



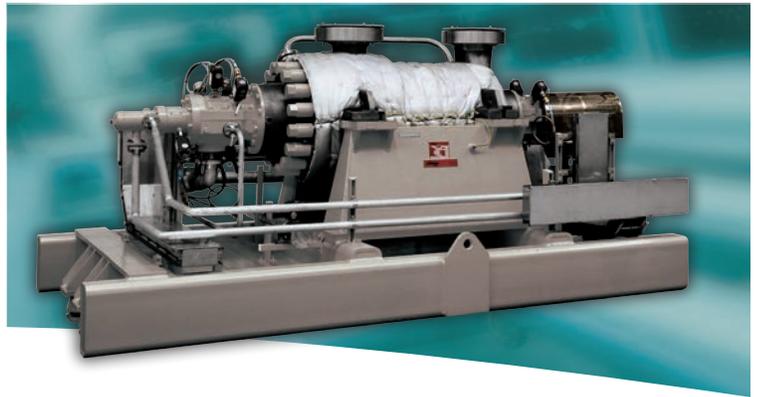
## *Pipeline Pump Seals*

in crude oil services, supercritical fluids, and refined products



*Experience In Motion*

*Flowserve provides expert technical solutions for the unique sealing needs of pumps in pipeline services.*



## ***The trusted partner in global pipeline pump sealing***

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

### ***Experience you can depend on***

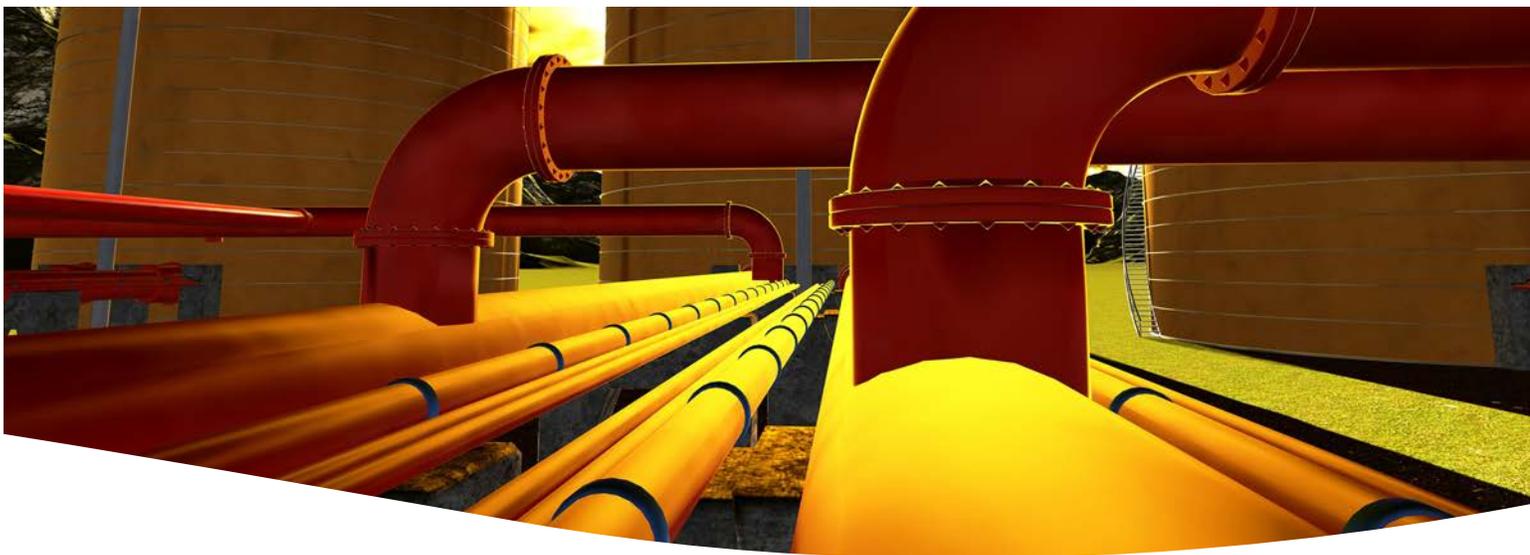
Flowserve pipeline seal specialists provide customers the technical support necessary to develop effective solutions for tough pipeline challenges. These solutions incorporate all manner of customer preferences, industry standards and regulations. Flowserve specialists have the knowledge and skills to work with customers to successfully achieve their operational goals.

