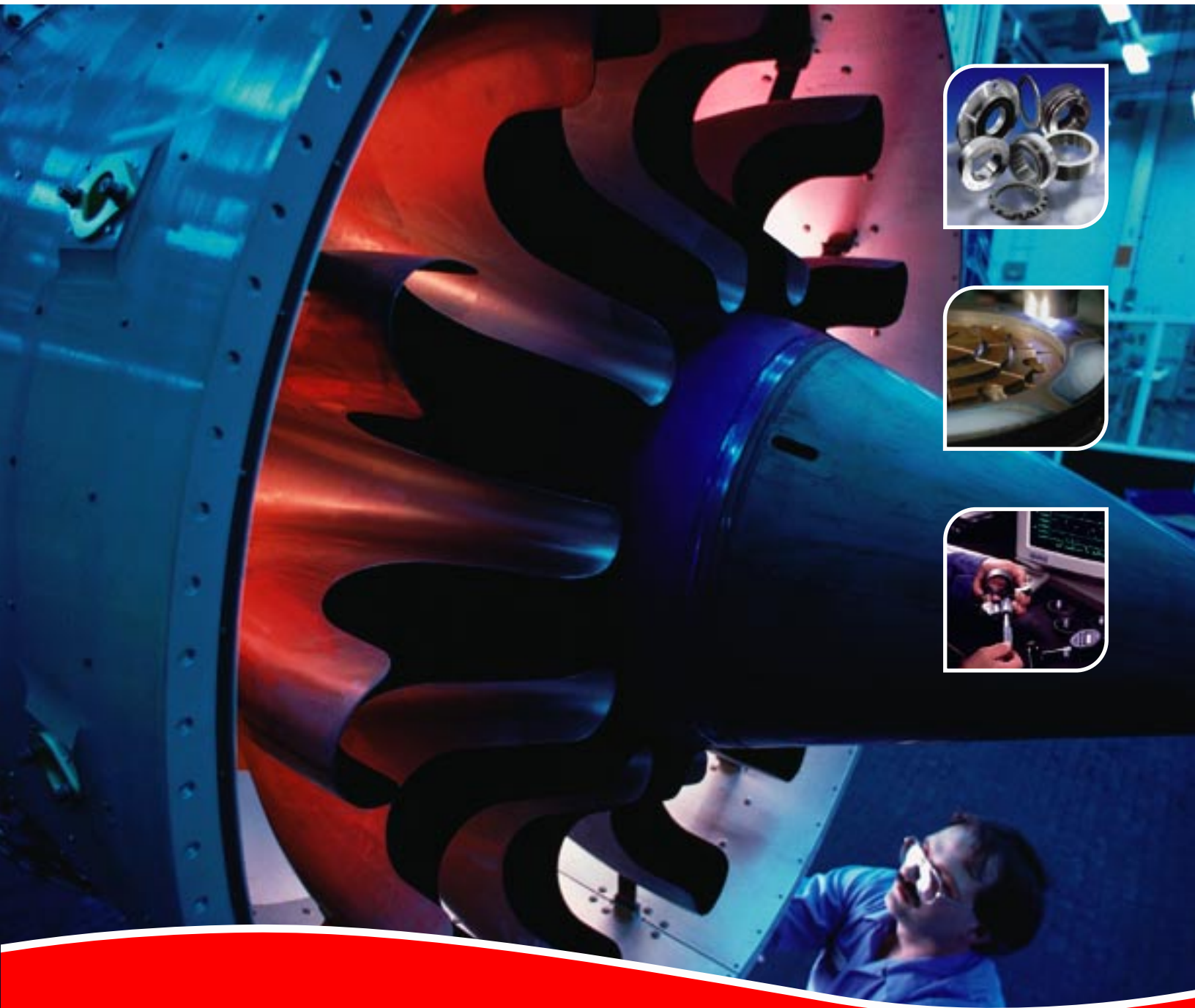




Gas Turbine Seals

Reliable solutions for gas turbine engines



Experience In Motion



Technology leader and total solutions provider

Flowserve has the technical expertise to provide superior products and solutions for all areas of your gas turbine sealing requirements. We are the leading-edge service provider of engineered mechanical seals and support services.

A convergence of technologies and experience from the most trusted names in mechanical seal manufacture and application, our heritage B/W, Durametallic, Pacific Wietz and Pac-Seal brands, present more opportunities for success than ever before.

