



# ADVANCED SEALING TECHNOLOGY INSTALLATION INSTRUCTIONS

## AST 80 DUAL CARTRIDGE SEAL

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The seal must be installed in accordance with these instructions, the equipment manufacturer's instructions, and plant safety requirements. If you are in doubt about any phase of installing this mechanical seal, stop the installation and get assistance. The decision to use any AST mechanical seal in a particular service is the customer's responsibility. If the pumped fluid is hazardous or toxic, appropriate precautions must be taken to contain any seal leakage.

### PREPARATION

1. Follow plant safety regulations prior to equipment disassembly:
  - lock out motor and valves
  - wear designated personal safety equipment
  - relieve any pressure in the system
  - consult plant MSDS files for hazardous material precautions
2. Disassemble the pump in accordance with manufacturer's instructions so the seal can be installed over the end of the shaft.
3. The shaft or sleeve diameter must be within  $+ .000 / - .002$  inch of nominal size. The shaft must be smooth ( $32 \mu$  inch  $R_a$ ) and free from nicks, grooves, and corrosion. Replace the sleeve or shaft if worn. Remove all sharp edges and burrs from shaft keyways, threads, and edges where the O-ring will slide.
4. Maximum shaft runout at seal chamber face is  $.002$  inch FIM. To measure, mount dial indicator on seal chamber and indicate shaft while rotating shaft.
5. Maximum axial movement of shaft (end play) is  $.005$  inch FIM. To measure, mount dial indicator on shaft and indicate seal chamber face while moving shaft axially.
6. The seal chamber face must be smooth ( $63 \mu$  inch  $R_a$ ) and free of nicks, burrs, and corrosion.
7. Maximum out-of-squareness of the seal chamber face to the shaft is  $.002$  inch FIM, ( $.003$  inch FIM for shaft size  $> 3$  inch). To measure, mount dial indicator on shaft and indicate seal chamber face while rotating shaft.
8. If the seal gland is piloted to the seal chamber, the register surface must be concentric to the shaft within  $.005$  inch FIM.
9. The O-ring elastomer installed in the seal is identified on the seal drawing. There may also be an alternate set of O-rings packaged with the seal. Determine what O-ring elastomer is suitable for your application by consulting an O-ring compatibility table. Be sure the correct O-rings for your application are installed in the seal.

### INSTALLATION

1. Lubricate the shaft sparingly with silicone lubricant (supplied with the seal) or with other lubricant compatible with the O-rings and your machinery and product. Do not use petroleum lubricants on EP O-rings. Make sure the gland O-ring or gasket is in place.
2. Slide the AST 80 seal onto the shaft. If the seal doesn't slide over the shaft, make sure the set screws do not extend into the bore of the seal sleeve. Don't loosen the three red half dog point set screws more than one-half turn—they hold the seal together.
3. Reassemble the pump components. Orient the seal gland as shown on the barrier fluid system diagram.
4. Check and reset the impeller clearance if required. The impeller can be reset at any time when the centering blocks are in place and the set screws are loosened (not more than one-half turn).
5. Push on the lock ring to bring the gland O-ring or gasket in contact with the seal chamber face. Install and tighten the gland nuts evenly in a diagonal sequence.
6. Connect and align piping and motor coupling.
7. Make sure the ends of the centering blocks contact the recess in the gland. Tighten all the set screws in the lock ring with the hex key provided with the seal.
8. Remove the centering blocks and screws. Save them to reset the seal after impeller adjustment or seal removal.
9. Rotate the shaft by hand to check for obstructions or contact. Do not start the equipment dry.

### PIPING AND OPERATION

1. Connect a barrier fluid system, as described on the following pages. A flush line can also be connected to the seal chamber tap. A flush from a clean external source (API Plan 32) should be used for abrasive services. For clean cool products, use a discharge bypass (API Plan 11) or a suction bypass (API Plan 13). For clean hot products, use a discharge bypass through a cooler (API Plan 21), preferably with a throat bushing.
2. Do not start the pump dry. Open valves to flood the pump. Vent air from the pump casing, seal chamber, and barrier fluid system.
3. Observe the startup from a safe distance. If the seal runs hot or squeals, stop the pump and check the barrier fluid system and gland centering.