#### **Pipeline seal specialists provide:**

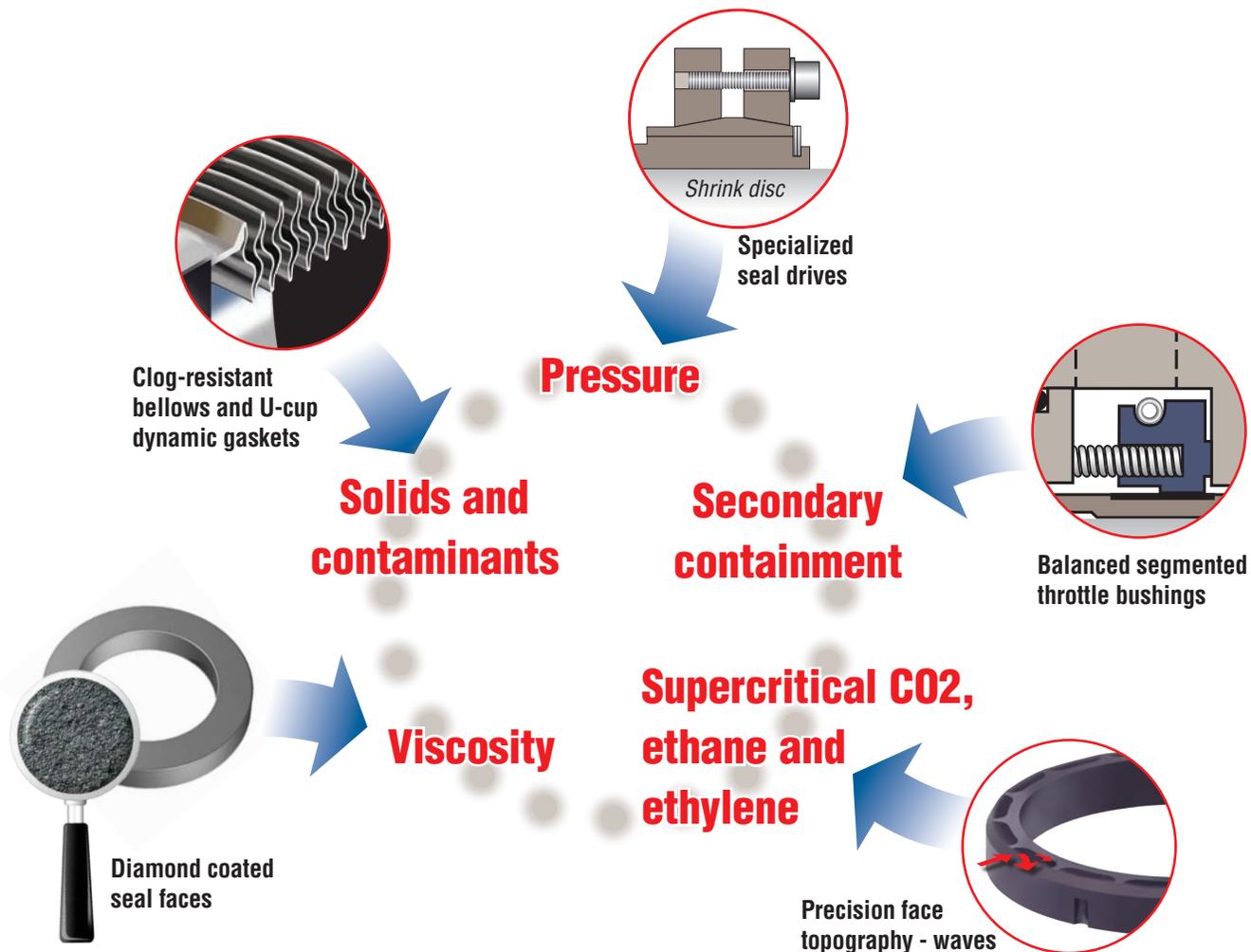
- up-front services including engineering analysis, materials review and product selection
- customer training
- field performance monitoring
- on-site installation and commissioning, technical services and troubleshooting

### ***Rugged pipeline pump seals***

Pipeline pumps present unique sealing challenges which are differentiated from downstream processing plants by the lack of plant utilities, remote locations, high pressures, and varying fluids with wide ranging viscosities. To address these challenges, mechanical seals need to be self-sufficient, heavy duty, and with robust secondary process containment features.



