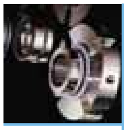
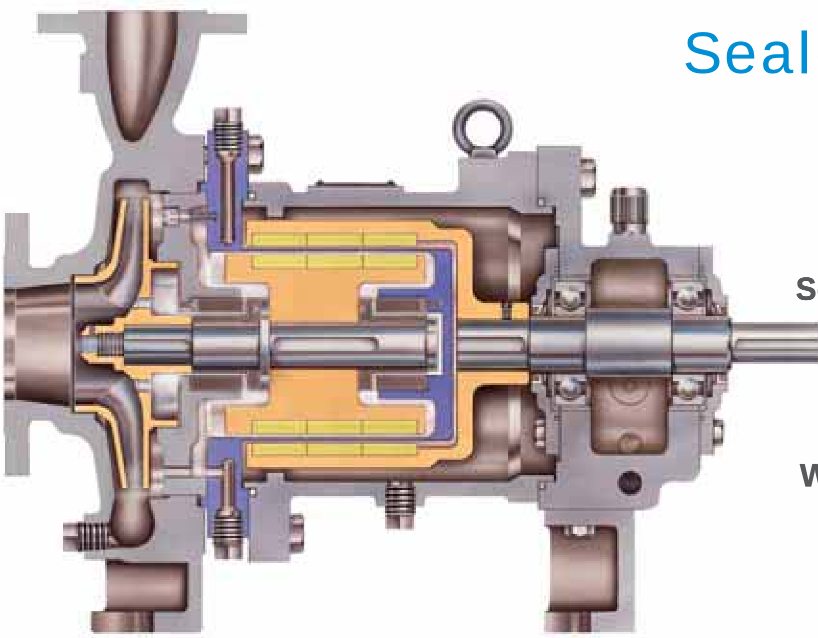


The Great Debate:

Sealed vs. Sealless



Mike Clark, Magnatex Pumps, Inc.

Sealless pump sleeve bearings must deal with the process fluid like primary seals do in a standard pump, but the similarities stop there. Which way is best? This forum revisits the question.

Our forum here responds to contributing editor Ross Mackay's recent article on magnetic drive pumps (*Let's Get Practical*, December 2005). I have great respect for his opinions, but I also believe there are other views on some of his points, plus additional items to consider.

To determine what type of pump to use, it's critical to understand not only the service and conditions, but other factors that are important to the user of the equipment. Certain applications are ideal for sealless pumps, while others are definitely not appropriate for them.

For example, applications involving all but a small percentage of solids are inappropriate – unless an external or filtered, recirculated flush is used. Services where the liquid could solidify in upset conditions and become difficult to remove from the cooling/lubrication passageways in the pump are also inappropriate.

There are many applications that can go either way, based on user preference. If lowest initial cost is critical, then sealed pumps sometimes look more attractive.

However, the long-term financial advantages of mag-drive designs must be considered, because a properly selected and operated mag-drive pump offers years of trouble-free service. Some users have run their pumps for almost two decades with no maintenance!

Ross's column notes that "because mechanical seals weren't sufficiently reliable, we (society) designed a pump that didn't use them." The axiom *necessity is the mother of invention* comes to mind.

No doubt a sufficiently strong market force drove so many manufacturers to develop such designs. Some major players have only recently introduced sealless products in response to market demand.

Few pump users dispute that seals are the weak point in a standard pump. Many plants regularly replace seals without considering alternatives. The article states that "the mechanical seal in a conventional pump . . . acts like a fuse . . . and becomes the first failure point," with mag-drive pump bearings playing the same role.

"Tribologically" speaking, sealless pump sleeve bearings must deal with the process fluid as do primary seals in a standard pump, so the challenges are similar.

But unlike a pump with a single seal that allows the pumpage to escape when it fails, the mag-drive pump bearings – and the shaft that supports them – are located within the casing/containment shell, so the potential of pumpage escaping in the event of a bearing failure is far less likely.

In fact, most manufacturers have provisions to limit the movement of internal parts in the event of a catastrophic failure, to further safeguard the containment of the pumped fluid.

Double seal arrangements can certainly be utilized in conventional pumps, but they require an elaborate barrier fluid system that can be expensive initially and challenging to maintain.

