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Coal Fired Power Plant Slashes Maintenance Time

The conditions inside of a coal-fired power plant can place heavy stress on components. The dampers and burners have to deal with high temperatures and the presence of particulate. Bearings functioning in this environment have to be durable, long-lasting and must be able to operate without frequent maintenance. This was not the case at one North American coal plant. The plant manager and his staff spent too much time maintaining the bearings inside the wind boxes that control the air supply to the combustion process. The bearings still failed regularly despite hours of work each week. Bearing failure meant that the combustion mix had fluctuated, leading to damaged boiler tubes, higher emissions and increased fuel costs.

By switching from lubrication-hungry roller-element bearings to GRAPHALLOY self-lubricating bushings, the plant greatly reduced maintenance demands while achieving a more predictable combustion mix.

The coal plant has three steam turbines running, each capable of generating 400 MW. Each boiler has 24 wind boxes fitted with dampers controlling the amount of air for proper combustion. These wind boxes are operating in air ducts with temperatures up to 600°F. The dampers are located near the supply of pulverized coal and the fans pull a significant amount of coal dust as well as fly ash into the wind boxes. The specially designed roller-element bearings originally used on the wind box dampers could not be lubricated due to inaccessibility. These bearings have repeatedly failed for many years due to the high heat and the presence of particulates. Clogging and bearing failures at the plant had become routine. When bearings failed the dampers would bind and prevent the flap gates from opening and closing properly. In turn, this would short-circuit the cooling process and the unit would require a shutdown to replace the bearings.

To make matters worse, the internal wind box bearings were difficult to access. Valuable time was wasted opening the wind box and either replacing the bearings, or manipulating them to get them moving once more.

The plant manager explained that the outside diameter (OD) of the bearing and the damper shaft were very close. Due to this tight fit, all it took was a little rust, scale, or particulate and the bearings would lock up. Technicians had devised various workarounds to buy a little more time such as removing rust and scale. Alternatively, they would chip away an eighth of an inch of material from the bearing sleeve. These fixes helped temporarily, but ultimately failed to solve the underlying problem. Plant availability suffered due to shutdowns and unscheduled maintenance. The dampers would either be locked shut or left open. The burners would end up with either too much air or not enough. Improper combustion led to unburned coal being exhausted into the environment and hot spots damaging boiler tubes.

Another consequence of bearing failure concerned uneven air/coal mixes between the wind boxes. With 24 boxes per boiler, it is important for plant reliability to maintain the same air/coal mixture in each box. This was difficult to manage as bearing failure and damper lock-up was a frequent occurrence.

With coal plants being challenged to meet strict emissions standards, the last thing the facility wanted was sudden spikes in NOx or CO. That could make them subject to inspection, heavy fines and even permanent shutdown. Too much oxygen and the NOx levels would soar. Too little oxygen and the CO levels would head beyond acceptable limits. Additionally, a reducing atmosphere (not enough oxygen) is harmful to boiler tubes.

It would be bad enough if we were talking about a few bearings. But the facility had almost 600 internal and another 600 external roller bearings in use for the wind boxes of its three steam boilers. At that scale, bearing maintenance became too big of an issue to ignore. This problem had become a nightmare.

Because the average amount of trouble-free operation of the roller bearings was about two months, the plant manager reported that he was searching for a solution. He decided to run a pilot project with an improved bearing design, installing self-lubricating GRAPHALLOY bearings in two-bolt cast iron flange block assemblies in the harshest positions inside one of the wind boxes to see how they performed.

After four months, the plant manager decided to roll out this technology across the facility. Over the course of this year, almost 600 external four-bolt wind box damper bearings will be replaced with these self-lubricating units as the external bearings can be replaced without an outage. By the end of next year, in tandem with scheduled shutdowns, another nearly 600 internal two-bolt bearings will be replaced.

The GRAPHALLOY bearings have now been in continuous service for almost half a year without issue and the plant manager is keen to see how long they keep operating without intervention.

Further, the plant has observed an improved combustion ratio. That equates to fewer emissions, higher power output, lower fuel consumption, the elimination of hot spots in the tubing and fewer maintenance headaches.

The plant manager's estimation, based on his experience to date, is that these bearings can continue untended for as much as five years. This will save him an enormous amount of time and money each year, enabling vital work to be done in other areas of the plant.