Getting the Most from Single-Point Lubricators

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In the petrochemical industry, bearing faults drive the majority of repair events for motors, pumps and compressors. In a study performed at 12 petrochemical plants, the data showed that approximately 60 percent of all motor repair events originated with bearing troubles.[1] This number differs significantly for pumps and compressors because of the impact on equipment life due to the performance of mechanical seals. Historical data gathered at these 12 facilities showed that bearing problems represent approximately 70 percent of all repair events for motors and 30 to 35 percent for pumps and compressors. This climbs to 80 percent in equipment that is selected and supplied with lifetime lubrication.[2]

When a bearing defect is allowed to progress to a catastrophic failure, the failure will be far more costly. This is because damage tends to grow exponentially with time. As equipment damage grows, so does the potential for extended downtime. Under these circumstances where repeated bearing failures are present due to bearing distress caused by lubrication deficiencies, it should be simple to justify the use of innovative techniques to reduce the number of failures.

The single-point lubricator is one method of extending bearing life. This technology was introduced into the petrochemical industry about 30 years ago with mixed results. In recent years, manufacturers have introduced significant technological advances that have increased the life of bearings and the reliability of single-point lubricators.

Lubrication by Automatic Single-Point Lubricators

Single-point automatic grease lubricators are refinements of the old compression grease cup (Figure 1). Grease cups are small containers filled with grease that are fitted to the bearing.

Click Here to See Figure 1.

The principle of operation is to force the grease into the bearing by turning down the cap or piston covering the grease charge. The next development in this line of products is the spring-loaded grease cup. The spring-loaded lubricator, a simple refinement of the compression cup, is accomplished by replacing the screw-down cap or piston with a spring-activated, leather-packed plunger. This plunger, when engaged by the spring pressure, slowly forces grease into the bearing. Neither of the two types of grease cups is recommended for use under conditions of wide temperature variation, where the consistency of the grease may be affected.

Single-point lubricators differ from the traditional grease cup by employing either a spring or an expanding gas pressure to exert a force on the cap, piston or diaphragm in contact with the grease volume. These continuous forced grease injection devices are screwed into the threaded grease port. They range in size from 2 to 18 oz. (60 to 250 cc) of grease capacity and can develop pressures as high as 65 psi (4 bar).

The original device, as shown in Figure 1, is spring-loaded. The flow of grease is adjusted by the use of a metering control principle. A piston O-ring seal, which creates a changing level of friction as it moves along the tapered wall of the reservoir dome, adjusts the flow. The changing resistance is designed to counterbalance the changing force of the compression

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spring as it gradually expands. Because the lubricators operate with a single universal spring (other sizes are available) at the lowest reliable pressure (under two psi), no grease is moved into the bearing until it is needed.

Variations in discharge flow rate are achieved by inserting different size orifices into the discharge nipple of this field-refillable lubricator. In application, the design is highly affected by the ambient temperature and the age of the grease in the canister. Tests performed by the author on the spring-loaded lubricator showed that in some applications the bearings would be overgreased, while in others, no grease would flow at all.

Click Here to See Figure 2.

The device shown in Figure 2 is a significant improvement on the original concept of the grease cup. Further details in the operation of lubricators of the same design as Figure 2 show a cylinder containing a pressure generator and a piston, which pushes the prepacked lubricant into the bearing in response to the pressure generator.

The pressure generator is a rubber bladder containing an electrolytic solution and a sealed plastic tube containing a galvanic strip of specially treated metal. After the injector is installed, the activating screw is used to break the plastic tube. This exposes the galvanic strip to the electrolytic solution, resulting in an electrochemical reaction within the bladder which produces a gas. As the bladder pushes against the piston, the piston pushes the lubricant out of the injector and into the bearing. When all of the lubricant has been expelled into the bearing, the unit expires and is thrown away, and a similar unit is installed.

The rate of lubricant ejection is a function of the gas production, which in turn depends on time and rate of reaction. Consequently, the rate of lubricant discharge can be predesigned into this device to accommodate the user’s discharge rate specifications.

Should the lubricant discharge flow be restricted due to viscosity increase, hardening of the grease or mechanical restriction in the supply line, the flow will be reduced or stopped. Under these conditions, the gas pressure will increase to a maximum of 136 psi until normal flow is restored.6 If resistance to lubricant flow is reduced, the lubricant flow will temporarily increase. This will continue until equilibrium between the amount of gas generated and the amount of lubricant discharged is reached.

Similarly, as with the older devices, the discharge rates are affected by ambient temperature variations because of the increase or decrease in the speed of the electrolytic action resulting from temperature changes within the bladder. As the temperature rises, the discharge rate increases and as the temperature drops, the rate decreases. A sudden large increase in temperature also causes the lubricant to expand within the unit, which will cause a temporary increase in discharge rate. Conversely, a sudden drop in temperature will cause the lubricant within the unit to contract. This results in a temporary decrease in discharge rate, until the gas production within the bladder compensates for the reduced volume within the unit, resulting from the sudden temperature drop.

For lubrication of electric motor bearings ranging from 25 to 400 horsepower, injector manufacturers recommend a unit, which at an ambient temperature of 77ºF (25ºC) would discharge approximately 0.166 cc per day and would be in service for 24 months. Elevation of the ambient temperature to 113ºF (45ºC) would increase the grease discharge rate by a factor of 4 to 0.66 cc per day, resulting in six months of service life for the device.

Click Here to See Figure 3.

Newer electromechanical devices are more sophisticated and capable of delivering lubricant to multiple machine points. A typical cross-section of one such device is shown in Figure 3. These devices consist of a reusable drive motor (battery or direct-wire powered), a refillable/replaceable lubrication canister and a small pumping device. These units can be set for different discharge periods and be turned on and off with a switch. They are also temperature independent and have precise discharge periods. Additionally, some of these units can be connected to a PLC to monitor operating conditions.