An important advantage of sealless pumps that was not mentioned is that they typically are not required to be monitored for fugitive emissions. This is a major ongoing cost savings for users.

Furthermore, without a seal to replace, close-coupled motors can be readily used on mag-drive pumps up to about 40-hp or more.

This not only eliminates the coupling cost, but the need for motor/pump shaft alignment and any associated failures and downtime. The resulting package size is smaller as well, making mag-drive pumps ideal for applications where space is limited.

The article rightly notes that mag-drive pumps should not run dry, but the same should be said for sealed pumps.

Seals allow small amounts of liquid to pass across their faces to provide lubrication – they do not like running dry. This is why they must be monitored for fugitive emission in critical applications.

Mag-drive pumps address this situation in multiple ways. First, manufacturers typically recommend simple monitoring devices that shut the pump down in the event of upset conditions. This is often accomplished by sensing power consumption, utilizing a non-invasive method (Figure 2). Such a device could prove valuable for standard sealed pumps, too.

Second, some OEMs have developed bearing materials/coatings that are more forgiving of upset conditions and can run dry for limited periods of time. There is hope that sealless pump bearing technology will eventually allow dry-running for extended periods as well.

The article explains that a typical mag-drive bearing material is silicon carbide, which, while quite hard, can be susceptible to thermal or mechanical shock. Interestingly, this same material is frequently found in mechanical seals.

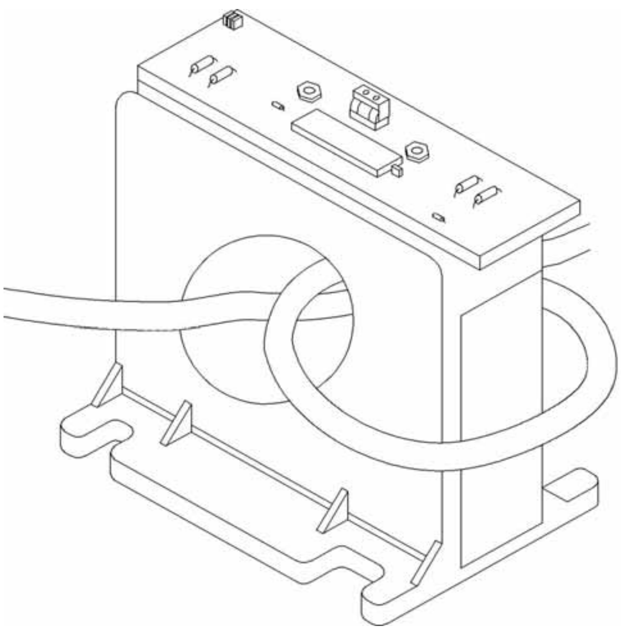


Figure 2. Non-invasive power monitor sensing Toroid that connects to the monitoring panel.

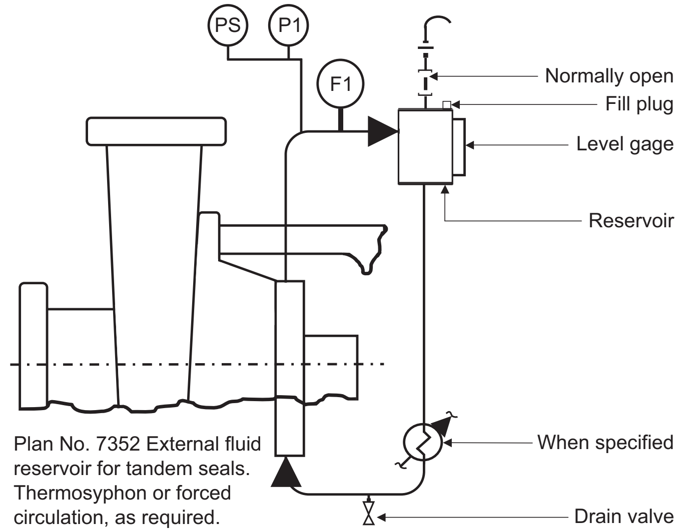


Figure 1. Typical piping arrangement for two seals in standard pump. *Reprinted from ASME B73.1-2001, by permission of The American Society of Mechanical Engineers. All rights reserved.*

Remember that the more frequent situation encountered in upset conditions involves some liquid remaining in the pump, which aids in bearing lubrication during brief episodes and prevents the bearings from breaking during brief dry-run periods.

