FLUID SEALING ASSOCIATION FSA

From the voice of the fluid sealing industry

SEALING SENSE

Why are mechanical seals still the preferred choice in the process industries?

This month's "Sealing Sense" was prepared by FSA members Phil Peck & Andy Martin.

The challenges facing process industries have changed although they continue to pump fluids, some hazardous or toxic. Safety and reliability are still of prime importance. However, operators increase speeds, pressures, flow rates and even the severity of the fluid characteristics (temperature, concentration, viscosity, etc.) while processing many batch operations. For the operators of petroleum refineries, gas processing facilities and petrochemical and chemical plants, safety means controlling and preventing loss of, or exposure to, the pumped fluids. Reliability means pumps that operate efficiently and economically, with less required maintenance.

A properly designed mechanical seal assures a pump operator of long-lasting, safe and reliable pump performance with a proven technology. Among multiple pieces of rotating equipment and a myriad of components, mechanical seals are proven to perform dependably under most types of operating conditions.

Pumps & Seals—A Good Fit

It is hard to believe that almost 30 years have passed since the mass promotion of sealless pump technology into the process industry. The new technology was promoted as the solution to all the issues and perceived limitations of mechanical seals. Some suggested that this alternative would eliminate the use of mechanical seals entirely.

However, not long after this promotion, end users learned that mechanical seals could meet or exceed legislated leakage and containment requirements. Further, pump manufacturers supported the technology by providing updated seal chambers to replace the old compression packing "stuffing boxes."

Today's seal chambers are designed specifically for mechanical seals, allowing for more robust technology in a cartridge platform, providing easier installation and creating an environment that allows the seals to function to their full potential.

Design Advancements

In the mid 1980s, new environmental regulations forced the industry not only to look at containment and emissions, but also at equipment reliability. The average mean time between repair (MTBR) for mechanical seals in a chemical plant was approximately 12 months. Today, the average MTBR is 30 months. Currently, the petroleum industry, subject to some of the most stringent emission levels, has an average MTBR of more than 60 months.

Mechanical seals maintained their reputation by demonstrating the ability to meet and even exceed the requirements of best available control technology (BACT). Further, they did so while remaining an economical and energy efficient technology available to meet emission and environmental regulations.

New computer programs allow seals to be modeled and prototyped prior to manufacturing to confirm how they will handle specific operating conditions before being installed in the field. Seal manufacturing design capabilities and the technology of seal face materials has progressed to the point that they can be developed for a one-to-one fit for a process application.

Today's computer modeling programs and technology allow the use of 3-D design review, finite element analysis (FEA), computational fluid dynamics (CFD), rigid body analysis and thermal imaging diagnostic programs that were not readily available in the past or were too costly for frequent use

Figure 1. Typical cartridge seal

with earlier 2-D drafting. These advancements in modeling techniques have added to the design reliability of mechanical seals.

These programs and technologies have led the way to the design of standard cartridge seals with much more robust components. These included the removal of springs and dynamic O-rings from the process fluid and made flexible stator technology the design of choice.

Custom Design Testing Ability

The introduction of standard cartridge seals has contributed significantly to greater sealing system reliability through their robustness and ease of installation. This robustness enables a wider range of application conditions with reliable performance.

In addition, more rapid design and fabrication of custom-designed sealing systems have enabled "fine tuning" for varying pump duty requirements. Customization can be introduced either through changes in the seal itself or, more readily, through auxiliary system components such as a piping plan. The ability to control the seal environment under varying operating conditions by way of a support system or piping plans is most critical to seal performance and reliability.

A natural progression also occurred that was more custom-designed pumps, with a corresponding customized mechanical seal. Today, a mechanical seal can be rapidly designed and tested for any type of process conditions or pump characteristics. The seal faces, dimensional parameters of the seal chamber and how the seal fits into the seal chamber can be designed and fabricated to a custom fit for a wide range of applications. Updating of

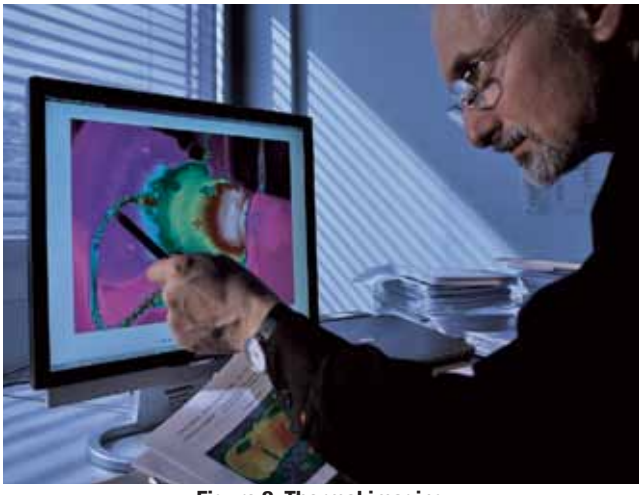

Figure 2. Thermal imaging

standards such as American Petroleum Institute (API) Standard 682 also has driven greater seal reliability through requirements that validate seal design, materials and functionality.

