Heavy-duty Drives Keep Coal-fired Facilities Running Smoothly

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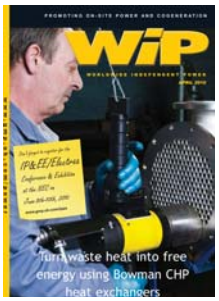

Nuttall® Gear

An Altra Industrial Motion Company

Heavy-duty drives keep coal-fired facilities running smoothly

By John G. Proven, P.E., Nuttall Gear

Gearboxes play an important role in the productivity of coal-fired power generation plants. The primary function of a gearbox is to change the speed of driven piece of equipment when the speed is different from the driver. Drivers in a power plant are typically steam or combustion turbines, diesel engines, or electric motors. Heavy-duty, mission-critical drive applications include coal conveyor systems, coal crushers, boiler feed pumps, and turbine generators that all operate at speeds different from the drivers. The reliability of the gearbox in any application depends on the following:

- The design parameters are properly specified
- The unit is properly maintained
- The unit receives proper lubrication of gearing and bearings

Moduline Integral gearmotors are full drive solutions including reducer, motor and brake. Units are typically installed as coal conveyor drives.

Keeping the boiler fed

Depending on the facility, a variety of conveyor systems are utilized to unload barges and railcars and move coal from bunkers to the furnace. These include long, overland belt conveyors, inclined/declined conveyors, and bucket conveyors. Conveyors often traverse long distances and may require multiple drive assemblies positioned along the length of the conveyor.

Reliable and durable conveyor drive mechanisms are needed to meet specific performance requirements while operating in tough, dusty conditions. Nuttall Gear, formerly the Westinghouse Gearing Division, has been providing heavy-duty speed reducers for power generation conveyor and crusher systems for decades and many Nuttall Gear units have been in service for over 60 years.

While some off-the-shelf models are available, typically each conveyor application requires a customer-specific solution engineered and manufactured to meet certain size parameters, special speed requirements, reduction ratios, environmental conditions and mounting requirements. Those parameters include the following:

- Input speed and power
- Required output speed and torque
- Service factor based on application - AGMA standard recommendations are good but the user must identify any unique factors.
- Environment
- Configuration requirements
- Duty cycle
- External loading requirement
- Desired design life - not necessarily infinite

Standard TDS model gearbox. Ideal to be customized for use on sizer and crusher applications.

The design engineer or the equipment user must provide this information to the gearbox manufacturer, as they know the required process. Gearbox OEMs are familiar with a large number of applications but not necessarily the expert in any of them.

Type SU/SD high-speed gears are designed for heavy duty applications including power generation pumps and turbines.

As a total drive source, Nuttall Gear, together with other Altra Industrial Motion brands, provides drive assembly packages that may consist of both mechanical and electrical drive components including an electric motor mounted on a bedplate, couplings and coupling guards, backstops, creep drives, chains, sprockets, clutches, and shoe or disc brakes. The engineering required involves incorporating specifications for each piece of the assembly and ensuring that the individual components when assembled result in a system that meets or exceeds the customer's performance requirements.

Complete drive assemblies feature the compact integral gearmotor design pioneered by Mr. R. D. Nuttall approximately 100 years ago. Nuttall Moduline® units can be applied with ratings up to 200 HP and output speeds from 1.5 to 1430 RPM. Depending on customer service requirements, the system can be designed to AGMA Class I, II or III service factors. AC motors, both standard and high efficiency, and DC motors can be incorporated again depending on customer preference or performance requirements. A full range of optional motor modifications can be utilized to meet exact requirements. Ductile cast iron housings and tapered roller bearings are standard gearbox features. Special shafts, seals, side rails, and brakes, plus a variety of mounting positions are also available. No external lubrication system is typically required. These units depend on internal splash circulation and the size of the units normally does not result in the need for an external heat exchanger.

Drive system reliability and longevity is enhanced through the use of through hardened steel helical gears, heat treated using in-house furnaces, for precise quality control, and turned, hobbed, and finished in the same facility. The application of through hardened gearing generally results in a larger, more robust gearbox, which is more resistant to shock loads that are experienced regularly in many conveyor applications. Through hardened gearing also provides exceptional wear-in properties and typically adds to the longevity of the product.

Controlling boiler feed pump speed

High-speed gearing is required for boiler feed pump applications. The Nuttall Gear SU/SD model is designed to handle the job. Units are available in ratings to 25,000 HP, with speeds to 20,000 RPM in ratios up to 15:1. Millions of hours of operation have proven the design integrity and reliability of these units on high-speed pump drives including boiler feed pump applications.

Dynamically balanced, precision, double helical gearing provides uniform load distribution and quiet running. Oversized split-sleeve bearings allow for smooth, efficient operation. Other features include split labyrinth non-contact oil seals and rigid cast iron or welded steel housings for long life. Optional multi-speed (shifters) gear train variations with either manual, pneumatic or hydraulic shifting are also available.

These high-speed units typically have a self-contained circulating lube oil system. The system will include a pump motor assembly (or a shaft-driven pump) and a heat exchanger and will incorporate various temperature, vibration, and pressure monitoring devices to provide the control room operators with information necessary to assess the unit's overall operating condition.

continued

Through hardened precision manufactured helical gearing provides exceptional wear-in properties and a high resistance to unexpected shock loads.

This critical information will indicate when a system should be taken off line and hopefully prevent an unplanned outage.

Additional functions

Gearboxes can be found in other areas of the facility that include the coal processing area of the plant. Coal pulverizers receive coal from the conveyors, and pulverize the coal into a fine powder as the final preparation for combustion in the boiler. These heavy-duty gearboxes typically operate in a very harsh environment and require special considerations to prevent contamination and accelerated degradation of the internals of the gearbox. The pulverizer generally will employ the use of a right angle gearbox.

Coal crushers require the application of a very durable gearbox as they break the coal into smaller more manageable and uniform pieces before being fed to a sizer. The sizer further refines the uniformity of the particle size prior to feeding the pulverizer. These units may be found at the power plant or at a coal processing facility that serves the power plant.

Gearbox service and replacement

As indicated above, gearboxes require service to maintain the continued reliable operation of the individual functions of the equipment and the power plant. Nuttall Gear has the ability to repair, rebuild, or upgrade a gearbox to protect the utility company's investment by not only servicing gearboxes manufactured by Nuttall Gear (and Westinghouse on older units), but also those produced by other manufacturers. In many cases, the original gearbox supplier is no longer in business and the power plant must rely on the "reverse engineering" capability of a full-service engineering department.

In closing, the initial specification of the gearbox must consider the performance expectations of the customer. The unit must be engineered, designed, and manufactured by the gearbox supplier correctly. The customer must properly maintain the gearbox including scheduled replacement of wear items and ensure that the unit is being properly lubricated with clean oil.

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