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PUMPS & SYSTEMS

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THRIVING Under Harsh Conditions

Also Inside:

- Peristaltic Pumps for Petrochemical and Mining
- Screw Pumps for Asphalt
- Cryogenic Treatment of Pumps
- Magnetic Drives Revisited

Special Section: FSA

ACHEMA 2006

Cover Photo Shows:
Klaus Union - Magnet Drive Pump
Model SLM NVO 350-300-400-31E14
8,000 GPM - 150 ft TDH - 500 HP

High Profile, Low Maintenance

Boris Nitzsche, Klaus Union, Inc.

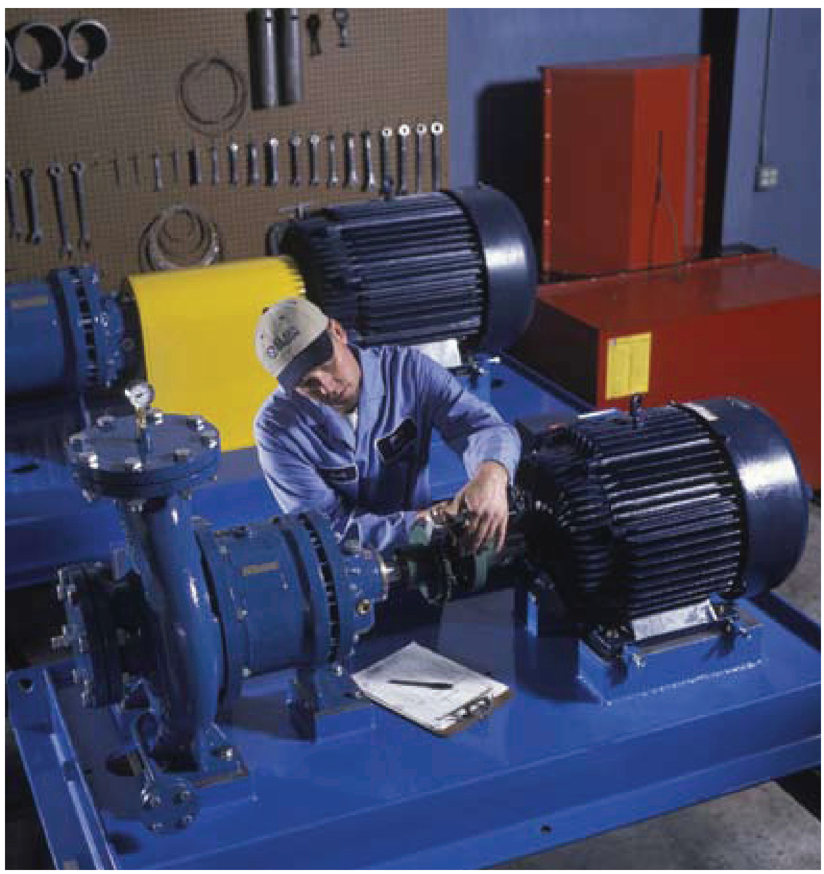
Sealless magnetic drive pumps are growing in popularity because their range of application coverage constantly continues to broaden.

State-of-the-art magnetic drive pumps now exceed driving power of 500-hp, flow rates of 15,000-gpm, delivery heads of 3,000-ft tdh, system pressures of 5,800-psi, operating temperatures of 840-deg F without cooling, viscosities of 3,000-cPs, as well as solutions for those "more challenging" applications containing solids, gas, very low lubricity or low NPSHA values.

These numbers speak for themselves. The industry demands manufacturers to continuously push the envelope and expand the range of available hydraulics and sealless magnetically driven solutions – especially for those applications that are to be considered "more challenging."

Pump users in today's competitive environment demand performance. For them, making the right choices is more important than ever before. What is the best technical solution for my application? Should I prefer a mechanical seal system, or is the magnetic drive pump a better solution for the service?

Although the answer to these questions is sometimes believed to be difficult, it is actually rather simple – so, to quote contributing editor Ross Mackay, *let's get practical!*



Mag-drive pumps now exceed driving power of 500-hp, flow rates of 15,000-gpm, delivery heads of 3,000-ft tdh, system pressures of 5,800-psi, operating temperatures of 840-deg F without cooling, and viscosities of 3,000-cPs.

Ideal Applications

Assume that as soon as a piece of equipment can do a job better, more reliably and/or more cost effectively than another solution, it becomes the smarter choice.

Based on this assumption, in what applications can a magnetic drive pump be the better solution?

First, as soon as "zero leakage" is a must, the use of a magnetic drive pump provides the advantage of eliminating a usually more-expensive double mechanical seal system with a pressurized sealing arrangement, all necessary auxiliary components and installations, as well as the related maintenance of this system.

