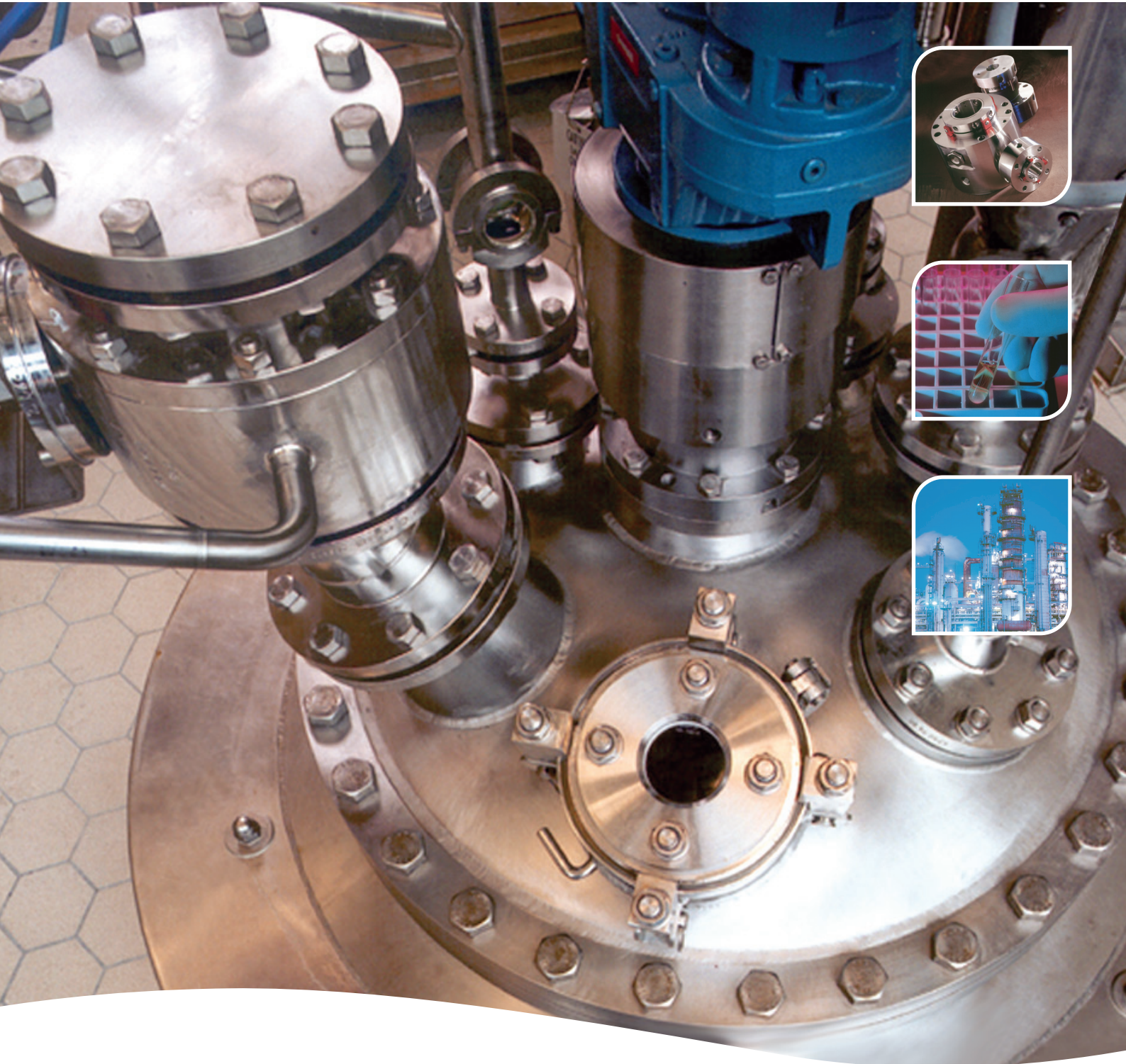




# *Mechanical Seals for Mixers and Specialty Equipment*

*Sealing solutions for safe, reliable operation of agitating,  
drying, filtering, separating and processing equipment*



***Experience In Motion***

*We are the leading-edge supplier of sealing solutions for the full range of applications in the chemical, pharmaceutical, food, and mining & ore processing industries.*



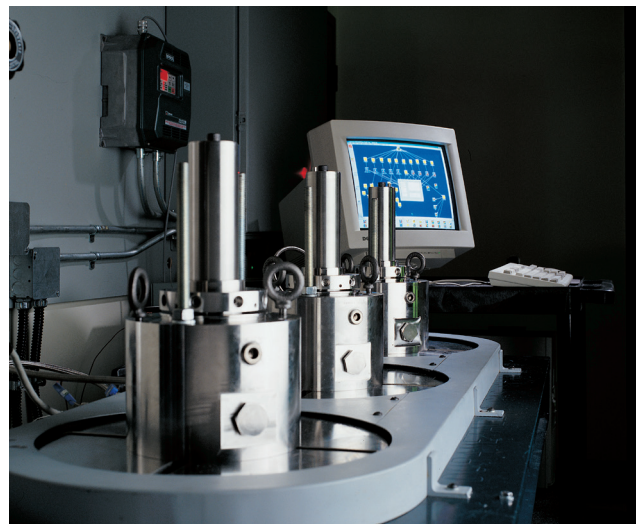
## THE FLOWSERVE ADVANTAGE IN MIXER AND SPECIALTY EQUIPMENT APPLICATIONS

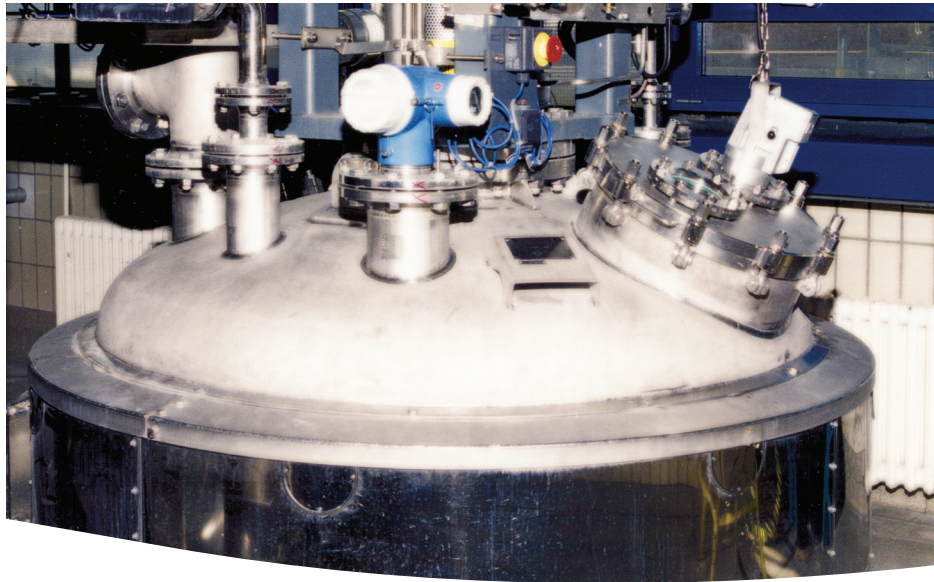
In chemical, pharmaceutical, food and mining & ore processing plants, diverse systems are employed for agitating, blending and mixing products.

