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## Consider bidirectional flow devices for mechanical seals

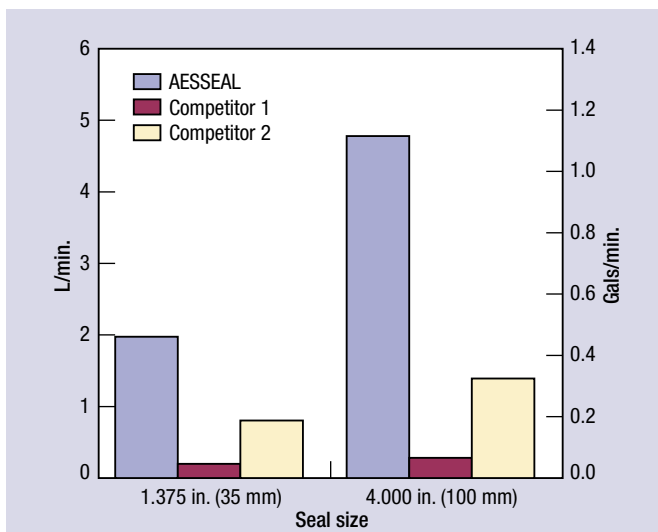
Many dual mechanical seals found in centrifugal pumps use either pumping rings or pumping screws to move barrier fluid. Typical flowrates achieved with pumping rings are extremely low, with most of the rotation energy going into the fluid as heat (Fig. 1). Pumping screws are more efficient, but depend on a rather close gap between screw periphery and its opposing stationary bore. This close gap can be a serious liability in situations where shaft deflection deprives the stationary and rotating component parts from remaining perfectly concentric (see also ISBN 0-88173-452-7).

We became intrigued with the issue when, in early 2005, we came across the following quote, written by João Amaral Teixeira, BEng, PhD, a professor at Cranfield University in the UK. The professor stated:

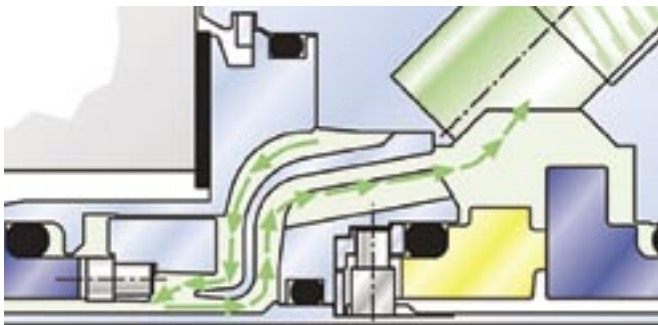
*“My colleagues and I in the Turbomachinery Group of Cranfield University’s School of Engineering were pretty impressed with the ingenious solution adopted by AESSEAL to overcome a fluid dynamics challenge in one of their seals. Why? Because the bidirectional pumping of flow in an effective manner and in the conditions, and subject to the dimensions of, the DMSF seal is not a trivial matter as anybody who has tried to will have found out.”*

This innovative device (Fig. 2) imparts relatively high head and, especially, high flowrates to the barrier fluid. Optimized configuration of the separating wall between inlet and outlet flow is achieved through computational flow dynamics. The result is deposition of cool barrier fluid at the hottest—and, thus, most important—region of the mechanical seal.

Seals incorporating these beneficial features are generally offered at prices that are virtually identical to those of conventional mechanical seals. In applications involving barrier fluid and where conventional mechanical seals do not incorporate the same capacity for heat removal, a bidirectional integral pumping design (Fig. 3) represents a feature that extends seal life, reduces downtime risk and benefits the maintenance budget. As in the case of many other zero-cost reliability enhancements, the payback can be deemed instantaneous, and the benefit-to-cost ratio is implicitly in a range that far exceeds 10:1. **HP**



**FIG. 1** Typical barrier flowrates for dual seals (source: AESSEAL plc, UK, and Knoxville, Tennessee).



**FIG. 2** API Plan 53 bidirectional flow device in a modern shaft seal (source: AESSEAL plc, UK, and Knoxville, Tennessee).



**FIG. 3** Bidirectional barrier fluid pumping device (source: AESSEAL plc, UK, and Knoxville, Tennessee).

**The author** is HP’s Equipment/Reliability Editor. A practicing engineer and ASME Fellow with over 40 years of industrial experience, he advises process plants on maintenance cost reduction and reliability upgrade issues. His 15th and 16th textbooks on related subjects are scheduled for release in late 2006.