Services utilizing a sealless magnetic pump to achieve zero leakage to the atmosphere are numerous and are found in many industries. The following types of applications are the most common ones:

- Toxic / Lethal
- Poisonous
- Carcinogenic
- Contaminated
- Aggressive
- High pressure
- Risk of fire
- Pyrophoric
- Explosive
- Cryogenic
- Hot / Cold
- Acid

Second, in cases where zero leakage must be achieved and the pumped liquid does not allow contamination by the barrier fluid of a double mechanical seal system, the sealless magnetic drive pump provides an excellent solution for this problem.

Finally, when frequent seal failures cause expensive repairs and downtime, even replacing a single mechanical seal pump with a magnetic drive pump can be beneficial and cost effective as well.

Low Maintenance

By design, magnetic drive pumps require very little maintenance. Many years of trouble-free service are common.

Under normal operating conditions, the rotating components of the pump do not contact. Merely two anti-friction bearings, supporting the outer magnet carrier in the drive frame, require simple maintenance. Many designs allow the replacement of these bearings without breaking the process seal. The popular close-coupled design can even eliminate these two anti-friction bearings, literally making the pump maintenance-free.

The key to successful and trouble-free operation is the appropriate application of the pump for the service. This requires involving the manufacturer and allowing an open dialogue to determine the correct solution for the service – especially when the liquid to be pumped is not a clean one with good lubricating characteristics.

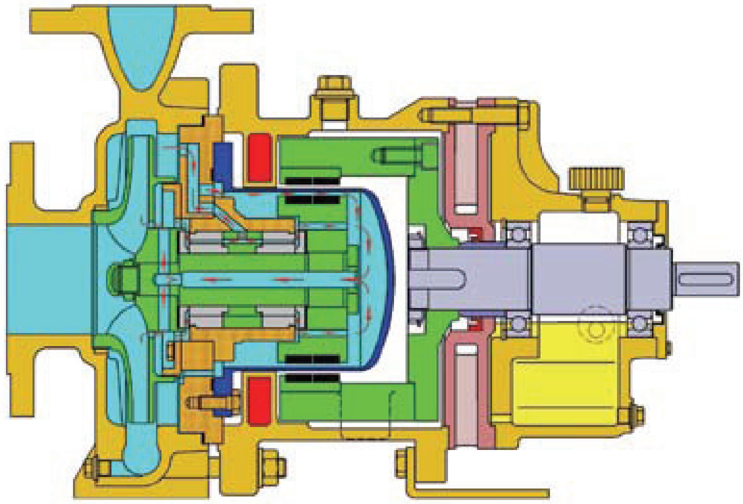


Figure 1. Cross-section of a mag-drive pump.

Similar to the lubricating circuit in a combustion engine, the magnetic drive pump not only pumps the pumpage, it also utilizes the liquid to lubricate journal bearings and dissipate heat.

Design Criteria

Besides selecting the most suitable hydraulic, along with the appropriate size and type of magnetic coupling to cover the desired range of operation, the manufacturer verifies that the pumped liquid provides the required characteristics to lubricate the internal bearings and, in case a metallic isolation shell is used, dissipate heat from the shell that is generated by eddy current losses.

An internal heat rise calculation should be requested from the manufacturer to verify that the pumped liquid does not vaporize due to the temperature increase of the internal cooling flow. This is of utmost importance, especially when handling boiling liquids and/or liquids with a steep vapor pressure curve.

Figure 2 shows how the design of the internal cooling circuit can provide the required pressure margin to handle the temperature rise caused by eddy current losses without flashing. Instead of introducing the internal flush flow back to suction pressure, this design maintains the required pressure level P6 above Return Vapor Pressure (RVP) to safely handle boiling liquids.

Flexibility

In addition to applying these basic design criteria, some manufacturers offer a wide range of design configurations and technical solutions as part of their modular system to allow further adaptation of the magnetic drive pump.

The following selection names a few of many available features to provide this flexibility, should changing operating conditions require modifying