Mixers, agitators, reactors, filters, dryers, and other specialty equipment require low maintenance operation and safety, both to protect the environment and the workplace. The mechanical seal design and sealing support system must provide excellent performance in each application, positively contributing to total operational reliability.

Flowserve provides the best sealing solutions drawing from the most comprehensive set of design options in the industry:

- Liquid lubricated, dry contacting or non contacting seal face technology
- Ability to tolerate equipment with significant radial and axial run-out allowing for axial and radial shaft movements
- Cartridge designs with and without a bearing
- Top, bottom and side entry seals
- Modular designs allowing easy part replacement
- Accommodation for sanitary gland/debris catcher for applications requiring steam cleaning
- CIP (Clean-in-Place) and SIP (Steam-in-Place) seal designs for the pharmaceutical and biopharmaceutical industries
- Reverse pressure capability and emergency sealing options
- Cooling and heating flanges and jackets
- Ability to design to customer and OEM specifications
- Split mixer seal designs allow easy installation without dismantling equipment
- Seal support systems for every piping plan to improve a seal's time between planned maintenance
- Designs engineered to comply with DIN, ISO, and other international standards
- Broad menu of internationally recognized materials to combat corrosion and erosion
- Vast experience providing pre-engineered designs to fit popular OEM equipment
- Seal support team experienced in sealing specialty equipment
- Batch process or continuous operation





## DESIGN CHARACTERISTICS OF SPECIALTY EQUIPMENT

### TOP ENTRY MIXERS

- Mechanical seal operates in gas phase at top of mixer vessel providing unique corrosion and heat transfer characteristics
- Forces on long shafts create shaft run-out at the seal
- Weight of the shaft and impeller must be supported by bearings in the gear box
- Hydraulic up-thrust of the shaft must be contained by the bearings in the gearbox
- Top entry mixers account for the majority of all specialty equipment
- Shaft sizes from 25 to 480 mm (1 to 19 inches)

### SIDE ENTRY MIXERS

- Mechanical seal operates in contact with product depending on process level
- Low process levels in vessel cause blade slapping on liquid surface and bounce shaft and seal
- Shafts, impellers, and seals operate at side of vessel
- Shafts are shorter, run-outs are smaller

### BOTTOM ENTRY MIXERS

- Mechanical seal operates in contact with product
- Gravity draws solids down into the seal area

- Seal change out is more difficult as the mixing vessel must be drained to access the seal

### DRYERS AND FILTER DRYERS

- Under vacuum with high temperatures
- Pasty initial product and powder final product
- Shaft moves up and down as much as 500 mm (19.7 inches) per stroke on a filter dryer
- Typically have the shortest and lightest shafts, provide lowest shaft run-out

### MINING AUTOCLAVES

- Process fluid: strong acid concentration in vapors (sulphuric) typically sparged with pure oxygen
- Temperature 200 to 290°C (400 to 550°F)
- Pressure 17 to 55 bar (250 to 800 psi)
- Shaft size 90 to 230 mm (3.500 to 9.000 inch)
- Shaft Speed 56 to 150 rpm

### CENTRIFUGES

- Typically low pressure, usually 1 bar (14.5 psi) or less, may reach 5 bar (72.5 psi)
- Typically three seals: two case seals and one feedpipe seal
- Temperatures typically low: less than 80°C (176°F)
- Moderate speed: 1200 rpm

## M SERIES MIXER SEALS

The M Series platform allows you to adapt the vertical shaft mixer seal to changing production requirements without investing in an entirely different seal. The seal faces can be changed out to run wet, dry contacting, or dry non-contacting gas barrier technology. With unprecedented application flexibility within one cartridge, the M Series design reduces the number of components in inventory and provides interchangeable parts across the product line for true component standardization.

M Series cartridge canister seals are designed to accommodate today's

demanding operating conditions and will satisfy tomorrow's needs for increased shaft size, temperature, pressure, and speed applications.

The M Series is available in designs fully compliant with the DIN standard. The complete size range from 40 mm through 220 mm is available for steel and glass lined vessels.

Optional materials compliant with FDA CFR 21, USP Class VI, ADI Free Components and similar specifications are available.

### **MD-200**

#### ***Top entry, dry contacting mixer seals***

##### ***Equipment Type***

- Mixers, agitators, blowers, fans

##### ***Operating Parameters***

Pressure vacuum to 6.7 bar (100 psi)

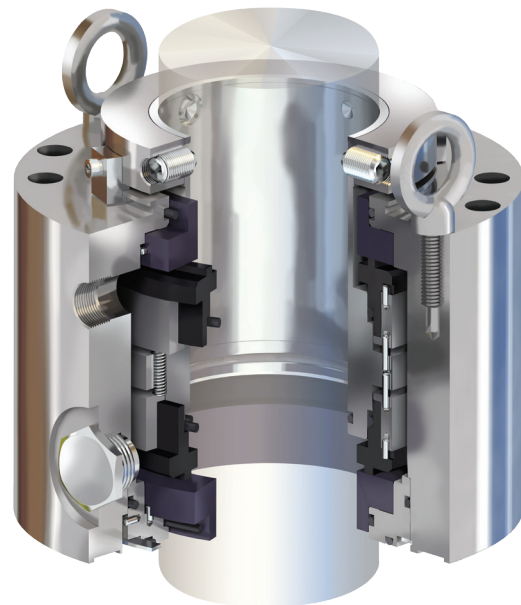
Temperature -40 to 150°C (300°F)

Speed up to 1.5 m/s (5 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

##### ***Features***

- Dual pressurized gas barrier seal with contacting seal faces
- Product side seal has reverse pressure capability
- Dry-running for minimized product contamination from barrier fluid
- Features self-lubricating faces
- Cooling flange for higher temperatures up to 200°C (390°F) available
- Available with or without bearing
- Optional debris well at inboard seal
- Available for steel or glass lined vessels



#### ***Other Configurations***

##### ***MD-200 DIN***

- Dimensions and flange connections to DIN for steel or glass lined flanges

##### ***MD-100***

- Single dry running seal

## MW-200

### Top entry, wet mixer seals

#### Equipment Type

- Mixers, agitators, filters, filter dryers

#### Operating Parameters

Pressure vacuum to 35 bar (500 psi)

