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Sealing Options for Self-Lubricated Bearings

Contamination is one of the most common causes for the failure of journal bearings. Metal bearings combat this problem with the use of grease zirks and maintenance schedules that are imposed on the end users. Grease is needed on a regular basis throughout the life of the machine to purge contaminants. This is a result of the inability of the bearing surface to ingest the particulate. Self-lubricated bearing manufacturers typically design bearing liners that are soft enough to ingest contaminants. Each manufacturer of this type of bearing uses a different construction to try to best solve this problem. In the case of PolyLube™ Fiber and MRP bearings, the liner architecture is designed with macroscopic pockets that allow debris to be ingested without compromising the transfer of PTFE from the bearing ID to the shaft surface. No matter how good the design of any bearing, there is still a limit to the amount of contamination that can be ingested. After this limit has been reached, damage to the shaft and bearing will continue until the joint is inoperable. Some typical applications that have environments that typically are highly contaminated are track roller systems used on off-highway equipment, joints in lower areas on earth moving equipment such as bull dozers and skid-loaders, and linkage systems in seeding and fertilizing equipment.

Polygon Company has explored options for extending the life of the PolyLube™ product lines with the use of seals. There are three options that are practical for today's highly contaminated bearing joints. These options range from a temporary solution for machines that are designed for a low cycle life, to a high cycle machine that will have an extended life. The amount of protection and the life of the seal are directly reflected in their unit cost. The three seal options that are most common are the o-ring, the canned radial lip seal, and the trak or AP seal.

The o-ring is the least expensive option. This seal is currently only for use with the PolyLube™ GT PTFE tape bearing liner and the PolyLube™ MRP liner. These liners are easily machined to accept the o-ring internally. This option should be used in mildly contaminated applications that are not in direct contact with the soil.

The canned radial lip seal is the option that is currently being used with increased frequency. This seal will be external to the bearing. The type of seal that is currently being recommended is a triple lip oil impregnated seal. This seal should be sized to fit the same housing bore that the PolyLube™ bearing is pressed into.



Polygon's application engineers will make recommendations to allow for the bearing and the seal to use the same housing bore. Design changes in the diameter of the housing bore may be necessary to accept both the PolyLube™ bearing and the seal.

The canned radial lip seal will have a finite life with respect to the design life of most machines. Drying and cracking of the seal is the failure mode that will take place. This does not mean that the joint will then fail before the useful life of the machine has past. The wear life left in the bearing may still be adequate to extend through the design life of the application. To keep the seal supple and maximize its life, Polygon Company recommends that the seal be oil impregnated. This type of seal and bearing configuration is currently being utilized in the heavy equipment industry. The life and cost of the radial lip seal will be greater than the o-ring option. From an economic standpoint, the cost of maintenance, or greater cost of neglect, will more than make up for the design improvement within the first year of use. This seal and bearing configuration will also allow for inspection and replacement of these seals to extend the life of the bearing and joint. The cost of replacing one shaft, considering the unit cost of the shaft and the man-hours needed to replace it, would pay for seals throughout the entire machine.

The final option for bearing protection is the trak or AP seal. This seal is by far the best option from the protection standpoint. It is also the most expensive seal, usually costing 4 – 5 times the amount of the bearing. Use of this seal will require a heavy wall PolyLube™ bearing to keep from costly machining for each housing bore. The outside diameter of this type of seal is typically a minimum of 0.75" larger than the inside diameter. Typically, the life of this seal should extend for the entire life of the machine. This seal is the "Cadillac" of the options presented.

Any design change has to be well thought out for the trade offs that are required. In the case of an addition of a seal to the design, the trade is extended life of the joint with reduced or elimination of maintenance vs. additional unit cost of the seal. The cost of machining and installing grease zirks will also be recovered when replacing greased joints. This cost savings will help to offset the disparity in unit costs of components. Polygon Company has made it a priority to suggest options that do not require grooves to be machined into the housing bores. Polygon Company is working diligently to offer total solutions to the economic and design issues that face engineers on a daily basis.