*Flowserve has developed technology to address the needs of our pipeline customers*



## ***HSH Seals are the workhorse of the pipeline industry***

***Capable of sealing the majority of crude oil and finished product fluid streams***

### ***Multiport flush design improves heat dissipation for uniform face cooling***

A standard distribution ring connected to the seal's flush port and located co-axially with the sealing interface improves the cooling efficiency of Piping Plan 11, 14, 21, 31, and 32 by injecting the flush flow 360° around the seal faces.

### ***Withstand high torque with heavy duty anti-rotation lugs engaged in seal face***

High torque-capable anti-rotation lugs along the length of the stationary seal face distribute contact loads, minimize distortion and minimize wear especially for high-viscosity applications.

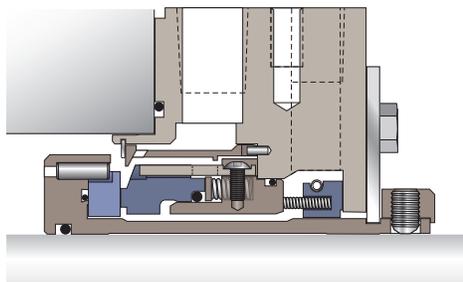
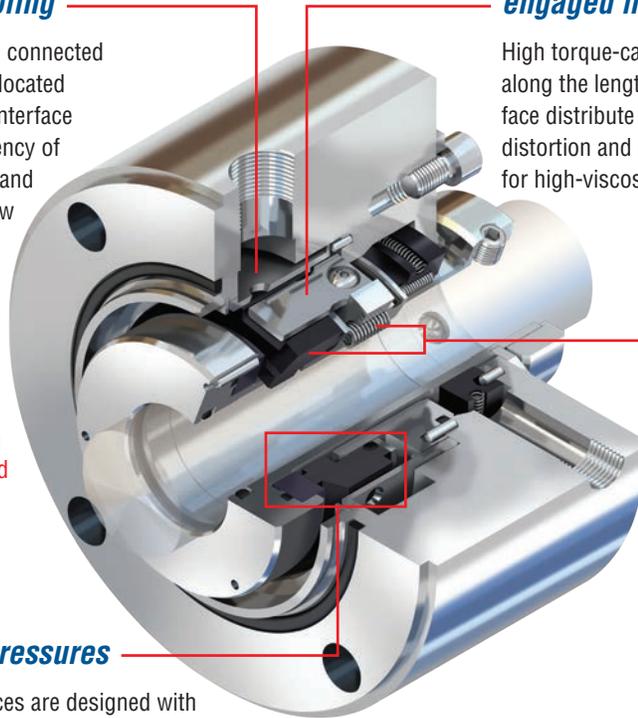
Single HSH seal model shown with floating segmented throttle bushing outboard

### ***Designed for high speeds and large shaft diameters***

Flexible stator design with Alloy C-276 springs allows high speed operation and is better able to tolerate out-of-square misalignment of the pump shaft to the seal chamber face.

### ***Designed for high pressures***

Thick cross-section seal faces are designed with proven FEA techniques to minimize deflections and stresses for reliable, low-leakage operation.



