Pipeline Pump Seals

in crude oil services
and refined products
Flowserve provides expert technical solutions for the unique sealing needs of pumps in pipeline services.

The trusted partner in global pipeline pump sealing

With a strong heritage of field-proven mechanical seals and systems, Flowserve is an established global brand for the complete range of pipeline pump applications. For over 70 years, Flowserve has been innovating, installing and servicing mechanical seals in pipeline pumps. Technologies and techniques have advanced over the years and today’s product portfolio delivers world-class performance with superior customer value.

Beyond a high-quality hardware supplier, Flowserve is a complete solutions provider that attends to every step of the sealing process. Our total lifecycle approach starts by establishing a thorough understanding of customer needs, setting a framework for the most beneficial, objective-oriented solution. Flowserve employees are committed to the highest professional standards for the industry’s best customer experience.

Flowserve invests in the success of customers through:

- product innovation
- continuous improvement
- professional engineering support
- training and consulting
- global coverage
- local Quick Response Centers

In return, customers enjoy the benefits of:

- reliability
- safety
- environmental compliance
- low life cycle costs
- equipment availability
- 24-hour service

Experience you can depend on

Flowserve pipeline seal specialists provide customers the technical support necessary to develop effective solutions for tough pipeline challenges. These solutions incorporate all manner of customer preferences, industry standards and regulations.

Through extensive internal training with our Rotating Equipment Specialist™ program and hands-on field experience, Flowserve specialists have the knowledge and skills to work with customers to successfully achieve their operational goals.

Pipeline seal specialists provide:

- up-front services including engineering analysis, materials review and product selection
- customer training
- field performance monitoring
- on-site installation and commissioning, technical services and troubleshooting

Local, rapid support to improve your equipment reliability

Flowserve Flow Solutions Quick Response Centers are strategically located throughout the world to provide our customers with local support needed to improve the reliability of their rotating equipment. We offer personal service, expertise and responsiveness to keep your process equipment operating at peak performance.

Your local QRC has the repair capability, machine tools, inventory and knowledgeable personnel supported by a global network of regional operations centers.
Quick Response Centers provide:

- fully integrated mechanical seal repair, manufacturing, seal face lapping, assembly, testing and after-sales service
- dedication to on-time delivery
- support available 24 hours a day, 7 days a week
- application and CAD expertise with a worldwide database for online drawing access and repair standards
- seal inventory and customized stocking programs
- superior quality and consistency from certified technicians and machinists in addition to approved vendors and sourcing centers around the world

You’re not alone with Flowserve

We are the preferred global supplier of fluid motion and control products and services. From engineered pumps and mechanical seals to automated and manual quarter-turn valves, control valves and actuators, we have a demonstrated expertise in all areas of the process industries. Through our collaboration with customers throughout the world, we have the depth of experience to provide tested solutions.

LifeCycle Advantage™ combines our technical expertise, training and consultative services with the power of Flowstar™ technology to deliver lower cost of ownership.

LifeCycle Advantage is a collaborative program designed to reduce total cost of equipment ownership (TCO) and improve operating profitability. Comprised of six interrelated value-building modules, a LifeCycle Advantage implementation consists of metrics-based programs and tools – such as our proprietary Flowstar software - that optimize management and operation of rotating equipment with an emphasis on:

- reliability
- energy efficiency
- inventory
- safety
- operations and maintenance
- procurement
- technical solutions

Many interdependent components contribute to the total life cycle cost of a pumping system. LifeCycle Advantage optimizes pumping system assets, increases mean time between repair (MTBR) and decreases TCO.
Mechanical seals for the full range of pipeline pumps

Through continuous investment in extending seal reliability, safety and performance, Flowserve has developed a versatile portfolio of mechanical seals and systems that uniquely handle the requirements of pipeline pumps. The seal types displayed in this brochure are intended as a basic introduction. Contact your Flowserve pipeline seal specialist to chart a path toward exceptional pipeline pump seal performance.