Decades of experience

Our development and improvement of mechanical sealing technology spans a century. Our depth of knowledge in all industrial applications for seals coupled with our world class engineering and manufacturing capabilities brings significant resources to your gas turbine. Our commitment to customer satisfaction is evident in our record of on-time delivery.

We're your partner in reliability

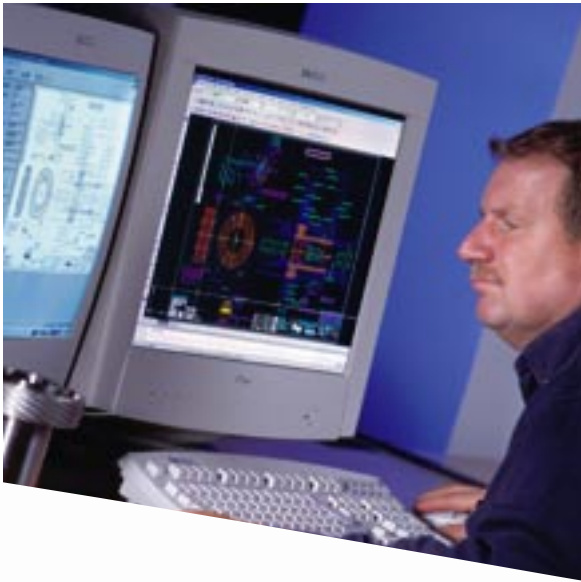
Flowserve is a leader in customer alliances, a valuable tool to that can help you optimize asset utilization and decrease inventory burden. It also helps us focus on solutions to your product applications. Within the alliance strategy, we partner with our customers to share a common long term vision of reliability and reducing the costs of doing business.

Commitment to quality

Flowserve employs a continuous improvement process (CIP) based on the principles of Six Sigma and Lean Enterprises to support a daily focus on the key performance metrics that drive our organization. These performance metrics enable us to maintain a proactive focus on our primary objective of on-time delivery of a quality product. CIP tools are used to create a culture of data-based decision making, root cause analysis, waste elimination, and reduction of process variation.

We have ISO 9001 certification and are compliant with aerospace industry AS9100 requirements and 10CFR50, Appendix B, Quality Assurance Criteria for Nuclear Power plants and Fuel Reprocessing Plants.





Global experience, local solutions

Flowserve operates five regionalized, state of the art manufacturing facilities and a worldwide network of over 65 localized Quick Response Centers (QRCs) to provide single source solutions for the improvement of equipment reliability.

Flowserve quality at your doorstep

Quick Response Centers provide:

- Dedication to on-time delivery
- Increased reliability through world-class products created with the most up to date engineering specifications
- Diagnostic and seal failure analysis tools such as Condition Data Point Monitoring and Flowstar.net
- Application and CAD expertise along with a common worldwide database for online drawing access and repair standards
- Rapid parts delivery through globally linked business systems allowing our facilities to share inventory
- Superior quality and consistency from approved vendors around the world

Responsiveness to your needs

The mission of the Quick Response Center is just that: responding to your needs quickly. We have sized and equipped our QRCs to turnaround repaired and manufactured seals in less than 72 hours, in most cases. We are available with support **24 hours a day, 7 days a week.**

We supply more than hardware, we are also part of your reliability team. Highly qualified rotating equipment specialists, application and sales engineers are available to review and troubleshoot problem applications. Quick Response Centers support our global strategic alliance program, which will maximize the performance of your operation.

Seals for gas turbine and aircraft applications

Bellows face seals

High performance end-face mechanical seals, engineered to operate over a wide range of conditions and in environments where elastomers and other secondary seals are not practical. All metallic construction makes them well suited for oils, fuels, gases, and hydraulic fluids in both high and low temperature services. Low spring-rate bellows convolutions eliminate a dynamic secondary seal and produce controlled loads over large axial working lengths.

Typical applications include:

Auxiliary power units, Gearboxes, Fuel controls, Gas turbine mainshafts, Hydraulic pumps, Generators, Steam turbines, Turbopumps, and other turbomachinery

O-ring pusher seals

General purpose end-face mechanical seals, engineered to operate in wide range of services such as oils, fuels, gases and hydraulic fluids. Elastomer O-ring or advanced spring energized secondary seals are selected to extend the temperature capability and chemical compatibility.