Newer units are available in capacities ranging from 60 to 500 cc (2 to 36 oz.). The choice of selector switch fixes the rate of gas generated in the electrochemical cell. The dispenser is adjusted to deliver lubricant at the specified rate against atmospheric pressures (14.7 psi absolute). Added backpressure will reduce the discharge rate. Depending on the manufacturer, selected units are capable of developing discharge pressure that exceeds 350 psi (23 bar).

Regardless of the type of device selected, questions remain on the appropriate method or technique that should be employed to lubricate bearings. Various user organizations employ different approaches of how to properly apply grease to different bearing configurations. A study of 12 petrochemical facilities showed that lubrication practices for grease bearings of general-purpose equipment varied, from one extreme of having no program for relubrication to the other extreme of employing continuous lubrication via oil mist. Four plants stated they had no lubrication program and ran equipment to failure. Correct grease application is essential to assure that neither excessive nor insufficient grease conditions create component failure. Match the manufacturer's recommendations for grease volume requirement with unit output when using single-point lubricators. Also consider these conditions:

Area Classification
Make sure that the lubricator you are considering is designed to meet the electrical area classification of the area of the plant where you plan to install it.

Overlubrication of Bearings
Too much grease in a bearing or its housing causes churning, resulting in a sharp increase in temperature and often, premature lubricant and/or bearing failure. On start-up, grease-lubricated bearings expel grease into vacant spaces around the housing. To prevent churning, there must be sufficient empty space in the housing to accommodate this grease. Relubrication volume is application-dependent, but a common rule for grease application is to pack the bearing completely, but fill only one-third of the bearing housing.

Underlubrication of Bearings
Even with the correct grease in your single-point lubricators, underlubrication can occur. The consequences are excessive heat and eventually metal-to-metal contact between bearing components. Always take into account the changes in ambient temperature at your site. For example, a common practice at a plant using electrochemical devices was to purchase 24-month lubricators to be replaced yearly. This was done to compensate for high temperatures during the summer.

Failure to Prevent Lubricant Contamination
Lubricant contamination is a leading cause of bearing failure. Dirt particles, other contaminants and the application of incompatible grease are all factors that increase equipment failures. The use of two incompatible lubricants will lead to deterioration in lubricating capability.

Using the Wrong Seals
The use of the correct bearing design (seal and shields) supplemented with a bearing isolator can be the difference between long-term reliable service and a "bad actor." Review all your applications with the bearing manufacturer to assure an optimum fit.

Failure to Relubricate Bearings
Even without exposure to contaminants, lubricant quality can deteriorate over time. Although single-point lubricators will continue to operate, failure to keep track of lubricant condition and age can lead to premature equipment failures. Contact the bearing manufacturer for recommendations on optimum lubricant replacement intervals.

Failure to Provide Relubrication Training
Maintenance technicians commonly receive training on bearing selection and installation, but not lubrication. Ensure that technicians are thoroughly trained in lubrication fundamentals as well.

Recommendations

Lubrication should not be left to chance. Optimized grease lubrication requires knowledge of bearing configuration, lubricant and operating conditions. Single-point lubricators should be selected and applied judiciously to obtain the desired extended equipment life. These lubricators have their place, but cannot be applied indiscriminately. They are quite useful in keeping bearing housing grease cavities full, keeping in mind the importance of bearing design and shield application. It is important to remember that this advantage can become a disadvantage if an overgreasing situation is created. Single-point lubricators are attractive in inaccessible locations. However, inaccessible should not mean forgotten. Climatic conditions and age can lead to changes in grease quality, and eventually to separation problems, which are frequently observed in many plants.

It is the responsibility of maintenance professionals to consider the cost of using single-point lubricators for every lubrication point in the plant. One must be cautious of grease compatibility issues when applying single-point lubricators with the refillable feature. The wrong grease or the mixture of incompatible greases can create as much trouble as improper lubrication does.

Depending on the application, single-point lubricators can extend the life of rotating equipment and increase reliability while significantly reducing the cost of applying the lubricant. In these days of reduced budgets and staffs, these devices can provide increased long-term service for the general-purpose equipment of the plant.

References

1. Bloch, H., (2000). “Practical Lubrication for Industrial Facilities.” Chapter 13, Fairmont Press, Inc.
2. Bloch, H. and Rizo, L. (1984). “Lubrication Strategies for Electric Motor Bearings in the Petrochemical and Refining Industry.” NPRA.
3. Bloch, H. (April 1978). “Optimized Lubrication of Antifriction Bearings for Centrifugal Pumps.” ASLE Paper No. 78-AM- ID-2.
4. Booser, E. (Aug. 21, 1975). “When To Grease Bearings.” Machine Design, p. 70-73.
5. Digilube Systems. Electrolube Automatic Electronic Lube Dispensing Systems. “Technical Bulletin A.T.S.” Springboro, OH. www.info@digilube.com/.
6. Permalube. “Technical Data Bulletin 10473-2-2.” Quincy, IL. http://www.permausa.com/.
7. Lubesite Systems, Inc. Kingston, NC. www.lubesite.com/products/product_200.html.
8. PLI, LLC. Racine, WI www.memolub.com.

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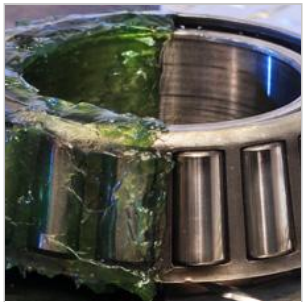

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