Sealed vs. sealless:

Recent technological advances in magnetic drive pumps

Recent innovative advances in sealless magnetic drive pump design and instrumentation have increased both the application and advantages of this technology compared to sealed pump alternatives. This article explores the scope for sealless and the operational and environmental benefits it brings to pump processes.

By David Clark, General Manager, Sundyne HMD Kontro

Pump engineers have traditionally opted to use mechanically sealed pump technology, when required, to handle volatile or hazardous liquids. The operation of mechanically sealed pumps requires significant levels of ongoing maintenance and the seals are always prone to leak, which may present a danger to both the operating personnel and the environment. As environmental controls become more stringent, and health and safety legislation receives greater emphasis, mechanical seals and their support systems are becoming increasingly complex. As they also become correspondingly more expensive to install and monitoring takes more effort, yet breakdowns remain as frequent, pump engineers are considering alternative technologies, such as the sealless magnetic drive pump.

Sealless pump containment shells.

Sealless magnetic drive pump technology removes the need for the dynamic seal, thus significantly reducing the complexity of the installation, ongoing maintenance and eliminating the risk of leaks or emissions. Sealless magnetic drive pumps have been around for nearly 70 years, with increasing adoption as safety and environmental legislation requirements have been refined. More and more pump engineers are recognizing the benefits that sealless pump operation offers and, consequently, the number of successfully operating installations is growing worldwide.

Sealless pump operation brings with it inherent advantages of safety, reliability, simplified maintenance and lower life-time costs. The technology continues to advance with time and there are a number of steps forward that make sealless pump selection an even more compelling choice for pump engineers.

Robust composite containment shells

The containment shell is a key feature of the sealless magnetic drive pump which acts as part of the primary pressure boundary between the two parts of the magnetic coupling. The shell is manufactured using a tough and durable, engineered composite PEEK matrix and carbon fibre reinforced material that offers high levels of process liquid compatibility. The composite containment shell eliminates the induction (or eddy current) losses associated with metallic containment shells in magnetic drive pumps, with a

significant list of benefits, including:

- reduced heating of the process liquid, which is essential when pumping volatile and heat sensitive liquids
- enhancement in the overall pump efficiency when compared to a similar sized pump incorporating a metallic containment shell
- it also makes the magnetic drive pump more robust to system upset conditions that might be experienced

Pump engineers will recognize that these features make the composite containment shell ideal for use on volatile and hazardous process pumping installations.

Bearing material upgrades

The default magnetic drive pump process lubricated bearing material of choice has become silicon carbide running against silicon carbide. In the majority of applications, this combination works well, but there are exceptions when pumping liquids with challenging properties; such as low viscosity or low specific heat. In such marginal pumped liquid applications, alternative bearing material combinations can be employed which are suited to different application conditions. Alternative bearing material combinations offer enhanced reliability, maximize process uptime and can be recommended to pump engineers when process conditions present a challenge.

Vertical in-line magnetic drive pumps

Magnetic drive sealless pumps are now available that combine the features of a horizontal sealless pump with the additional benefits of a vertical in-line configuration. These include a significantly reduced footprint and minimal requirements for piping modifications when upgrading from other in-line designs.

The footprint reduction makes the vertical in-line range ideally suited for offshore applications, retrofits or where floor space for capital equipment is at a premium. The hydraulic designs of this range incorporate radial diffusers, maximizing efficiency, and a wide variety of material or metallurgy options are available, including stainless steel, carbon steel and duplex stainless steels.

Process liquid state monitoring

Condition monitoring instrumentation utilizes non-intrusive ultrasonic technology to continually monitor the state of the process liquid inside the pump. The instrument detects the presence of gas from outside the confines of the pump pressure boundary and provides an early warning of adverse conditions that are likely

Vertical magnetic drive sealless pump with conditioning monitoring device.

to impact pump bearing lubrication, cooling of the magnetic coupling and potentially upset the process operation. One of the key features is that it is measuring and reacting to the primary cause of a potential problem and not the secondary cause, which is the case when monitoring power or temperature. Some of the benefits of this system are that it increases process uptime, provides real time data on the internal fluid, detects the early presence of gas, ensures correct priming and venting and eliminates the potential for dry running. The device can easily be retro-fitted to many existing magnetic drive pump installations, providing increased peace of mind for end users.

Bringing the technologies together

During a recent upgrade to meet current American Petroleum Institute (API) standards, a petrochemical plant in the Far East took the opportunity to review

its operation of single mechanical seal pumps in comparison to a replacement with sealless pumps. During the evaluation process, the magnetic drive pump technologies, including the technologies described above, were taken into consideration. The sealless pump technology option offered would completely eliminate fugitive emissions, reduce the initial installation costs, reduce the cost of ownership and allow full site serviceability. The selection decision for the pump engineers involved was obvious and an API-compliant magnetic drive pump upgrade was ordered to replace the previous sealed pump installation.

The magnetic drive pump package comprised of vertical inline pumps and horizontal pumps, which were supplied in accordance with the API 685 Standard 2nd edition. This pump package was installed along with a condition monitoring device on each pump, robust (high efficiency) composite containment shells and upgrades to the bearing materials.

In addition to operational and environmental enhancement, a decision to select magnetic drive pumping technology can bring significant commercial benefits. Because a magnetic drive pump installation does not require all the ancillary equipment and support systems typically associated with a mechanical seal installation, it is often a more economical design solution, requiring less intervention, fewer scheduled maintenance checks and, therefore, optimizing the valuable time of pump engineers.

About the Author

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