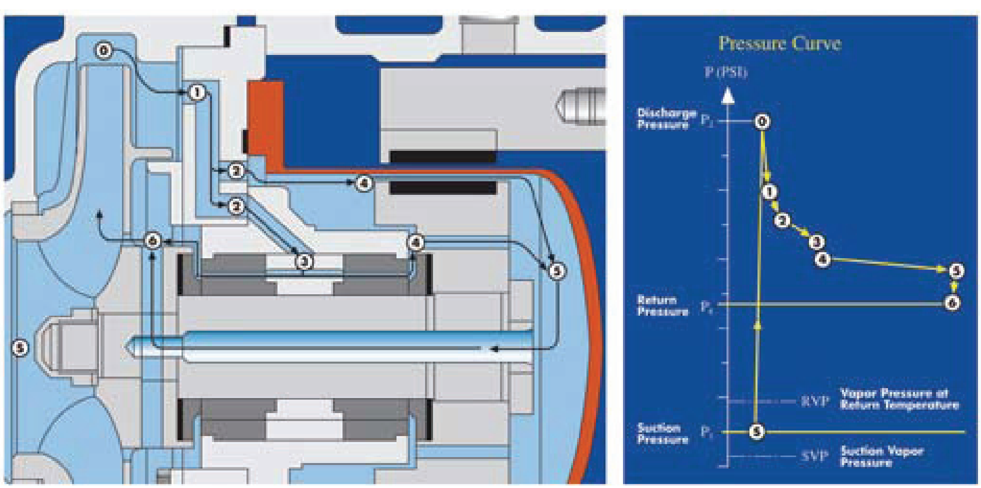


Figure 2. Lubricating and cooling circuit for boiling liquids.

the pump's design in the future:

- Upgradeable magnetic coupling to higher/lower torque requirements
- Variety of isolation shell materials (Hastelloy, Titanium, non-metallic)
- Alternative journal bearing materials for low lubricity liquids
- Internal flush system designed to handle boiling liquids
- Self cleaning internal/external filter to protect journal bearings from solids
- Suction inducers to handle low NPSHA applications
- External flush feed connection to lubricate, cool and flush with clean liquid
- Double-wall isolation shell for critical services requiring double containment
- Heating and cooling of case and magnet area
- Center-line support for high temperature applications

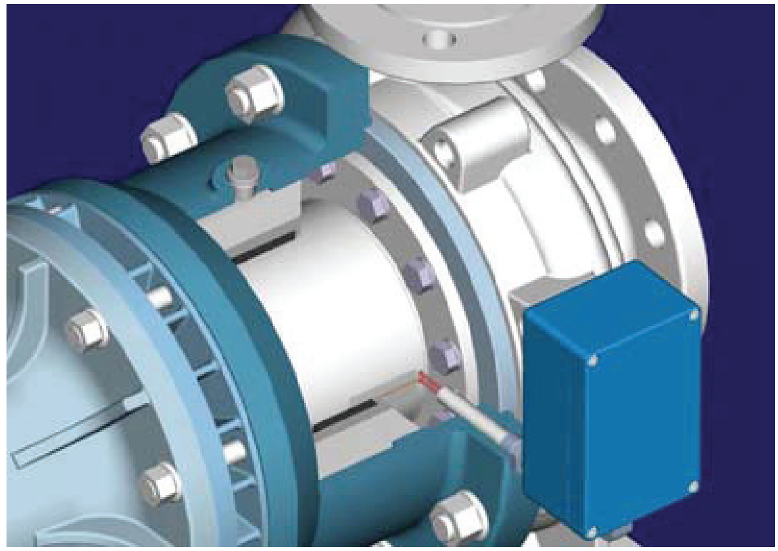


Figure 3. TPS system to monitor isolation shell temperature.

Protect Your Investment

To ensure years of trouble-free operation and to protect the magnetic drive pump from damage related to possible system upsets, off-design operating conditions and operating errors, monitoring of the pump deserves special attention.

Using our example again, the lubrication circuit in the combustion engine of our car is constantly monitored to prevent engine damage in case we lose oil pressure, are low on oil, or overheat. As soon as the engine light in the dash board blinks, we know it is crucial to stop the engine in order to prevent possible damage.

Figure 3 shows a system to monitor the isolation shell temperature. Locating the temperature probe between the rotating magnets allows the probe to detect temperature changes without delays. This is where the eddy currents occur and induce heat into the shell.

By monitoring horsepower and temperature, the following critical modes of operation are detectable and allow the shut down of the pump to avoid damage:

These basic guidelines show how simple it is to get many years of trouble-free service from your magnetic drive pump. Even when the pump is to be inspected after years of operation, state-of-the-art magnetic drive pumps avoid the use of sensitive o-rings, special tools and complicated alignment procedures, all of which make it easy to work on the equipment.

Critical Modes of Operation	HP Trip		Temp Trip	
	Low	High	Low	High
Operating below minimum flow or at zero flow	X			X
Operating above maximum flow		X		
Flow interruption or dry run	X			X
Magnetic coupling decoupled	X			X
Worn or damaged anti friction bearings		X		
Worn or damaged journal bearings		X		
Plugged internal ports				X
Cavitation or intrained gas	X			X

Figure 4. Critical modes that are detectable by monitoring horsepower and temperature.

The magnetic drive pump requires similar attention.

As soon as necessary lubrication and/or cooling are not provided, damage to the pump's components can occur. The two most efficient methods to protect your investment are monitoring the power consumption and the temperature of the isolation shell. Both systems are maintenance-free, inexpensive and easy to install.

So *let's get practical.* Today's magnetic drive pump designs have evolved from an exotic niche product in the early years to an acknowledged solution for many industries. Seal-less magnetic drive pumps are the first choice for many end-users when leakage is not an option.

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