Many options, one company

Flowserve offers a variety of seal configurations to satisfy customer preferences, applicable standards and regulatory requirements. Seal designs may include:

- pusher or bellows
- flexible rotor or flexible stator
- single or dual
- wet dual or dry containment
- hard-hard or hard-soft seal faces
- flush plans and support systems
- environmental controls
- high alloy and corrosion-resistant materials
- Precision Face Topography
- cartridge design
- fixed, floating or custom throttle bushing
- shaft engagement options

Low Pressure

<table>
<thead>
<tr>
<th>Seal Type</th>
<th>Pressure Range</th>
<th>Description</th>
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<tr>
<td>QB</td>
<td>Up to 52 bar (750 psi)</td>
<td>Good first choice flexible rotor O-ring pusher seal for general pipeline services has a wide range of standard material options. Multi-spring design is also available as a flexible stator QBR or single spring QBS.</td>
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<tr>
<td></td>
<td></td>
<td>Fluids: light crude, hydrocarbons, ammonia, refined products, NGL</td>
</tr>
<tr>
<td>BX</td>
<td>Up to 28 bar (400 psi)</td>
<td>Thick-plate welded metal bellows seal for various refined and high viscosity fluids reduces the possibility of seal face hang-up. Rotating bellows have a self-cleaning effect in dirty fluid services.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluids: refined products, crude oil, gas oil, ammonia</td>
</tr>
<tr>
<td>UO</td>
<td>Up to 69 bar (1000 psi)</td>
<td>Workhorse pusher seal with thick section components is suited for tough, dirty services because of its single coil spring and large, elastomer U-cup seal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluids: heavy crude, bitumen, ammonia, NGL</td>
</tr>
</tbody>
</table>
*Medium Pressure*

**UOP**

Up to 103 bar (1500 psi)  
flexible rotor

A high pressure variant of the UO seal, the heavy duty UOP seal is used extensively in higher pressure services and has seal faces specially designed to handle the harsh conditions of mainline pumps.

- Fluids: crude oil, bitumen, gas oil, NGL

**HSH**

Up to 103 bar (1500 psi)  
flexible stator

Higher pressures require robust seal face drive features especially in high torque, viscous oil services. HSH flexible stator seals fit narrow seal chambers and offer a floating throttle bushing as standard.

- Fluids: crude oil, bitumen, gas oil, NGL

*High Pressure*

**UHTW**

Up to 207 bar (3000 psi)  
flexible stator

Extreme pressure demands custom-engineered attention to every element of construction. Seal faces and components utilize finite element analysis to minimize distortions for low leakage operation.

- Fluids: crude oil, carbon dioxide, NGL

*Containment*

**GSL**

Up to 41 bar (600 psi)  
flexible rotor

Wavy-face containment seal runs dry as a safety back-up during normal operation and directs process leakage to the drain. GSL seals can be configured with any inboard seal type.

- Fluids: hydrocarbons, refined products, crude oil

*Many applications, one company*

Crude oil and refined products pipelines encompass the entire production cycle from extraction to refining and delivery. Each step along the way can present unique challenges to both pumping and sealing thus each step requires careful treatment. For example, high sulfur crude oil in a 83 bar (1200 psi) mainline between-bearing pump requires a different sealing approach than an unloading terminal pump moving gasoline. Some of the main pump types and scenarios that sealing solutions provide value-added reliability include:

- centrifugal and multi-screw
- vertical and horizontal
- overhung and between-bearing
- API and ASME/DIN
- heavy duty and general service
- loading and unloading terminals
- mainline and booster
- land-based, off-shore and subsea
- homogenous and multiphase fluids
- hydrotransport
Protecting our environment

Flowserve mechanical seals provide the reliability required to protect the fluid asset inside a pump as well as the environment on the outside. The costs of a spill can have ecological and safety-related burdens that surpass lost production costs. Flowserve is committed to enabling cleaner, safer, energy-efficient rotating equipment operation with a positive, sustainable impact on our environment.

Pipeline pumps distributed along great distances in remote locations need the highest reliability from their mechanical seals and systems with minimal maintenance requirements. Initial sealing system selection, design, materials of construction and quality craftsmanship are essential considerations toward safe, trouble-free operation. Upfront planning for leakage containment and monitoring is the first step toward implementing a comprehensive sealing solution.