### ***Operating Parameters***

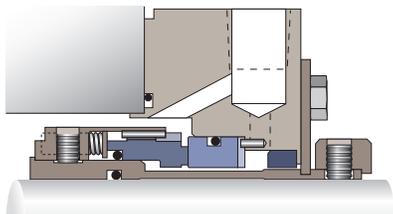
<b>Dynamic Pressure</b>	up to 103.4 bar (1500 psi)
<b>Static Pressure</b>	up to 206.8 (3000 psi)
<b>Temperatures</b>	-40° to 260°C (-40° to 500°F)
<b>Specific Gravity</b>	0.3 and higher
<b>Surface Speed</b>	up to 46 m/s (150 fps)
<b>Shaft Sizes</b>	25.4 to 156 mm (1.000 to 6.125 inches)

**Low Pressure**

**QB** Up to 52 bar (750 psi) flexible rotor

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.

- Fluids: light crude, hydrocarbons, ammonia, refined products, NGL

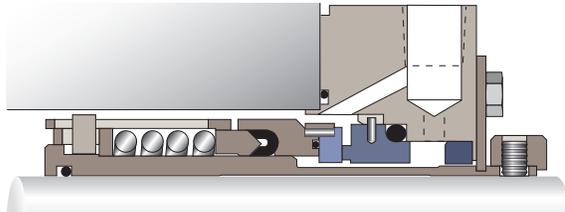


**Medium Pressure**

**UO** Up to 69 bar (1000 psi) flexible rotor

Moderate pressure pusher seal with thick section components is suited for tough, dirty services because of its single coil spring and large, elastomer U-cup seal.

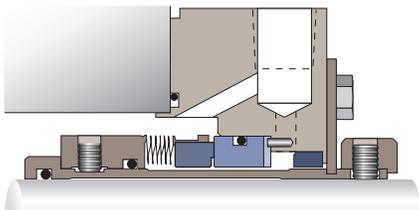
- Fluids: heavy crude, bitumen, ammonia, NGL



**BX** Up to 28 bar (400 psi) flexible rotor

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.

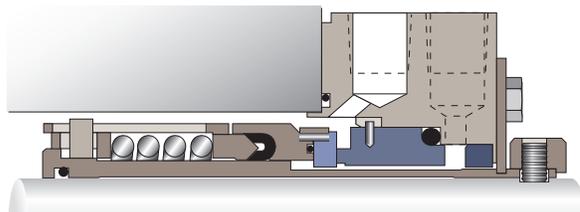
- Fluids: refined products, crude oil, gas oil, ammonia



**UOP** Up to 103 bar (1500 psi) flexible rotor

A higher 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

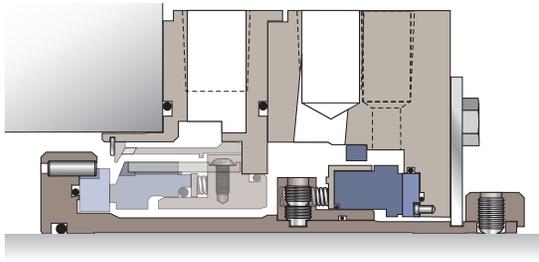


**Containment**

**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

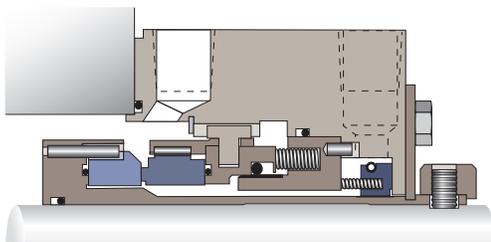


**High Pressure**

**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



## 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.

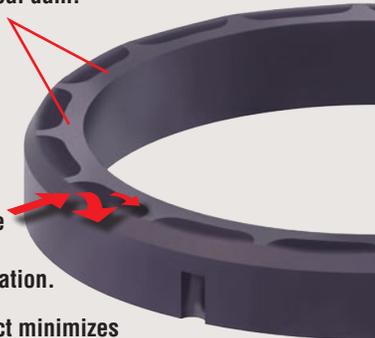
### Precision Face Topography

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.

Seal faces contact lightly at wave peaks and seal dam.

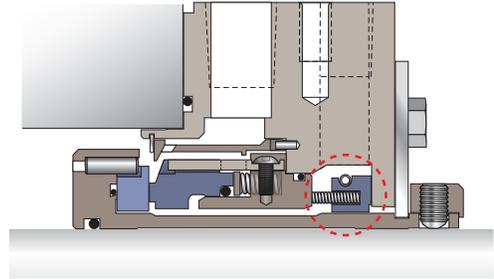
Fluid enters wave valleys to increase load support and reduce heat generation.