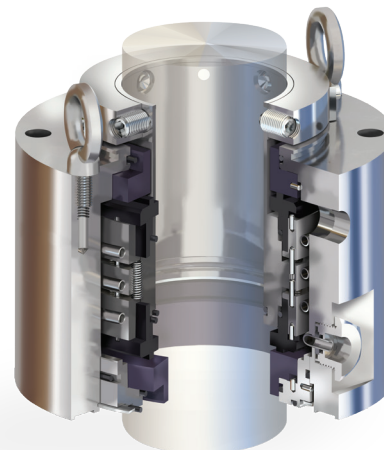
Temperature -40 to 200°C (390°F)

Speed up to 4 m/s (13 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

#### Features

- Liquid lubricated seal
- Product side seal has reverse pressure capability
- Balanced dual pressurized seal
- Cooling coil options for higher temperatures available
- Cooling flange for higher temperatures up to 300°C (570°F) available
- Available with or without bearing
- Designed for steel or glass lined vessels



#### Other Configurations

##### MW-200 DIN

- Dimensions and flange connections to DIN for steel or glass lined flanges
- Available with or without bearing

## ML-200

### Top entry, lift-off mixer seals

#### Equipment Type

- Mixers, agitators, filters, filter dryers

#### Operating Parameters

Pressure vacuum to 6.7 bar (100 psi)

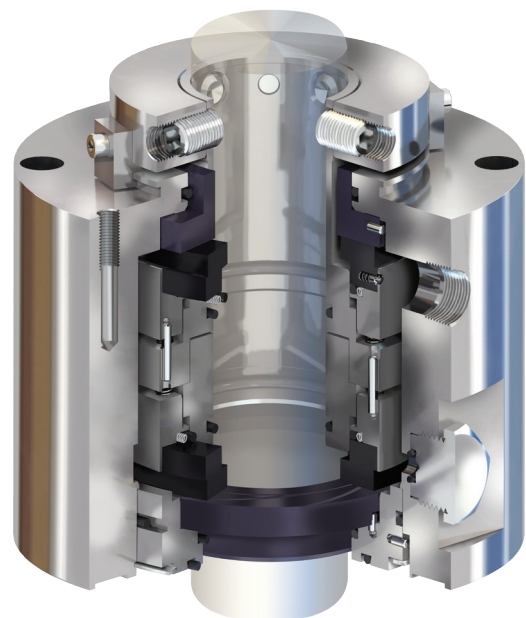
Temperature -40 to 200°C (390°F)

Speed up to 10 m/s (33 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

#### Features

- Noncontacting, lift-off gas barrier seal
- Advanced lift-off technology avoids wear from seal face contact
- Barrier leakage does not affect product quality
- Low drag design for the dynamic O-ring (no hang-up)
- Operates with a simple gas barrier support system
- Optional with or without bearing
- Cooling flange for higher temperatures up to 300°C (570°F) available



- Sanitary gland option for sterilization purposes
- Available for steel or glass lined vessels

#### Other Configurations

##### ML-200 DIN

- Dimensions and flange connections to DIN for steel or glass lined flanges
- Available with or without bearing

## Mixerpac 581

### Top and side entry seals for high pressure applications

#### Equipment Type

- Mixers, reactors

#### Operating Parameters

Pressure vacuum to 250 bar (3600 psi)

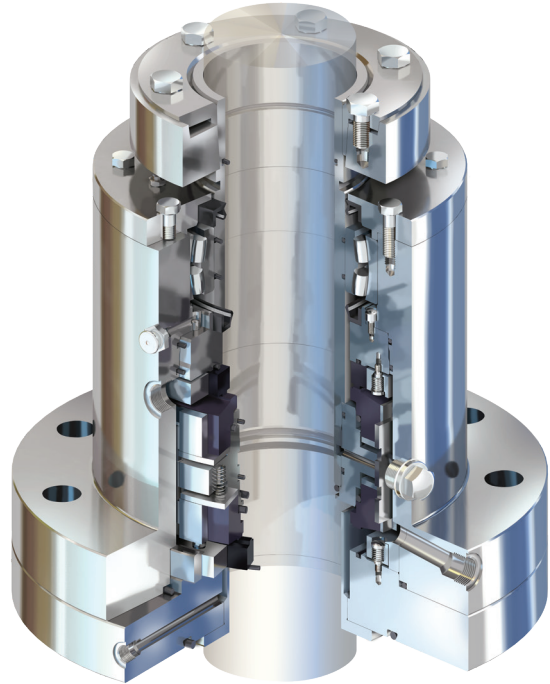
Temperature -40 to 200°C (390°F)

Speed up to 4 m/s (13 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

#### Features

- Modular cartridge design with bearing
- Liquid lubricated seal
- Balanced dual pressurized design
- Seal faces optimized through FEA
- Cooling flange for higher temperatures up to 300°C (570°F) available
- Optional with or without leakage collector
- Optional materials compliant with FDA CFR 21, USP Class VI, ADI Free Components and similar specifications



## Mixerpac 587 (without bearing)

## Mixerpac 588 (with bearing)

### Top and side entry mixer seals

#### Equipment Type

- Reactors, dryers

#### Operating Parameters

Pressure vacuum up to 40 bar (580 psi)

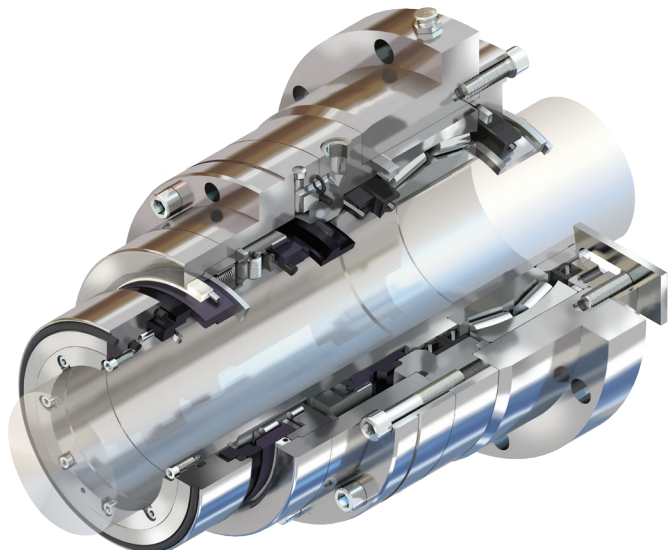
Temperature -40 to 200°C (390°F)

Speed up to 4 m/s (13 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

#### Features

- For highly viscous or pulverized products
- Liquid lubricated dual seal
- Guiding bushing provides proper barrier liquid circulation to the product side faces for sufficient heat dissipation
- Designed with few gaps and crevices
- Available designs for sterile applications



## **Mixerpac 585** (without bearing)

## **Mixerpac 586** (with bearing)

### **Bottom entry seals for slurry service**

#### **Equipment Type**

- Reactors, dryers

#### **Operating Parameters**

Pressure vacuum up to 6 bar (87 psi)

