

SEALING SENSE

How can I extend the performance range of standard cartridge mechanical seals?

In today's global environment, the "one size fits all" approach is used for so many products that we expect it to apply to just about everything. In the mechanical seal industry, one problem with that philosophy is the definition of the word *all*. Mechanical seals must live in literally every environment under the sun—from extreme hot to extreme cold, wet to dry, solid to gas, acidic to caustic and so on. Until relatively recently, a vast variety of mechanical seals were needed to accommodate these pump applications.

Cartridge Seals

The advent of standard cartridge designs allowed for easy, trouble-free installation on equipment, but they were limited as to the variety of applications each design could handle. With the introduction of universal or modular cartridge seals, one seal family utilizing various combinations of common cartridge seal hardware and seal faces can be applied virtually throughout a plant, increasing seal life. It reduces complexity while conserving valuable resources time and money.

The implications of this technology are far-reaching. Plant-wide seal standardization streamlines operations. The number of variables in installation and maintenance is reduced, and the process is simplified. This increased operational efficiency reduces maintenance costs. Streamlining the process also ensures that the seals are installed correctly, and correctly installed seals increase plant reliability. Using a standard seal family can also reduce a plant's spare parts inventory and material costs.

Modularity

Universal/modular cartridges are based on a modular concept that allows application-specific seal arrangements that incorporate interchangeable seal face material, elastomer bellows, O-ring or metal bellows seal heads fitted to standard adaptive hardware (typically the gland plate, sleeve, collar and setting

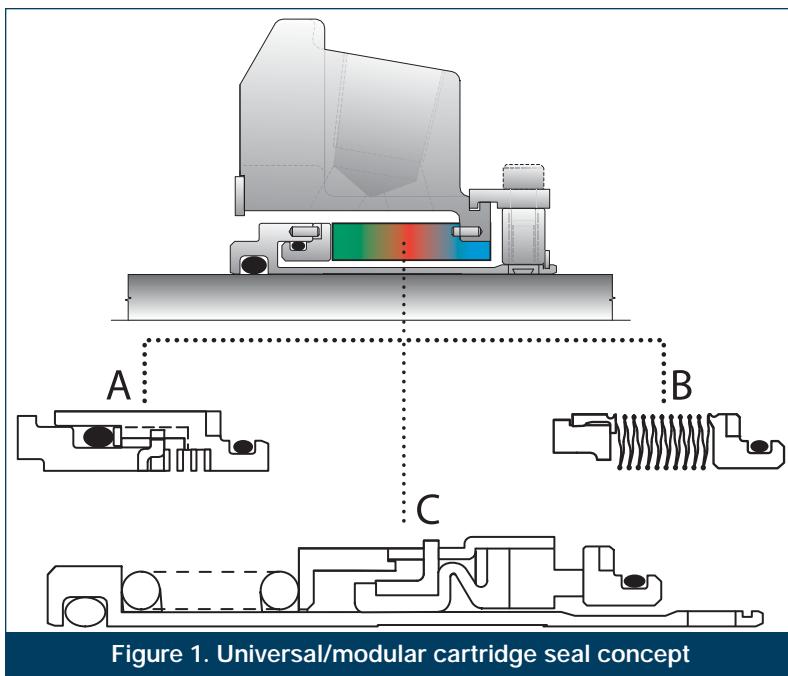


Figure 1. Universal/modular cartridge seal concept

tools). Universal or modular seals typically fit both standard ANSI B73.1M and DIN 24960 pumps, so users who are already comfortable with a particular seal type and have both ANSI and DIN pumps benefit from the technology. The flexibility from modularity also enables the universal cartridges to meet a wide range of service requirements.

Modularity allows the building of seals appropriate for a given application. By standardizing the adaptive hardware into which the appropriate seal is applied, the seal technology can change to fit the individual pump's environment. Handling temperatures to 400-deg F, pressures to 400-psig and speeds to 5,000-rpm, these seals accommodate fluids such as aqueous solutions, caustics, hydrocarbons, acids and even dry running.

Configurations

Basic configurations can cover an extensive range of applications. The unique design of universal/modular cartridge seals increases component interchangeability across a variety of

configurations. Single and dual arrangements typically incorporate the same seal head for both the inboard and outboard seal, which applies to both O-ring and metal bellows designs. In fact, the O-ring seal heads can be directly interchangeable with the metal bellows seal heads.

This flexibility offers some important advantages. On site, a technician can easily upgrade or change the capabilities of the seal in minutes without discarding the existing seal. Within a common set of adaptive hardware, an O-ring seal can be transformed into a metal bellows seal, and a metal bellows can become an O-ring seal. With other combination of parts, either can change into an elastomer bellows design. Upgrading or changing the seal with interchangeable components conserves resources since no components are wasted.

