Reliability is Everything

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To survive and thrive, process manufacturers must examine every process, technology and component to make sure it is helping achieve optimum performance. Mechanical seals are no exception. Long-lasting, well-performing seals reduce operating costs and help increase profitability. When it comes to mechanical seals, reliability is everything.

When selecting mechanical seals, users generally look for reliability, ease of installation, availability, flexibility and other factors related to the operating environment. However, if seals leak, damage other components, or cause maintenance work and downtime, all other benefits are meaningless.

Therefore, it is important to use reliable mechanical seals that contribute to a lower total cost of ownership. Seals do this by providing greater flexibility in varying operating conditions, experiencing less downtime and maintaining a longer seal life. With that in mind, Flowserve developed the ISC2 Series of standard cartridge mechanical seals (www.flowserve.com/ISC2) specifically to provide reliable performance in off-design operation, frequent starts and stops, and other known causes of seal failure (see Figure 1).

Next Generation Bounds Forward
The ISC2 series — the second generation of the Flowserve ISC series — takes a giant leap forward in performance and reliability. This series will run longer, cooler, in tougher conditions, in larger sizes and in more
equipment than any other standard cartridge seal Flowserve offers, regardless of heritage.

The seals offer wider-ranging capabilities and emerge as a truly global product that can be used and serviced anywhere in the world.

In fact, the ISC2 series satisfies multiple global standards, such as ASME B-73, EN 12 756, JIS and API 682. Seal designs that satisfy API 682 are designated ISC2-682 seals and meet all design and qualification testing specifications. ISC2-682 seals are applicable to API 682 Category 1 and 2 for Type A and B, Arrangement 1, 2 and 3 seals.

Safety is paramount, and ISC2 seals do more to protect workers and the environment than any other standard cartridge seal. For example, pressurized dual seals provide zero process emissions, and the outboard seal can handle full operating conditions if the inboard seal were to fail.

**Enhanced Features, Reliability**

ISC2 seals are available in four primary configurations: single pusher, single metal bellows, dual pusher and dual metal bellows (see Figure 2).

The series features an expanded size range that matches industry needs: 25-200 mm (1.000-8.000 in.) shaft size for pusher seals and 25-95 mm (1.000-3.750 in.) shaft size for bellows seals.

Other enhancements include patent-pending thermal management technology, robust drive mechanisms, high-efficiency barrier circulation and rigid setting devices. The seals feature a bimetal high alloy sleeve and increased pilot length. Let’s examine some features in detail.

**Thermal Management for Short-Term Dry-Run Tolerance:** Thermal management is a key enabler of long-term seal life and less downtime because it allows the seals to tolerate short-term dry-run events without overheating. Thermally conductive and mechanically compliant graphite material dramatically improves heat transfer between the silicon carbide seal face and the adjacent metal.

**Self-Aligning Square Head Pins for Three Times More Torque:** New square-head drive pins reduce seal-face fractures by self-aligning a flat surface on the pins with slots in the seal faces. This distributes torque loads evenly over a large area instead of creating a high-stress point load. As a result, the torque-carrying capability of the ISC2 is three times that of similar competitor seals — ideal for users whose pump applications include high-viscosity or sticky fluids.

**Sizeable Throttle Bushing:** A substantial fixed carbon bushing on the atmospheric side of single seals provides an added measure of safety and reliability in the unlikely event of a seal failure.

**Hard 17-4 H900 Set Screws to Lock the Cartridge:** The 17-4 H900 stainless steel drive collar set screws securely engage the shaft or pump sleeve and lock the cartridge sleeve in place. These hard screws greatly increase holding power and reduce the opportunity for galling the drive collar if the user ever needs to remove the seal.

**Enhanced Dual Seal Barrier Circulation for Cool Running:** The dual pusher and dual bellows design incorporates an advanced design volute groove that dissipates seal-generated heat, circulates clean barrier fluid, and increases barrier fluid flow up to three times more than competitive seals.

**FOOD PROCESSOR BOOSTS RELIABILITY**

Companies all over the world are benefiting from increased seal reliability. At a food processing plant in the Slovak Republic, a troublesome seal was replaced by an ISC2 single pusher seal in a standard bore pump running starch milk. The ISC2 seal continues to run well, and it has surpassed two years of no-fault performance.
Designed for Processing Companies
Many processing industries benefit from the ISC2 seals’ reliability, and many companies are reporting advanced performance after installing the seals. Here are a few examples.

Chemical: The ISC2 seal is corrosion-resistant standard with optional materials of construction, and provides excellent dual seal performance in hazardous and toxic fluids.