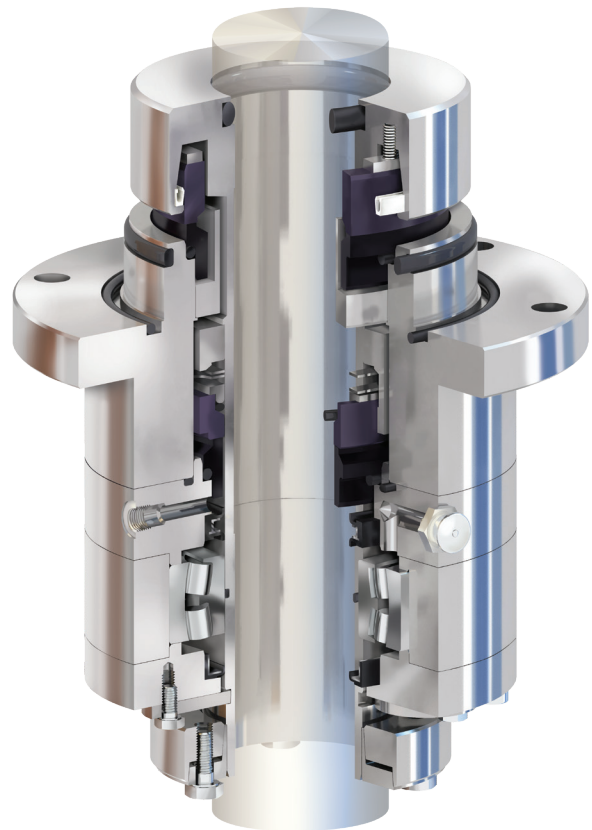
Temperature -40 to 200°C (390°F)

Speed up to 4 m/s (13 fps)

Shaft Sizes 40 to 220 mm (1.575 to 9.000 inch)

#### **Features**

- Liquid lubricated dual seal
- Integrated self aligning spherical roller bearing as movable bearing configuration
- Rotating spring-loaded unit, including self-emptying features
- Bushing provides proper barrier liquid circulation to the inboard product faces for sufficient heat dissipation
- Designed with few gaps and crevices



## **ST Series**

### **Bottom entry mixer seals for sterile applications**

#### **Equipment Type**

- Bioreactors

#### **Operating Parameters**

Pressure vacuum to 3.4 bar (50 psi)

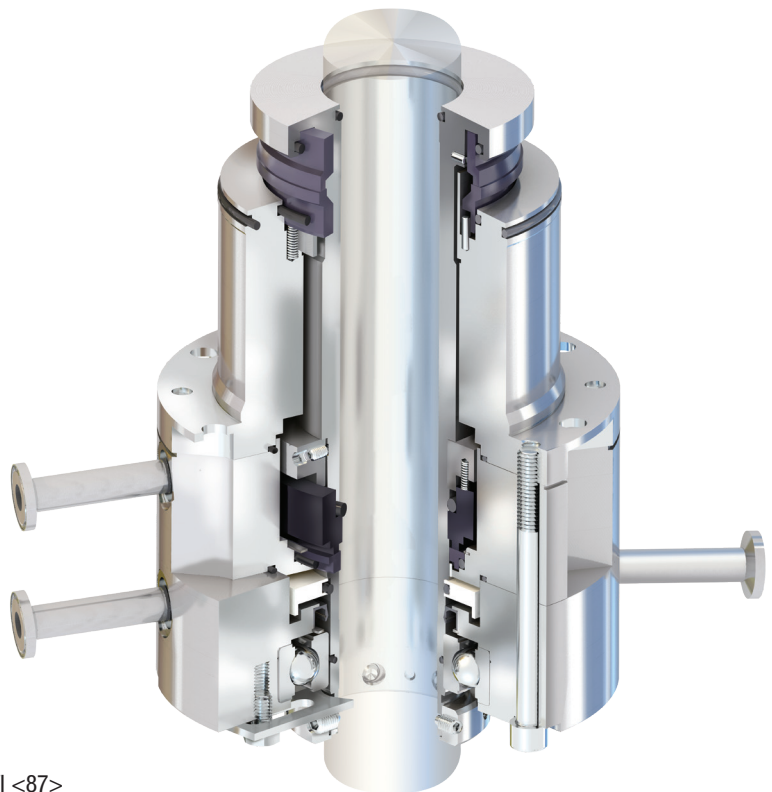
Temperature -40 to 135°C (275°F)

Speed up to 4 m/s (13 fps)

Shaft Sizes 25.4 to 108 mm (1.000 to 4.250 inch)

#### **Features**

- Liquid lubricated dual pressurized seal
- For sterile vessels, CIP and SIP use, drainable
- Minimum crevices
- Clean product side
- Optional with or without bearing
- Materials compliant with FDA CFR 21 and USP Class VI <87> <88>. All components are ADI free. Materials available to meet additional specifications as required.



## MWC-200

### Dual pusher seal for large size mixers

#### Equipment Type

- Mixers, agitators, reactors

#### Operating Parameters

Pressure	up to 20 bar (290 psi)
Temperature	up to 225°C (437°F)
Speed	up to 1.7 m/s (5.6 fps)
Shaft Sizes	up to 480 mm (18.900 inch)

#### Features

- Dual pressurized wet seal for large shaft mixers
- Composite seal face assemblies for reverse pressure capability and increased torque capacity
- Titanium materials standard for metallic components in contact with the process
- Multiple cooling cavities to support dead ended barrier flow conditions



- Robust and proven drive mechanisms capable of handling significant torque loads
- Custom spherical roller bearing to support the equipment shaft through adverse operating conditions

## ISC2-MW

### Dual pusher seal for mixer service

#### Equipment Type

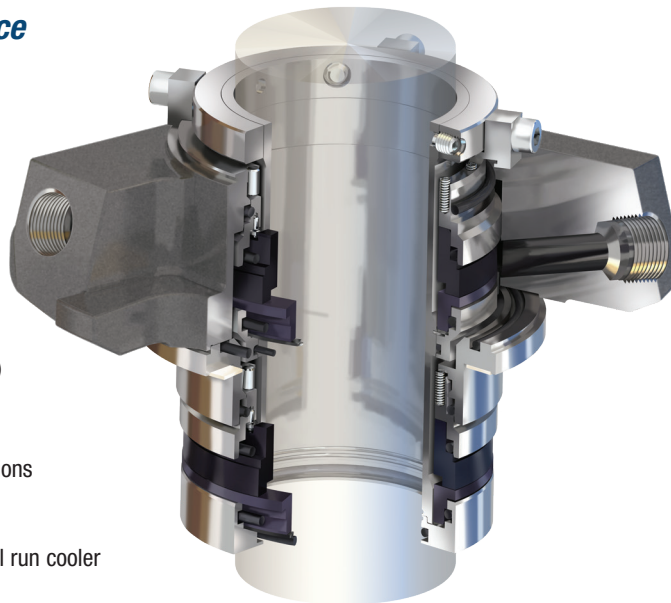
- Mixers

#### Operating Parameters

Pressure	up to 20.7 bar (300 psi)
Temperature	-40 to 204°C (400°F)
Speed	up to 1.1 m/s (3.5 fps)
Shaft Sizes	25 to 200 mm (1.000 to 8.000 inch)

