Vertical Loop Reactor

Power Transmission System

- Increasing Bearing Reliability
- Dodge System1 Advantage

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Power Transmission system of the Vertical Loop Reactor

The basic power transmission system of each disk aerator set of a VLR system consists of:

- (2) bearings
- (1) 4 pole motor (20-50hp)
- (1) Shaft Mounted reducer, reduces motor RPM from 1750 to disk aerator requirements of 30-60 RPM (58:1 to 29:1)

The shaft sizes range from 3 to 6 inches in diameter, and can be very long. Relatively small diameter - long shafts can have excessive run out, with some shafts wobbling almost +/- 2 degrees. If the bearing sealing system cannot maintain proper contact, there is the possibility that contamination can enter the bearing, thus cause shortened life.

The issues with the existing PT system were the use of competitor’s setscrew bearings that were marring the shaft and in some cases leaving the shaft ends unusable due to the amount of damage attained when the bearings failed. What is crucial in the application of bearings in this environment is the sealing system. A poor sealing system allows the incursion of water into the bearing cavity, which accelerates grease degradation, and permits metal-to-metal contact. This rapidly leads to the bearing’s cage failure.
Increasing Bearing Reliability

From another similar application, another situation where a competitor’s bearing failed due to ineffective sealing. The single contact seal could not effectively protect against shaft wobble and allowed moisture ingress into the bearing.

The bearing shown in this picture exhibits symptoms of general lubrication failure. In general, the procedure of bearings failing in this manner starts with some form of water ingress into the bearing cavity, and mixing with the lubrication. The changes the properties of lubrication, but moreover allows metal-to-metal contact to occur - which abrades the cage and allows the spherical rollers to skew.

Eventually, the cage will become distorted due to the increasing friction produced by roller skidding. Next, the bearing will begin to lose its internal clearances and heat will begin to increase which further breaks down lubrication properties.

Eventually, the cage will snap and the rollers will tend to break free. Next, rollers will tend to fall out of the bearing and the inner ring will ride on the outer ring, which creates a lot of heat and destroys the lubrication, which turns into a hard cake (soap base). One thing that is also noticeable is the presence of rust on the installation side of the bearing, indication that the area is quite damp.
The Solution

Shaft wobble can occur due to the general symmetry of the aerators. These shafts tend to be long relative to the shaft diameter. Below is an example from a similar power transmission arrangement. In this real life example, the shaft length between bearing centers is 27 feet (324’), the shaft diameter is only 4”, and the center axial tube is approximately 8” in diameter.

![Diagram of power transmission arrangement with labeled parts]

For a reliable system, the bearing system should permit the maximum amount of static and dynamic imbalance possible. The general type of bearing recommended for this application would be a spherical style of bearing. The sealing system employed to protect the bearing has to be able to protect the bearing cavity during wobble. The patented DODGE Trident seal has proven itself effective in protecting bearing lubrication in instances of shaft misalignment.
Dodge Trident Seal Operation

The Trident triple lip contact seal is designed to eject dirt and moisture from the bearing and provide fresh grease to the bearing at all times.

The tapered seal land allows constant lip contact even during misalignment.

The seal is available on DODGE Imperial and ISAF bearings.

Another Benefit to Dodge Imperial Bearings

- Shipped installation ready (also pre-lubed) and requires no component assembly
- Clearance setting is accomplished by turning the nut a specific distance past the zero point
- All Imperials available in expansion & non-expansion
- Machined feet to close tolerance for easy alignment
- Higher speed capacities than competitive products
- No fretting of the shaft because the bearing is installed via a patented adapter sleeve
The Dodge System1 Advantage

To simplify and lessen the cost of procurement of the system, Dodge field sales engineers utilize a unique group within the organization called System1.

http://www.dodge-reliance.com/system1/index.html

This group has the capability of assembling the complete system package quotation. This typically can save thousands on a project basis. The System1 group assembled the complete retrofit package consisting of bearings, motor, shaft mounted gear reducer, mounting structure and belt guard.
The Solution

The Dodge field sales engineer utilized DODGE Imperial bearings (below), and System1 support for a recent project.

The end user and consulting engineer were thrilled with the speed of procurement and installation of the system for a large aeration disk retrofit project.

The reducers were supplied with premium efficient motors, DODGE Torque ARM with twin taper bushings. The reducers, belt guards and motors were supplied as one unit.

As the end user indicated “all we had to do was pick up the aeration disks with a crane, slide the new equipment on the shaft, tighten them down and we were done”. The systems have been operating faultlessly since.