A Custom Fit

The seal industry battles with the commoditization of seal technology daily. Too many buyers think that "a seal is a seal is a seal." Standard pumps often can use the same basic seal. However, when installed and applied to specific process conditions, some type of customization in the sealing system is often implemented to obtain the required reliability under that specific set of operating conditions and chemical process.

Fluid Sealing Association FSA

"Sealing Sense" is produced by the Fluid Sealing Association (FSA) as part of its commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps. As a source of technical information on sealing systems and devices and in cooperation with the European Sealing Association (ESA), the FSA also supports the 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 five with a specific product technology focus. As part of its educational mission it develops 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 recently updated and enhanced Life Cycle Cost Estimator, a web-based software tool for the 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, energy usage, reliability, safety, and environmental compliance.

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

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Even with the same standard cartridge design, a wide range of customization potential exists from a selection of material components to the piping plan employed. Guidance on the selection of the components of the sealing system by the seal manufacturer is crucial to achieving the level of performance and overall reliability needed. This type customization can allow mechanical seals to stretch normal usage up to 30 to 60 months of MTBR rather than 24 months.

With this approach, the end users can be assured of receiving a sealing system that is designed for their specific application, form and function. The capability provides the end user with the knowledge required about the operation of the pump before it is installed. Guessing is not necessary regarding how the pump works or if it can handle the application.

Reliable Design

While most process operators perform the same functions, the applications are not the same. Processes run at different speeds, different temperatures and different viscosities, with different operational procedures and different pump configurations.

Through the years, the mechanical seal industry has introduced significant innovations that have decreased the sensitivity of seals to varying operating conditions and led to an increase in reliability. This means that if an end user lacks monitoring instrumentation to provide warnings for vibration, temperature, bearing and motor loads, today's seals, in most cases, will still perform their primary functions.

Conclusion

Through reliability engineering, material enhancements, computer-aided design and advanced manufacturing techniques, mechanical seals continue to prove their value and reliability. Despite changing emissions and containment control, and safety and exposure limits, seals have stayed ahead of the challenging requirements. That is why mechanical seals are still the preferred choice in the process industries.

Next Month: *What are the current emission standards for valve packing?*

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

P&S

FSA—the Voice of the Fluid Sealing Industry

In 1933, 36 American and Canadian companies attended the inaugural meeting of the Mechanical Packing Association in New York. After changing its name to the **Fluid Sealing Association** in 1970, the organization has grown to represent more than 85 percent of the manufacturing capacity for North America.

The FSA has five divisions with a specific product technology focus: Mechanical Seal, Gasket, Compression Packing, Piping Systems Non-Metallic Expansion Joint and Ducting Systems Non-Metallic Expansion Joint.

The FSA publishes a quarterly newsletter for sealing industry professionals that includes the latest updates on education opportunities, publications and standards, technical articles and general industry news. If you are interested in receiving this electronic newsletter, send your name and email address to info@fluidsealing.com. The next issue will feature information on the Compression Packing Division's upcoming webinar on compression packing technology basics.

If you are having a problem with sealing gasketed joints, go to the FSA's website (www.fluidsealing.com) for a new tool offered by the Gasket Division. A questionnaire is available for download to your computer. The form can be completed electronically and then forwarded by email directly to an FSA Gasket Division member, so that he/she may help you eliminate costly leaking flanges.

The initiatives of the Mechanical Seal Division include Sealing Systems Matter, which is based on an energy-driven total life cycle cost approach to sealing systems. The Life Cycle Cost Estimator software tool, part of Sealing Systems Matter, is a web-based tool for calculating and comparing pump seal life cycle costs. The software has recently been updated and is available for download from the FSA's website or under the Seals topic at www.pump-zone.com. Publications from the Mechanical Seal Division include the *Mechanical Seal Handbook*, which served as the basis for the Hydraulic Institute's publication, *Mechanical Seals for Pumps: Application Guidelines*.

Publications from the FSA's other divisions include the popular joint ESA/FSA pamphlet *Gasket Installation Procedures* from the Gasket Division, the updated *Compression Packing Technical Manual* from the Compression Packing Division, *Non-Metallic Expansion Joints and Flexible Piping Connectors Technical Handbook* from the Piping Division and *Ducting Systems Non-Metallic Expansion Joints Technical Handbook* from the Ducting Division. These publications are available to purchase on the FSA's website, www.fluidsealing.com. FSA industry standards are also available there for free download.

The FSA collaborates with several other organizations to fulfill its mission. Since 1999, it has collaborated with the ESA on several technical documents and recently completed a joint strategic planning session that calls for additional joint ventures. The FSA has also partnered with the Hydraulic Institute since 2007. The collaboration has included seminars, short course and joint work on publications and a series of webinars on mechanical seals.

For more information, please contact the Fluid Sealing Association, 994 Old Eagle School Road, Suite 1019, Wayne, PA 19087, 610-971-4850, www.fluidsealing.com.