Typical applications include:

Auxiliary power units, Gearboxes, Fuel controls, Gas turbine mainshafts, Hydraulic pumps, Generators, Steam turbines, Turbopumps, and other turbomachinery.

Rotors

The rotating elements of end-face mechanical seals, designed to meet the demands of the operating conditions. Common materials include alloy steel, stainless steel, and ceramics such as silicon carbide, silicon nitride and tungsten carbide. Hard face coatings are available for additional surface protection. Various configurations and drive mechanisms provide flexibility to meet application requirements. Lift features may be applied to the rotor face to create a non-contacting seal and to enhance performance.





Segmented seals

Segmented carbon ring circumferential seals, engineered with higher pressure capability than similar circumferential seals. Their compact construction is ideal for use in limited space while allowing for large axial shaft movement. Pressure balanced ring designs and hydrodynamic surface features provide low gas flows and long life in a variety of configurations. Joint technology provides anti-fouling in bearing oils, solids, or other process contaminants.

Typical applications include:

Auxiliary power units, Gas turbine mainshafts, Steam turbines, Turbopumps, and other turbomachinery.

Controlled clearance seals

Metal banded carbon ring circumferential seals, engineered to provide a controlled radial clearance throughout the service cycle of the application. These non-contacting seals are capable of operating in a wide range of conditions with reduced leakage compared to a metal labyrinth. Their compact construction is ideal for use in limited space while allowing for large axial shaft movement.

Typical applications include:

Auxiliary power units, Gas turbine mainshafts, Steam turbines, Turbopumps, and other turbomachinery

Specialty bellows seals

Engineered to achieve static or semi-static sealing and is capable of accommodating temperature extremes, large relative movements between sealing surfaces, and pressure fluctuations. Welded metal bellows are customized for services that include high/low temperature oils, fuels, gases, and hydraulic fluids.

Typical applications include:

Auxiliary power units, Fuel systems, Gas turbines, Hydraulic systems, and other turbomachinery

Magnetic face seals

General purpose end-face mechanical seals, engineered to operate typically in oils. Magnets energize the seal faces, offering a compact construction for use in limited space while allowing for large axial shaft movement.

Typical applications include:

Gearboxes and other accessory equipment

Flowserve pioneered micro machining mechanical seal faces with lasers and was first in developing bi-directional non-contacting seal faces, hydrodynamic surface tension technologies and spring energized grafoil.



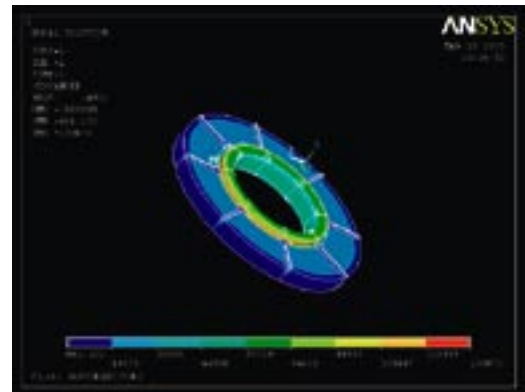
The solution is in our technological advantage

The depth of our experience in gas turbine and other industrial applications for mechanical seals is unmatched. This is evident by the latest advances we've made in seal face technology and seal design.

Leading-edge, non-contacting face technologies

The gas turbine industry demands seals that operate at extremely high speeds where life and reliability are expected by its demanding customer. Flowserve is the industry leader in advanced methods of producing seal faces that run cooler with less wear. Through our innovations in design and analysis using Finite Element Analysis, Computational Fluid Dynamics and a vast array of analysis tools, we can produce predictable results in product life in high speed applications.

Through our advances in micro machining mechanical seal faces, by the use of laser machining technology, our manufacturing system can produce very uniform, repeatable patterns beyond previous limits. This system also creates improved surface finish and novel patterns in a wide area of micro finishes. This high level of technological know how, developed from over a hundred years of experience, enables us to deliver reliable seals for all types of turbomachinery.





Extensive research and testing facilities

Flowserve's leadership and competence in the industry comes from our dedication to innovation, evident in our research and testing operations throughout the world. We've designed and implemented apparatus capable of testing seals at extremely high speeds, temperatures and pressures. Rigorous trials in demanding applications using light hydrocarbons, hazardous gases and abrasive slurries mean our seals perform as expected to our customers highest demands.

Our relationship with university research facilities and long time membership in the Fluid Sealing Association and European Sealing Association gives us insight into new stages of breakthrough seal technology.





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