#### Features

- Economical cartridge seal for top entry installations
- Dual wet design
- Thermal management technology helps the seal run cooler and tolerate dry running events
- 1.14 mm (0.045 inch) TIR on sizes up to 89 mm (3.500 inch) shaft size
- 1.52 mm (0.060 inch) TIR on sizes greater than 89 mm (3.500 inch) shaft size
- Volute groove significantly increases barrier fluid flow to promote cool running even at mixer speeds





## VRA

### Top entry, dry running single mixer seals

#### Equipment Type

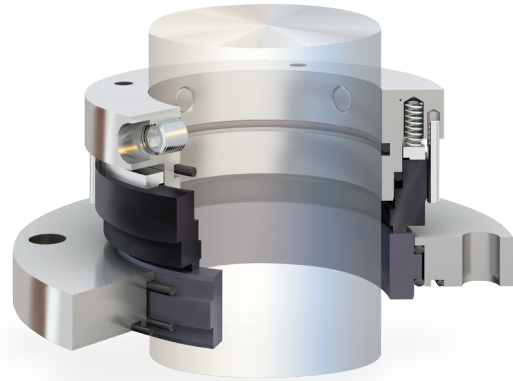
- Mixers, agitators

#### Operating Parameters

Pressure	up to 6 bar (90 psi)
Temperature	-18 to 150°C (0 to 300°F)
Speed	up to 1.5 m/s (5 fps)
Shaft Sizes	40 to 220 mm (1.500 to 9.000 inch)

#### Features

- Dry running contacting seal
- Single outside design
- No buffer fluid system needed
- Tolerates intermittent eccentricity up to 3.8 mm (0.150 inch) TIR
- Available with or without bearing
- Optional cartridge design
- Sanitary gland for sterilization purposes



- Optional materials compliant with FDA CFR 21, USP Class VI, ADI Free Components and similar specifications

#### Other Configurations

##### VRA-C

- No product-wetted metal parts

## MSS

### Top entry, split mixer seal

#### Equipment Type

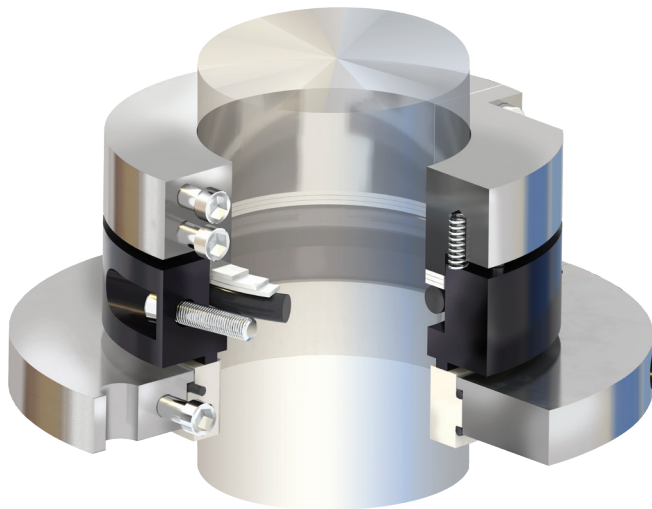
- Mixers, agitators

#### Operating Parameters

Pressure	up to 6 bar (90 psi)
Temperature	-18 to 150°C (0 to 300°F)
Speed	up to 1.5 m/s (5 fps)
Shaft Sizes	40 to 220 mm (1.500 to 9.000 inch)

#### Features

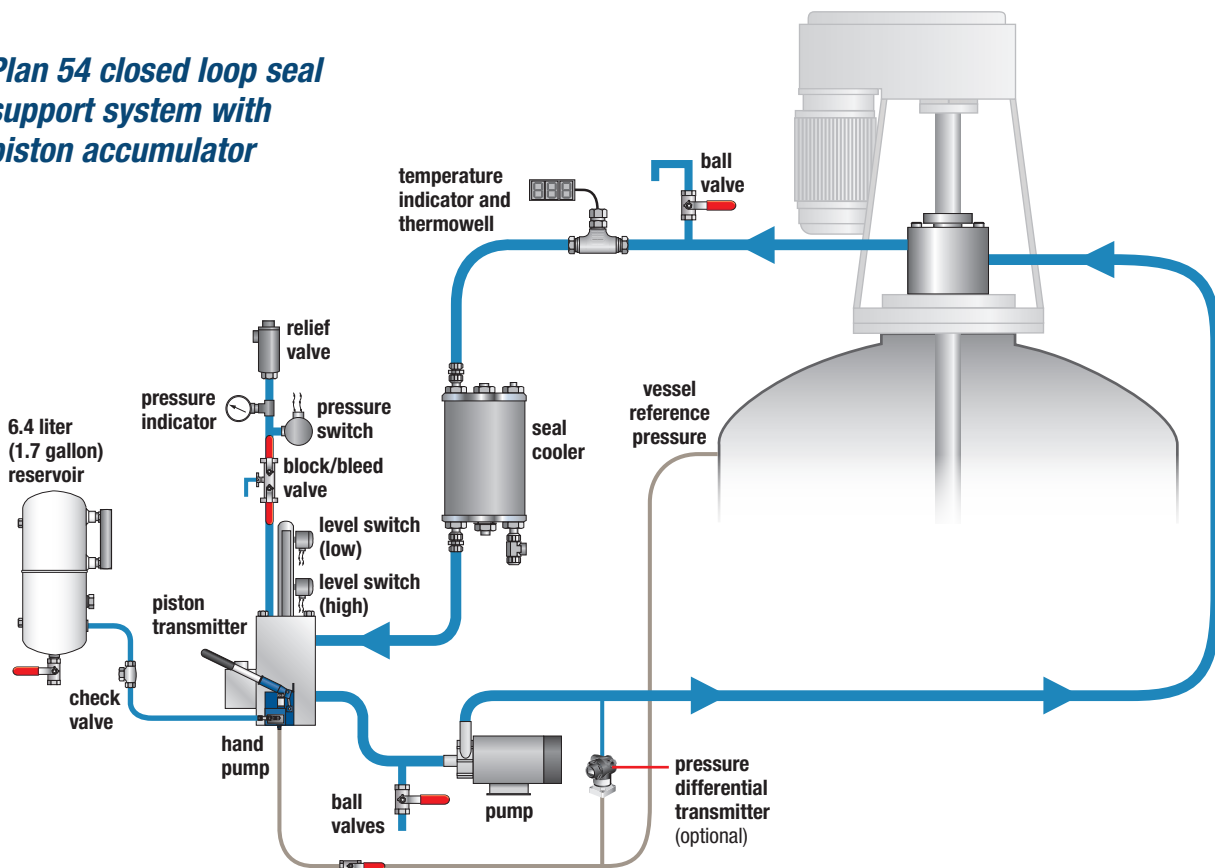
- Dry running, single balanced, contacting design
- Outside mounted split seal, no wetted metal parts
- Installation without machine disassembly
- Other sizes and operating limits upon request
- Optional materials compliant with FDA CFR 21, USP Class VI, ADI Free Components and similar specifications



## Optimize equipment performance with seal support systems

Dual pressurized mechanical seals require pressurized barrier fluid. In the following Plan 54 systems, the barrier fluid provides positive separation between process fluid and atmosphere when no process leakage can be tolerated.