For example, a chemical company in Florida with a turpentine oil derivatives application in a 63.5-mm (2.500-in.) shaft ANSI pump struggled with dry running, cavitation and consistently failing mechanical seals. The company first tried to fix the problems with a non-Flowserve seal, but that resulted in chipped faces and failed gaskets. It then tried another seal, which failed because of excessive barrier fluid leakage.

Next, the customer installed a dual pusher ISC2 seal. More than a year later, it still runs leak-free.

Corn Processing: The ISC2 seal is ideal for corn processing applications where drive mechanisms must tolerate high torque loads from high-viscosity fluids and sticky fluids.

In addition, the seal’s high barrier-fluid flow rates enhance dual-seal cooling.

One corn processing company in western Indiana has benefited from the seal’s reliability. In its dirty condensate service, a seal in an enlarged bore seal chamber consistently failed 50 percent of the time within 24 hours of start, often while the pump ran through several start-up, dry run and cavitation events.

An enlarged-bore ISC2 single pusher seal was installed, and it continues to operate successfully in the same environment, maintaining containment for the customer.

Pulp and Paper: In pulp and paper, packed pumps can be retrofitted to significantly reduce leakage and water consumption. Unfortunately, the industry uses numerous processes that can be challenging to mechanical seals.

For example, at a paper company in Quebec, Canada, a cleaning process involving hot acid and condensate water flushes through the pump and piping, pushing red sulfite liquor with 69 percent dissolved solids through the components. Product pumping is interrupted every four to six hours for a one- to two-hour cleaning cycle, and then product returns and the cycle repeats.

Prior to the installation of ISC2 seals, seal life averaged two months.

The customer installed ISC2 seals in two applications — a standard bore pump and an enlarged bore pump — and they are running leak-free after more than 18 months.

Years of Reliable Operation
Meeting all major international standards and designed to fit hundreds of pump models from global manufacturers, these seals are capable of sustaining years of uninterrupted, long-term operation. As a result, the ISC2 series can help users increase the reliability of their operations while reducing overall cost of ownership. After all, when it comes to seals, reliability is everything.

For more information, visit www.flowserve.com/ISC2 or www.flowserve.com.
Despite increased interest in renewable and alternative energy sources, the long-term demand for oil continues to grow. Demand is projected to rise by 1 percent per year through 2030, according to the International Energy Association “2010 World Energy Outlook.” As a result, oil companies are spending billions of dollars to develop nontraditional technologies to maximize production from new and existing reserves.

Sour gas re-injection (SGI) is one of those nontraditional techniques, and it shows promise as a key technology because of its benefits, which include:

- Increasing oil production.
- Avoiding the production of large amounts of sulphur as a by-product of the sweetening process.
- Eliminating flaring of sweetened gas and the subsequent CO₂ production.
- Maintaining well pressures at levels suitable for full exploitation.

Sour gas is toxic because it contains significant amounts of hydrogen sulfide — 20 percent or more. SGI requires reliable seals that can handle the extremely high pressure generated by the centrifugal compressors.

Dry gas sealing technology is the industry standard for extremely high-pressure applications such as SGI. One such breakthrough application can be found at an SGI operation in the Tengiz oil fields in the Republic of Kazakhstan in Central Asia. Flowserve was invited to participate in a project for the Tengiz fields that would test the limits of dry gas sealing technology: develop seals capable of operating successfully at 425 bar (6,164 psi).

NEXT-GENERATION HIGH-POWER DRY GAS SEALS
Flowserve continues to develop dry gas seal technology and delivers seals for the highest-pressure injection applications in oil fields today. Flowserve GASPAC dry gas seals are state-of-the-art, field-proven compressor seals for reliable high-pressure sealing. These modular seals feature a unique single rotor design and are the first in the industry with diamond-like coating. The GASPAC dry gas seals also have the most references in the industry with bi-directional seals and noncontacting separation seals.

Flowserve applies continuous advancements to proven seal technology. For example, Flowserve has completed internal tests up to 500 bar (7,252 psi), with the current seal design showing the capability to seal up to 600 bar (8,702 psi). In addition, calculations and virtual tests of dry gas seal designs have reached a new peak of 700 bar (10,153 psi). Flowserve’s goal is to extend operating capabilities beyond 800 bar (11,603 psi). These promising results reflect the next generation of seals for high-pressure and ultra-high-pressure dry gas applications.

For more information, visit www.flowserve.com/gaspac.