Precision Face Topography

When application conditions push the boundaries of contacting seal face performance, Precision Face Topography can change the sealing dynamics directly on the surface of the seal faces. Smooth, sinusoidal, bi-directional waves are one technology that augments the load support of the seal faces, reduces heat generation and increases reliability. Flowserve can apply Precision Face Topography to many of our seal designs and extend performance in mixed phase, supercritical phase, and light end applications.

Single seals with a containment device and drain connection in the gland

Fixed bushings provide basic, economical leakage containment. Use with Plan 65 liquid leakage detection.

Floating bushings create a self-centering, close-clearance restriction. Use with Plan 65 liquid leakage detection.

Custom containment devices per customer preference. Use with Plan 65 liquid leakage detection.

Balanced floating bushings provide maximum leakage containment in high pressure services. Use with Plan 65 liquid leakage detection.

Dual seals with a pressurized or unpressurized support system

Dual wet seals provide zero process emissions or an installed spare. Use with Plans 52, 53 or 54 support systems.

GSL containment seals run dry until taking over as a wet backup seal. Use with Plans 75 or 76 vent and drain systems.
Protecting your sealing environment

Piping plans and seal support systems assist the environment of the mechanical seal itself by providing cooling, flushing, pressurization and instrumentation. Let a Flowserve pipeline seal specialist fine-tune the piping plan to optimize your seal life. Popular piping plans commonly used in pipeline pumps include:

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<tr>
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<th>Plan Description</th>
<th>Special Purpose</th>
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<tr>
<td>11</td>
<td>Flush from discharge</td>
<td>Default inboard seal flush</td>
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<td>13</td>
<td>Recirculation to suction</td>
<td>Vertical pump venting</td>
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<tr>
<td>52</td>
<td>Dual nonpressurized loop</td>
<td>Tandem seal safety</td>
</tr>
<tr>
<td>53</td>
<td>Dual pressurized loop</td>
<td>Double seal support</td>
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<td>54</td>
<td>External circulation system</td>
<td>High pressure support</td>
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<td>56</td>
<td>Fixed throttle bushing drain</td>
<td>Liquid leakage detection</td>
</tr>
<tr>
<td>56B</td>
<td>Adjustable throttle bushing drain</td>
<td>Liquid leakage detection</td>
</tr>
<tr>
<td>56A</td>
<td>Orifice; throttle bushing drain</td>
<td>Vapor leakage detection</td>
</tr>
<tr>
<td>66A</td>
<td>Containment seal drain</td>
<td>Liquid leakage detection</td>
</tr>
<tr>
<td>66B</td>
<td>Orifice; throttle bushing drain</td>
<td>Vapor leakage detection</td>
</tr>
<tr>
<td>75</td>
<td>Containment seal vent</td>
<td>Vapor leakage detection</td>
</tr>
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</table>

**Plan 52**

Dual liquid seals operating with a low pressure buffer fluid loop create a safe, cool environment for both the inboard and outboard seals. The buffer fluid can protect and stabilize the inboard seal during process upsets and the outboard acts as an installed spare, ready to take over full process pressure. Buffer fluid level and pressure can monitor the integrity of the inboard seal and trigger alarms.

**Plan 65A**

Liquid leakage detection for single seals involves directing fluid to the drain for monitoring and disposal. An effective containment device minimizes product escape to the environment. A level switch or transmitter is used to alarm on excessive flow rate or accumulated leakage. Orifice size and instrumentation are selected based on the process conditions.

**Plan 75**

Suitable for both vaporizing and non-vaporizing fluids, Plan 75 systems vent and drain the space between the inboard seal and a dry running containment seal. A leakage collection reservoir instrumented with a liquid level indicator and pressure sensor gives a continuous view of inboard seal health. When inboard seal leakage becomes excessive, the containment seal provides effective environmental protection.
Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, this Flowserve product is designed to perform its intended function safely during its useful life. However, the purchaser or user of Flowserve products should be aware that Flowserve products might be used in numerous applications under a wide variety of industrial service conditions. Although Flowserve can provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user should assume the ultimate responsibility for the proper sizing and selection, installation, operation, and maintenance of Flowserve products. The purchaser/user should read and understand the installation instructions included with the product, and train its employees and contractors in the safe use of Flowserve products in connection with the specific application.

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