### Plan 54 closed loop seal support system with piston accumulator



#### What

This system features:

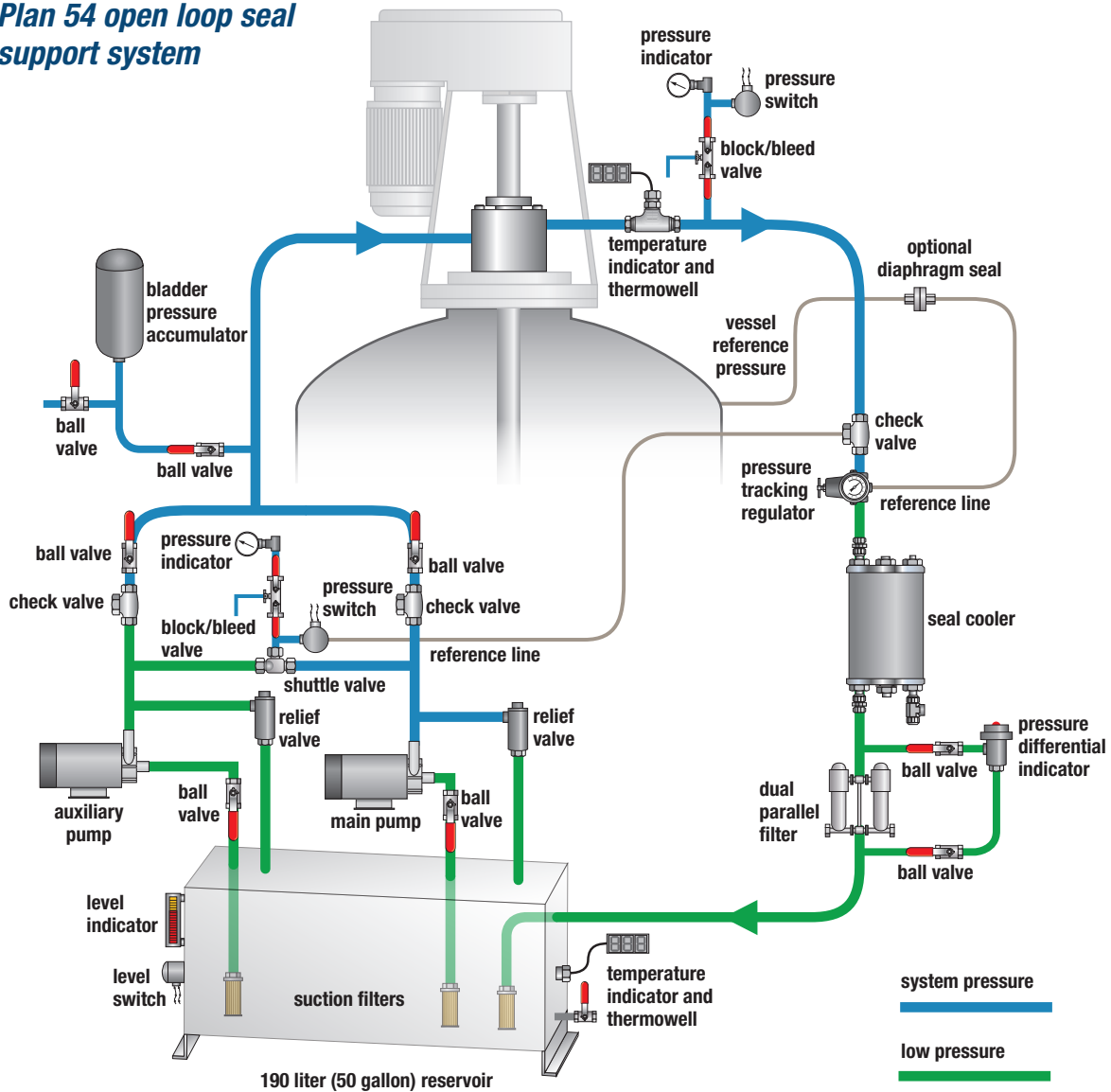
- Piston transmitter driven by vessel pressure establishes higher pressure in the barrier fluid
- System is refilled with a hand pump as required during operation
- The piston transmitter system has a pressure relief valve so the seal cannot be over-pressurized during refill with the hand pump
- The piston transmitter system has a limit switch to signal when the piston needs to be refilled
- A pump circulates the barrier fluid for seal cooling
- Seal cooler removes heat from the barrier fluid
- System monitors pressure, temperature, and level of barrier fluid
- Visual indication and DCS feeds

#### Where

This system may be used on any dual pressurized mechanical seal with operating requirements within the capability of this unit. This closed loop piston transmitter design is used where:

- No existing plant barrier pressure is available
- Reliable mechanical vessel pressure tracking is desired
- Little space is available due to minimum footprint
- System is required to be in close proximity to the seal
- Hand pump filling of closed seal barrier fluid loop is desirable

## Plan 54 open loop seal support system



### What

This system features:

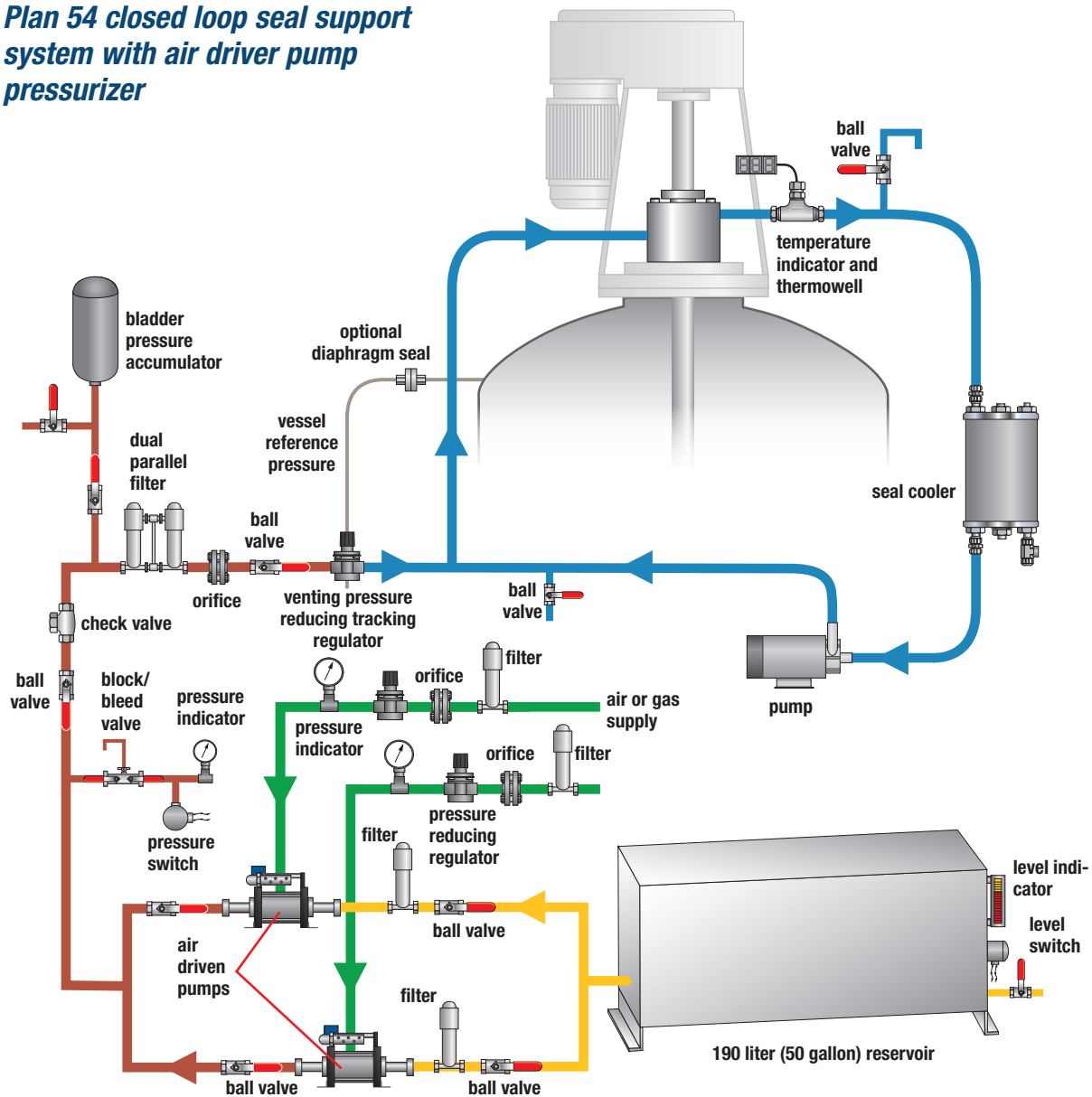
- 190 liter (50 gallon) barrier fluid reservoir that can be easily filled during operation
- System monitors pressure, temperature, level, and flow of barrier fluid
- Visual indication and DCS feeds
- Barrier pressure is set based on vessel pressure by a pressure tracking regulator
- Auxiliary pump in case of main pump failure
- Bladder pressure accumulator to maintain barrier pressure on seal when power is lost
- Dual parallel filters can be replaced during operation
- Seal cooler to remove heat from the barrier fluid
- High point bleed valves to completely purge system of air

### Where

This system may be used on any dual pressurized mechanical seal with operating requirements within the capability of this unit. This open loop /open vessel design is used where:

- No existing plant barrier fluid is available
- Critical processes demand dual back-up systems
- Can be installed in close proximity to the seal when open footprint is available
- One dual seal requires Plan 54
- Visual confirmation of seal performance by viewing barrier fluid level is desirable
- Manual filling of the barrier fluid reservoir is desirable

## Plan 54 closed loop seal support system with air driver pump pressurizer



closed loop seal circulation

air or gas pressure supply

piston pump high pressure

atmospheric pressure barrier fluid

### What

This system features:

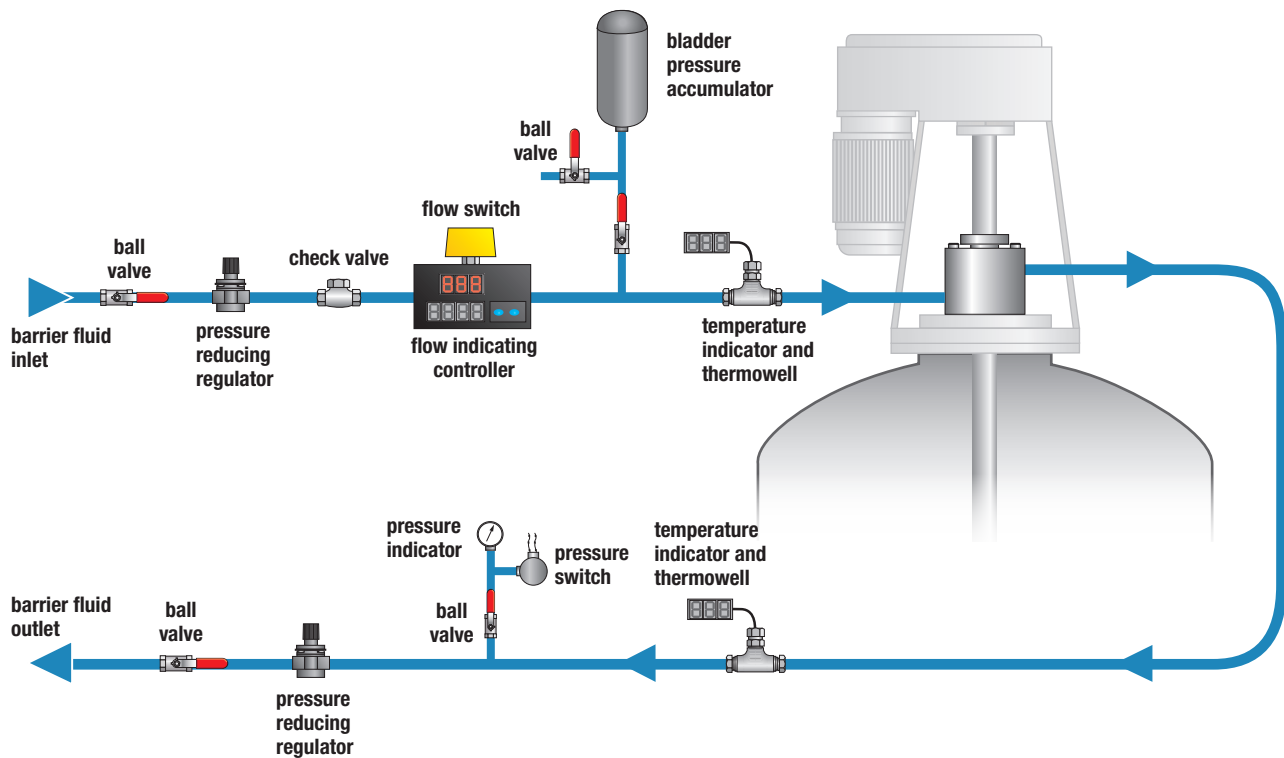
- Air driven pumps provide pressure to the closed loop
- Auxiliary pump to back up main pump
- Air pump can be replaced while system is in operation
- Air pump can be driven off any source of gas pressure
- Dual filters can be maintained during operation
- The air pumps provides high liquid header pressure which is then regulated to the closed loop pressure