Recirculation effect minimizes fouling for high reliability.

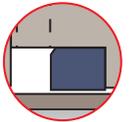


## Configure single and dual seals for low environmental impact

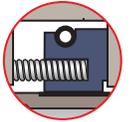
### Single seals with a containment device and drain connection in the gland



**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.



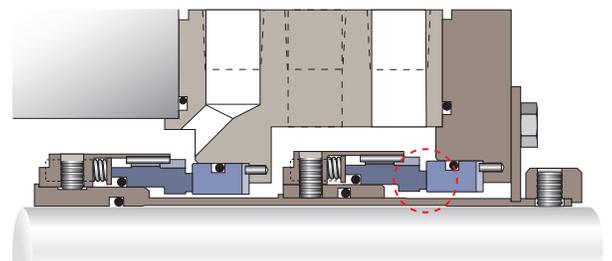
**Custom** containment devices per customer preference. Use with Plan 65 liquid leakage detection.



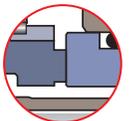
**Balanced floating bushings** provide maximum leakage containment in high pressure services. Use with Plan 65 and Plan 66 liquid leakage detection.



### 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



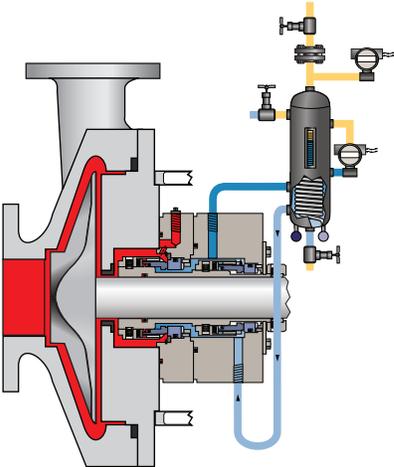
# Protecting your sealing environment

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:

<b>Plan</b>	<b>Plan Description</b>	<b>Special Purpose</b>
11	Flush from discharge	Default inboard seal flush
13	Recirculation to suction	Vertical pump venting
52	Dual nonpressurized loop	Tandem seal safety
53	Dual pressurized loop	Double seal support
54	External circulation system	High pressure support
65A	Fixed throttle bushing drain	Liquid leakage detection
65B	Adjustable throttle bushing drain	Liquid leakage detection
66A	Double throttle bushing drain	Vapor leakage detection
66B	Orifice; throttle bushing drain	Vapor leakage detection
75	Containment seal drain	Liquid leakage detection
76	Containment seal vent	Vapor leakage detection

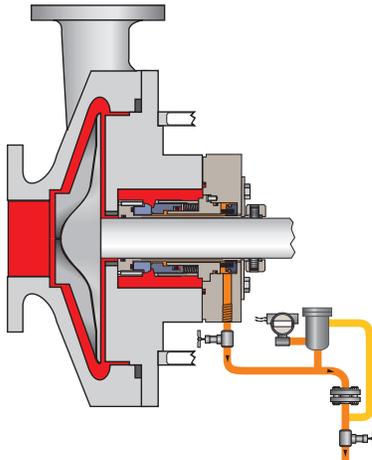
### Plan 52

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.



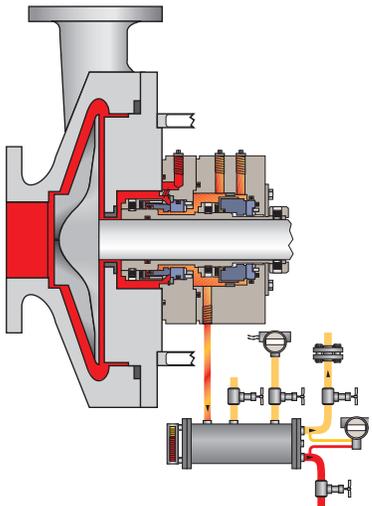
### Plan 65A

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.



## *Strategically located throughout the world, our QRCs provide local, rapid support*



### *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

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