The article also discusses concern about selecting the proper magnet material relative to operating temperature considerations.

It is correct to note that upset conditions can result in temperature excursions that impact the strength of the magnets, but the power monitoring device noted above can minimize or eliminate this concern. When a mag-drive pump runs dry, or against a closed discharge valve, the low power drawn by the pump trips the monitor, shutting off the pump.

The article's remaining technical observation is that mag-drive pumps can decouple and "if the pump operates in this state very long, the magnets will be permanently demagnetized." Power monitoring eliminates this problem.

I disagree with the comment that this pump design is "particularly vulnerable to abnormal operation conditions . . ." The power monitor addresses the concerns about increased capacity, specific gravity or viscosity. While the article suggests the use of power monitors, it should be pointed out that their *proper use* eliminates many concerns.

A major advantage of some mag-drive pumps is reduced radial loading compared with standard, seal-type, overhung models.

For example, the straddle-mounted design with bearings on either side of the inner magnet provides excellent stability, reduces radial loading and allows the pump to be more tolerant of off-peak operation (Figure 3).

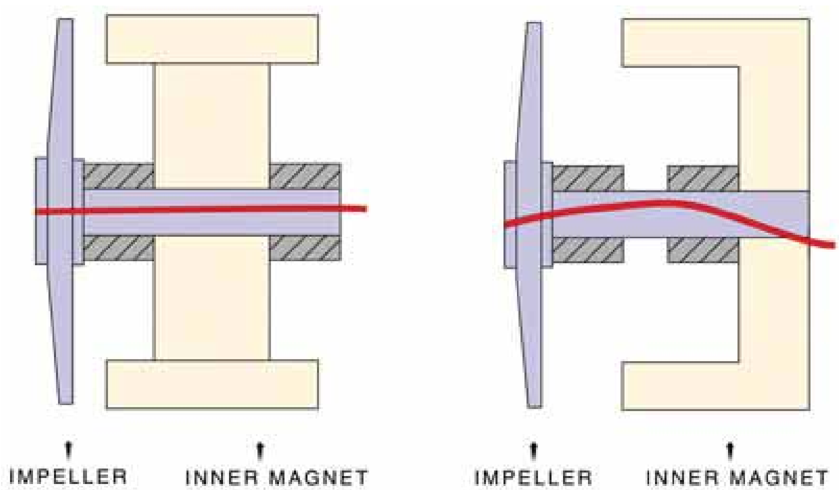


Figure 3. Straddle mount design (on the left) vs. overhung design.

This pump design commonly offers an 8-to-10 year life, or more, without maintenance. One user discovered his mag-drive pump had operated 16 years without an outage. It didn't fail at that point, either – he took it down for preventative maintenance. Few sealed pumps in process applications operate this well.

From a commercial standpoint, the article suggests that mag-drive pump failures "are usually much more expensive." I don't dispute that in a failure of major proportions. But I submit that the frequent repairs, including replacement of often expensive seals over the life of a traditional pump, would be more than the total cost of a major mag-drive repair.

I also suggest that such major mag-drive failures are not as common as implied, especially if some of the precautions suggested above are taken. Mag-drive pumps are a good, cost-effective option for providing years of trouble-free operation in many pump applications, potentially saving pump users tens of thousands of dollars over the life of the equipment.

I agree with Ross that sealless pumps are "not . . . the answer to every condition that causes seal failure." They *can* be an ideal solution across a broad range of applications when eliminating mechanical seals is desired.

As the article states, "the magnetic drive pump is very reliable in certain applications involving toxic and other dangerous fluids . . ." to which I'd add corrosive, noxious, high purity liquids, and expensive fluids. This is illustrated by one user's desire to eliminate leakage of very high-cost thermic oils used for heat transfer. He was losing over $100,000 per year using sealed pumps.

Less "dangerous" fluids can also be added to the list, including liquids that, when leaked onto a floor, could cause an employee to slip. A risk management department might find sealless pumps very attractive. Similarly, using mag-drive pumps to move process fluids with an objectionable odor can provide a much more pleasant working environment.

Let's get practical. Sealless pumps, when properly applied and operated, are the obvious selection for many applications. I submit that if mag-drive pumps are suitable for the challenging services noted in the article, why not consider them for other applications to eliminate seal issues?

P & S

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