### Where

This system may be used on any dual pressurized mechanical seal with operating requirements within the capability of this unit. This closed loop/piston pump pressurizer is used where:

- No existing barrier fluid is available
- Pressurizer is used to pressurize multiple individual seal loops
- Pressurizer can be located far from the seal loops
- Critical processes when dual back-ups are required
- Small space available at the mixer/seal
- Manual filling of the atmospheric barrier fluid reservoir is desirable

## Flush Plan 54 seal support panel



### What

This control panel contains the following features:

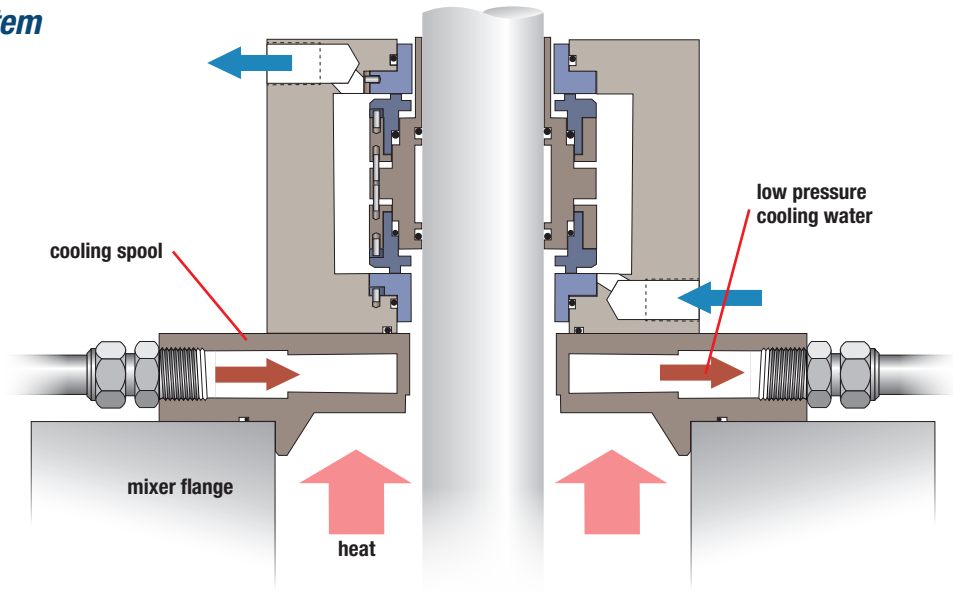
- Controls flow and pressure to the seal
- Pressure and flow set from one panel
- Visual indication and DCS feeds for temperature, pressure, and flow
- Owner/user can use existing source of plant barrier fluid
- Accumulator designed in system for temporary loss of barrier pressure or flow

### Where

This panel may be used on any dual pressurized mechanical seal with operating requirements within the capability of this panel. This open loop control panel is used where:

- Appropriate barrier fluid, barrier fluid flow, barrier fluid pressure are available
- Monitoring of seal performance at mixer is important
- Simplicity, cost, and maintainability are important

**Auxiliary cooling system control used with Plan 54 seal support system**



**What**

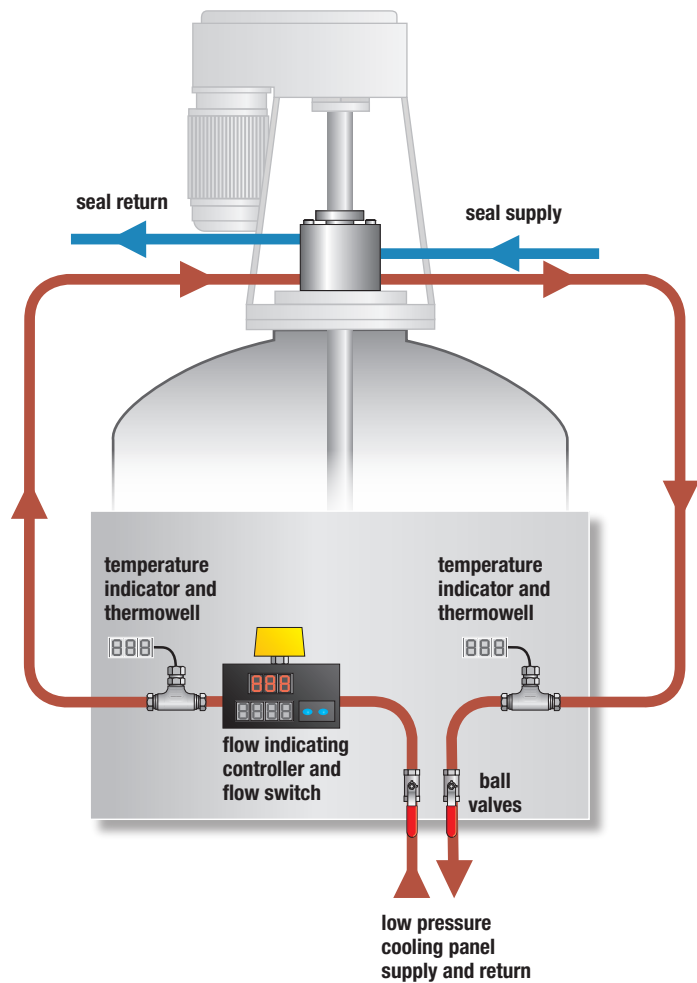
This control panel contains the following features:

- Protect inboard elastomers from thermal stress
- Reduces the heat flow into the Plan 54 barrier fluid so the barrier fluid flow can be reduced
- Reduces the temperature of the Plan 54 barrier fluid so the barrier fluid will last longer
- This panel can support a cooling spool used with a single seal
- This panel has visual indication and DCS feeds for temperature and flow into and out of the cooling spool
- Operator provides source of cool water flow

**Where**

This panel is used on any top entry mixer where extreme temperatures in the vessel might conduct heat to or from the mechanical seal causing damage to seal components and/or the barrier fluid. Use this panel where:

- It is necessary to block extreme high or low temperatures in the vessel from the seal
- Source of cool low pressure plant water is available for cooling
- Cooling spool and/or jacket are included in the mechanical seal design



## *Flowserve is the leading-edge provider of seal support products and engineered systems*



Fluid control over the sealing environment is very important to achieve effective and dependable sealing performance. Seal support systems are used to create that favorable environment around the mechanical seal. The appropriate selection of a seal support system will deliver years of reliable service and operating cost savings.

Flowserve employs a specialized engineering team with years of experience and knowledge designing and selecting seal support systems to suit specific applications, specifications, and unique customer requirements. We offer a full range of products that meet ASME, API, PED, ISO, and NR13 design criteria





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