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In Olympic track and field events, measuring device reliability can mean the difference between gold and silver medals, or between a new world record and failure to qualify. Measuring devices must be reliable from one competition to another anywhere in the world, despite variables such as temperature, air pressure and humidity that might affect their readings. The same is true for mechanical seals.

No matter what the application, a reliable mechanical seal can be the difference between a productive, profitable and safe operation, and a company facing component failure, leaks, maintenance, unscheduled downtime and associated costs. Mechanical seals have proven their reliability in different applications throughout the world. One such example is the Ambatovy mining project in Madagascar, off the eastern coast of Africa.

The Ambatovy project is a world-class, large-tonnage nickel project positioned to be among the world’s biggest lateritic nickel mines by 2014, if not before. Dependable seals and other components are vital for ensuring project success.

Massive Resource Development
The project is a joint-venture partnership and the country’s largest capital project to date. Construction on the mine site, located near the city of Moramanga, began in 2007. Mechanical completion is expected late this year, with initial production to begin soon after. It is scheduled to remain in production for at least 27 years, with annual production of about 60,000 tons of nickel and 190,000 tons of ammonium sulfate.

To ensure the success of such a massive project while in critical development, the purchasing team is procuring goods and services that meet or exceed customer expectations for cost, delivery and quality. The team has developed strong partnerships with suppliers known to be the best in their field. One of those is Flowserve, which has delivered autoclave mixer seals, compressor seals, slurry pumps and other flow control solutions.

Reliable in Harsh Conditions
In open-mining operations such as the Ambatovy project, cranes dig the ore, and trucks move the ore to a nearby processing plant. There, ore is crushed to increase the efficiency of separating chemical tailings and metals. The ore then is moved through autoclaves — high-pressure and high-temperature vessels in which strong acids are sparged with oxygen to chemically separate the metal from the ore.

The rough environment requires unfailing flow control components. One example of this is a specialized Flowserve seal, which is designed for reliability in the brutal temperature, pressure and corrosive autoclave atmosphere. The Flowserve MW-200RW dual pressurized cartridge canister mechanical seal has been used in mining autoclave applications in which temperatures may be as high as 288°C (550°F) and pressures as high as 65 bar (950 psi).
Enhanced Seal Design
The Tengiz field is one of the world’s 10 largest crude oil fields, and one of the most complex to produce. The extreme seasonal temperatures in the region [ranging from 36°C (96.8°F) to -40°C (-40°F)], in addition to the high-pressure SGI operation, require a keen focus on reliability at all times.

Therefore, seal performance, reliability, safety and, most importantly, repeatability is essential to the Tengiz project and its oil recovery. Therefore, Flowserve developed an enhanced, reliable seal design that could withstand the increased pressure.

These Flowserve GASPAC dry gas compressor seals (www.flowserve.com/gaspac) used stationary faces made of silicon carbide with diamond-like carbon coating. To simulate operating conditions, the company leveraged analytical tools such as finite element analysis and computational fluid analysis tools to analyze the dry gas seal’s core components.

Uncompromising Evaluations
Once the improved seal design was ready, Flowserve began rigorous testing to simulate real-site conditions as well as limits even beyond design criteria. In 2005, Flowserve conducted tests at its Dortmund, Germany facility, including long-duration steps, start-and-stop, heat-run and 250 cycles of coast-down tests.

Evaluations were successfully repeated at the OEM test facility. Flowserve then installed the seals for a full-density test at the Tengiz oil fields. The seals again demonstrated their reliability and robustness and were released for operation.

Reliability is the Key
Whether an athlete performing in an Olympic race or a mechanical seal performing in an autoclave mining operation, both function under tremendous pressure, extreme temperatures and other tough conditions. For both, component reliability can make or break the effort. Reliable components such as seals, pumps and tanks play an important role in helping Ambatovy Project leaders achieve their goals of adopting environmental safeguards, showing respect for local residents and contributing to the local economy.

For more information about Flowserve seals, pumps and other reliable solutions for harsh environments, visit www.flowserve.com.
ISC2 Series Seals

The most comprehensive industry coverage

ISC2 Series seals meet all major international standards and are designed to fit hundreds of pump models from global manufacturers.

Improve operational efficiency throughout your facility

Based on an extensive global review of equipment requirements, performance expectations, service conditions and best practices, ISC2 seals are the most capable general purpose cartridge seals available. Facilities that standardize with ISC2 seals will immediately benefit from less inventory, greater flexibility, rapid availability, less downtime and longer seal life.

Award-winning technology

The ISC2 Series has been awarded the 2010 Innovation Award from Flow Control magazine.

To learn more, visit www.flowserve.com