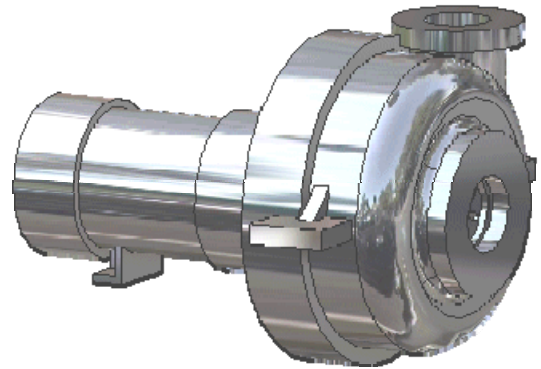


Last month's issue provided an [overview of sealless pump design](#) and the basic differences between various sealless pump types. This month the discussion extends to sealless pump application and operation and some important considerations when choosing the proper pump.

Dale B. Andrews

Sealless pumps have been commercially available for over 50 years and have been available as a commodity product for the last 25 years. Manufacturers promise zero-leakage and the elimination of mechanical seals. Why then, has the world not embraced sealless pumps as the solution to risks associated with mechanical seal failure? The answer to this question is based in reliability. A sealless pumps, like any pump properly applied, can be a reliable pump. Unfortunately, operational requirements, process conditions and yes, all of us, regularly interfere with proper operation. All pumps are subject to premature failure if not operated properly. In such situations sealless pumps are less tolerant and more failure prone as compared to regular centrifugal pumps.



Sealless pumps rotors are generally supported by plain journal bearings. Bearing clearances are fixed by the manufacturer without consideration for the characteristics of the pumped fluid. Thrust is usually accommodated by a thrust (or bumper) disk that is designed to limit the extent of shaft float. A thrust disk acts more as a shaft stop than a bearing surface. Radial bearings have limited fluid film generating capability and the shaft is free to float axially within the pump housing within the limits established by the thrust disk. Most pump designs have some form of thrust balance capability that serves to keep the rotor position centered within the housing. However, thrust balance devices are reactive designs that cause a change in rotor position as a result of change in rotor position, an inherently non-steady state condition. The result is a machine that is very stable under fixed operating conditions, but not necessarily stable under variable operating conditions.

What are some of the things that would cause a change in the radial or axial thrust balance? Probably the most common cause would be sudden changes in flow rate/discharge pressure as a result of the action of valves or other downstream process equipment. Any change in the system pressure will cause a change in flow rate. For any change in flow rate there will be a change in the radial and thrust forces on the rotor and a subsequent shift in rotor position that the thrust balancing mechanism will then act to compensate for. Cavitation can create highly erratic and substantial changes in load on an impeller; so can internal recirculation resulting from operating too far out or too far back on a pump curve. Any of these conditions will accelerate the wear of the thrust disk and bearings.

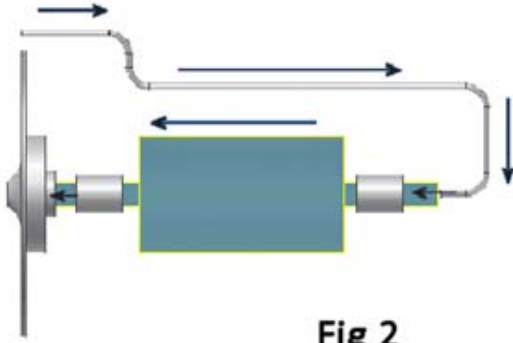


Fig 2

In addition to hydraulically induced damage, sealless pumps are also susceptible to mechanical bearing damage caused by run-dry operation or entrained solids. Most sealless pumps rely on a stream of fluid from the pump discharge to cool the motor and lubricate the bearings (Fig. 2). When the pump runs dry, so do the bearings. This happens when a pump starts dry, or loses suction in operation. It also occurs handling liquids that are at or near boiling point, which vaporize in the motor/bearing compartment. Without lubrication bearings can fail rapidly. Finally, unless special design provisions are made, any solids in the fluid stream will also be recirculated through the support bearings accelerating bearing wear. Choices in bearing materials can prolong bearing life, but lubricated bearings in a solids-free environment will last longer than the alternative.

In summary, sealless pumps fail for many of the same reasons as traditional pumps, it is just easier for them to do it. A clean, cool, and constant supply of lubricating fluid combined with steady state operation at or near the BEP of the pump are life extending considerations for any pump, but especially so for sealless pump designs.