

Automatic saving

John Pulliam, Alemite, US, describes how the importance of automatic lubrication systems has grown in the mining industry, why proper lubrication is important and how it can maximise uptime to improve productivity.

Coal mining operations invest millions of dollars annually in off-road equipment, conveyors, draglines and other machinery. With increasing pressure to boost profits on existing capital investment, mining maintenance supervisors are realising the importance of proper lubrication to maximise machinery uptime and control rising maintenance and repair costs.

The need for automatic lubrication

Joe Dunbar is the production supervisor and technical service specialist at Anchor Hydraulics in Madisonville, Kentucky and has worked with the mining industry for more than 20 years. He estimates that a typical coal mining operation uses 40 to 60 pieces of equipment, equipment that requires lubrication, in some cases as frequently as every three minutes.

Lubricating large volumes of equipment by hand is not feasible. Dunbar estimates that a typical mining operation might use as much as 12,000 lb of grease/month. With such high lubricant usage rate, the annual cost of grease used in one of these operations can easily run into tens of thousands of dollars. When the cost of labour is added to that total, it is easy to recognise the potential cost saving that an automatic lubrication system can offer.

Mining equipment, such as conveyors, loaders and dozers, must perform for 16 hours a day or more, often seven days a week, without stopping. It is not financially feasible to halt operations to apply lubricant. With automatic lubrication systems, the equipment is lubricated as required

without the need to shut down the equipment. In addition to nearly constant operation, the equipment is frequently exposed to dirt and highly abrasive coal, moisture, temperature extremes and mechanical stress, causing bearings to wear rapidly. Automatic and timely lubrication plays a major role in maintaining a protective barrier for moving parts, substantially reducing equipment failures.

The primary advantage of automatic systems is that lubrication is applied in measured amounts on a regular basis. Automatic systems prevent extreme fluctuations between over and under-lubrication, which can significantly reduce bearing life. Since automatic systems are closed systems, lubrication points are kept contaminant-free and product spillage is virtually eliminated, improving safety and reducing waste. These systems also minimise the possibility of human error, such as overlooked lubrication points or the application of incorrect lubricants.

Maintenance best practice

As the price of petroleum products continues to rise, coal has experienced a resurgence in popularity as a lower cost, more readily abundant domestic fuel source. This rising demand for coal, along with the rising cost of equipment and labour that is needed to extract coal, adds to the importance of proper lubrication. In recent years, Joe Dunbar has witnessed a big push in larger mining operations for improved documentation of equipment maintenance. By keeping more detailed service records, mining maintenance supervisors now have tangible evidence of the importance of regular,

planned lubrication. Joe has found that mining supervisors communicate regularly with each other to determine the best maintenance practices and to standardise these practices within the industry. Armed with detailed records, maintenance supervisors no longer have to rely on trial and error when it comes to maintaining their equipment. The complexity and high cost of equipment demand that policies and procedures are established to ensure proper lubrication.

Automatic systems improve safety

Automatic systems can also reduce the total cost of ownership through improved employee safety. Lubricating equipment manually in the mining industry is difficult and sometimes even impossible because of the enormous size of the equipment. Personnel must perform maintenance at dangerous heights, in a greasy, dusty environment. With automatic lubrication, maintenance is performed regularly without the need for an operator to put himself into a potentially hazardous situation. Despite the 'automatic' nature of these systems, they still require regular visual inspection from maintenance personnel to ensure that reservoirs are replenished and in working order and that lubricant delivery piping has not been punctured or crushed.

Automatic lubrication systems

There are three types of automatic lubrication systems: parallel injector, parallel



An Alemite battery operated grease gun is used to lubricate bearings. Grease guns are still the best option for lubrication in some situations. Battery operated grease guns make manual lubrication quicker and more efficient than manual grease guns.



An Alemite high pressure series modular divider valve is used to supply lubricant to points on off-road equipment.

dual line and series progressive. Each of these systems has a specific application within the mining industry. Although the series progressive and dual line-type systems are commonly used on mining equipment, the most popular type of system for coal mining is an injector system.

Injectors are positive displacement devices that operate in two stages. Firstly, system pressure builds, forcing the injector to discharge a precise amount of lubricant. The injector resets when a compressed spring inside it forces the measuring piston back to its resting position after

the pressure is vented back to the reservoir. Injector systems typically use a controller to activate the pump. Once the controller activates the system, the pump pressurises the line and injectors fire as they reach their set discharge pressure. After the injectors discharge lubricant, a vent valve relieves pressure in the system. Injectors operate independently of, or in parallel with, each other. Therefore, their order of operation is simultaneous. Since injector systems are parallel systems, the malfunction of one injector does not result in the stoppage of the entire system. Injectors allow the adjustment of each outlet and a wider range of output than valve-type systems. Injectors can be removed or added without redesigning the existing system. Field testing confirms that injector systems can operate reliably in harsh mining environments for years without replacement.

Manual systems

While automatic lubrication is needed for many applications, manual lubrication is sometimes the only practical means by which to apply lubricant to bearing surfaces. There are two basic forms of manual lubrication: using a manual or battery powered grease gun through fittings inserted directly into the bearing housing or using remote junction header blocks with lubrication lines attached to bearing points. There will always be a need for some form of manual lubrication in areas where piping is not practical or the number of bearings does not justify an automatic system. With manual systems, lubricant lines are generally within sight of the technician and can be visually checked. However, with manual lubrication, there is no reliable record of the maintenance task. Also, caution must be taken when lubricating manually as operators, using grease guns that can develop pressures as high as 15,000 psi (1035 bar), run the risk of blowing out seals or collapsing bearings.

A grease gun is the most expensive available means of lubrication because someone is required to operate it. Not only is the direct labour cost considerable, but typically the amount of lubricant dispensed in a manual application is far more than the bearing requires or can handle in the short-term.

Cost

From a total cost of ownership perspective, automatic systems have higher upfront costs than manual systems, but are

much less expensive over time because they minimise labour and lubricant costs while increasing bearing life. Payback is typically fast and profits are improved with lower maintenance costs and increased productivity.

Joe Dunbar estimates that a mining operation that loses just 5% of uptime over the course of a year could easily pay for an automatic system. If the cost of labour required to apply lubricant to individual points and the waste of lubricants are factored in, system payback could be achieved in just a few months.

Joe Dunbar routinely installs injector systems on Caterpillar 992 loaders. The installation of an injector system on one of these loaders typically runs from US\$ 8000 - 15,000. Dunbar admits that operators could lubricate these loaders manually, but it is likely that their lubrication would be inconsistent. There are 25 lubrication points on a Caterpillar 992, some needing lubrication every three to five minutes. To lubricate the loader properly, therefore, would take approximately three to four hours of labour/day. In addition, manual lubrication would require equipment shutdown, which would only add to the

labour cost and reduce efficiency further.

Investing in automatic

Mining maintenance supervisors recognise that automatic systems provide lubrication documentation. A controller records the amount of lubricant used and the frequency with which it is used, as well as its consistency. An automatic lubrication system takes the burden of the lubrication maintenance task away from the operator. Furthermore, automatic systems are flexible and expandable. They are designed to meet the end user's specific application, taking into account environment, temperature, type of lubricant to be used and the distance that the lubricant will need to be pumped. ■



The Alemite CLS 1000 controller is used to activate a pump that supplies the injectors with lubricant. The controller allows remote monitoring and control of automatic lubrication equipment.