running for more than 10 years. There has not been one report of failure of these bearing protection devices or the bearings even though some 750 known installations have been tabulated.

The protection device is known as the bearing isolator. More than a million and a half bearing isolators have been installed in various forms of rotating equipment, such as pumps, electric motors, gear boxes, steam turbines, and machine tool spindles, since it was first introduced to the process industries in 1977. Bearing isolators are non-contact, non-wearing, permanent, and absolute bearing protection devices.

Over-greasing of roll bearings is somewhat of a tradition in papermaking. The bearing isolators that are designed for roll bearings are made to accommodate the excess greasing, whether it be manually applied or from an automatic constant greasing system. Over-greasing of bearings is one of the most common reasons for bearing failure in the paper industry; bearing isolators practically eliminate this chronic problem.

Bearing isolators are a made-to-order item. Dimensions of the shaft, housing, and available protrusion length are necessary for the manufacturer to produce a specific isolator for the designated roll bearing. Normally, given these parameters, the isolators can be delivered to the point of use within 48 hours, or sooner if there is an emergency situation at the repair site. P&P