The heads and mating rings are also interchangeable in some designs. This flexibility gives the user the option to select whether the seal head or seat should rotate according to specific needs or preference. Operating with the inboard seal head rotating helps remove any solids build-up that creates, in essence, a self-cleaning rotational action.

On the other hand, a rotating mating ring and stationary seal head accepts more gland or shaft misalignment, which allows higher shaft speeds and provides greater cooling efficiency.

Single seal versions can typically accept a quench gland with a restriction bushing or lip seal, and dual seals can use pumping rings to assist barrier fluid circulation. This flexibility also makes universal/modular seals both ANSI and DIN pump compliant. The seal's gland is designed with slots to accommodate multiple bolts and bolt circle diameters. Pipe taps are freely accessible to allow universal fitting to either ANSI or DIN standard pumps rotating clockwise or counterclockwise.

Seal Design Advantages

Seal manufacturers continually enhance designs to provide maximum reliability, emission containment and cost-efficiency. Each of the basic versions—the O-ring pusher, metal bellows and elastomer bellows non-pusher—has inherent benefits. The O-ring pusher seal, perhaps the most versatile of seal designs, accommodates a wide range of elastomer materials and handles the most difficult chemical service conditions. The elastomer bellows seal is an excellent general purpose application seal, providing flexibility and hang up resistance as well as self-alignment, which is an important maintenance-saving feature. Automatic adjustment compensates for potential problems commonly found on older equipment such as abnormal shaft end play and runout. Advantages of the metal bellows seal

Fluid Sealing Association

Sealing Sense is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps. *This month's Sealing Sense was prepared by FSA Member Mike Kraus.* As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump technology issues on rational total Life Cycle Cost (LCC) principles.

The **Mechanical Seal Division** of the FSA is one of six with a specific product technology focus. As part of their educational mission they develop publications such as the *Mechanical Seal Handbook*, a primer intended to complement the more detailed manufacturer's documents produced by the member companies. This document served as the basis for joint development of the more comprehensive *Hydraulic Institute* publication: *Mechanical Seals for Pumps: Application Guidelines*. Joint FSA/ESA publications such as the *Seal Forum*, a series of case studies in pump performance, are another example as is the *Life Cycle Cost Estimator*, a web-based software tool for determination of pump seal total Life Cycle Costs. The *Sealing Systems Matter* initiative also was launched to support the case for choosing mechanical seals

that optimize life cycle cost, reliability, safety and environmental compliance.

The following members of the **Mechanical Seal Division** sponsor this *Sealing Sense* series:

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include self-cleaning and increased reverse pressure capability. The reverse pressure capability feature found on most modern modular seal designs allows the use of the same dual seal for pressurized barrier or unpressurized buffer fluid applications, and will handle system upsets.

Efficiency and Flexibility

The advanced technologies incorporated in today's universal/modular seals increase efficient seal operation and reduce overall costs. This is even more evident in the advanced capabilities now available, such as wet and/or dry running seals. This advanced technology is perfect for applications that may run dry occasionally, such as tank car loading or unloading, or even full-time dry running for single seals and secondary containment on dual seals.

Narrow-faced seals with rugged drive mechanisms and interchangeable hard (tungsten or silicon carbide) seal face material allow seals to perform longer in higher viscosity fluids and/or applications with a high number of starts and stops.

Non-contacting spiral groove upstream pumping technology eliminates or significantly reduces the costs of complex, high pressure buffer fluid systems needed in dual seal systems. This technology reduces seal face heat, seal support systems cost and has proven to reduce operating and maintenance costs.

Summary

Modular seal designs do not lessen the need for proper selection of the core seal whether it is a single or dual, unbalanced or dual balanced, ID or OD pressurized, pusher or non-pusher, rotating head or seat and so on. A comprehensive design and materials selection for a given application far outweighs the benefits of modularity.

However, pairing best practices with seal design selection and the latest universal/modular technologies offers plant and maintenance engineers the opportunity to create a safer, more productive plant. Installation and maintenance are simplified. The possibility of an incorrectly installed seal is reduced. Upgrades and repair can be made on site. These efficiencies translate to maximum seal reliability and a reduction in the time spent on seal installation, maintenance and repair. Not only does this represent cost savings, but it also means more uptime and higher productivity plant-wide.

Next Month: *What is the impact of packing friction on equipment performance?*

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingsensequestions@fluidsealing.com.

P&S

The State of the Art in Seal Technology...

Unmatched Application Versatility
a selection of single, dual, and dual pumping seals designed to fit virtually any application

Simplified Installation
cartridge-mounted design are factory assembled and require no critical installation measurements

Environmentally Engineered
unsurpassed seal failure protection to comply with increasing safety regulations and pollution standards

Flexible Repair Programs
"in-field" repair kits, as well as "in-house" repair facilities to meet specific seal requirements

World-Wide Distribution
an expanding global network of qualified local support personnel



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