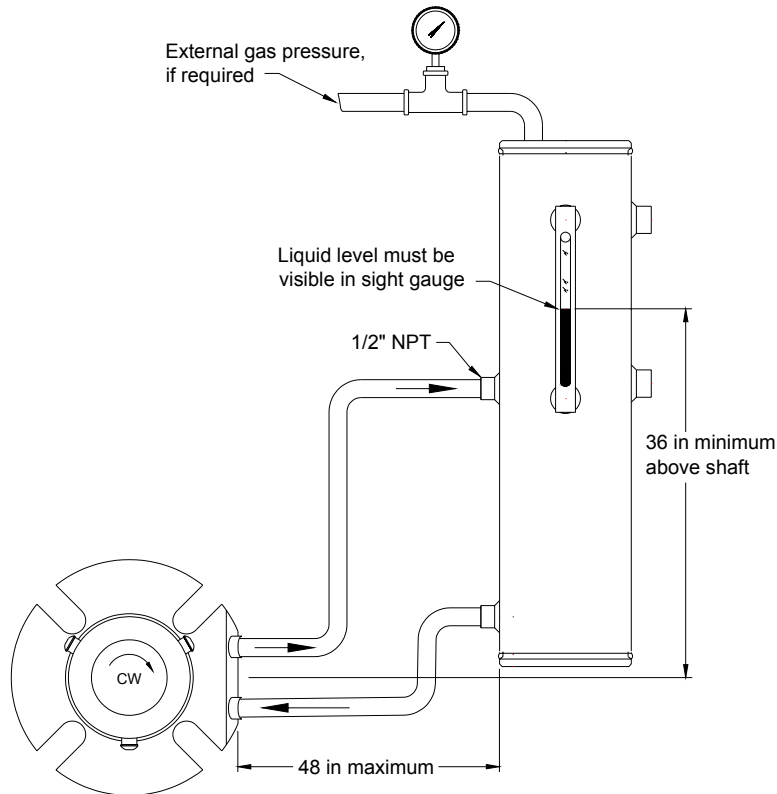
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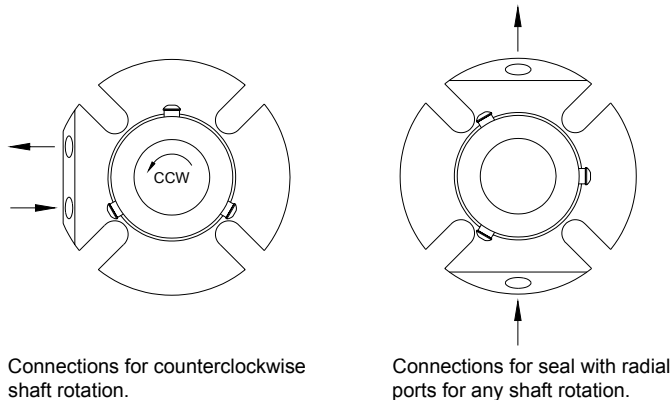
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## AST 80 DUAL CARTRIDGE SEAL

### BARRIER FLUID SYSTEM



Typical installation of AST 80 dual seal with tangent ports for clockwise shaft rotation (viewed from coupling).



#### Notes:

1. Return line from seal to reservoir (hot line) is connected to top port on both seal and reservoir.
2. Minimize flow restrictions in piping. Use 1/2 inch or larger 300 series stainless tubing. For tubing use smooth, long-radius bends. For piping, use 45° elbows instead of 90° elbows.
3. All lines shall slope up from the seal gland to the reservoir at a minimum of 1/2 inch per foot.
4. Hot lines should be insulated as necessary for safety.



## BARRIER/BUFFER FLUID SELECTION

Dual seals may be operated with either a pressurized barrier fluid or an unpressurized buffer fluid between the two seals. A pressurized barrier fluid (Plan 53, or double seal operation) is used when the pumped fluid must be isolated from the environment to prevent flashing, crystallization, or polymerization; or when the pumped fluid is toxic or hazardous. The barrier fluid is typically pressurized 15-30 psi over seal chamber pressure.

An unpressurized buffer fluid (Plan 52, or tandem seal operation), is used to provide cooling or lubrication to sealed fluids with poor lubricating characteristics, such as light hydrocarbons. A buffer fluid which has a lower vapor pressure than the sealed fluid, and which is immiscible with it, allows the process fluid leakage to bubble through the buffer fluid to be vented to flare or other control device.

Neither barrier nor buffer fluids should be confused with a seal flush (Plan 11 and others), which is injected directly into the pumpage through the seal gland or the pump's seal chamber.

A barrier or buffer fluid should be

- compatible with the process,
- compatible with the seal materials,
- a good lubricant and heat transfer medium for the seal faces,
- benign to the environment and the workers in the plant.

Some good choices for barrier and buffer fluids:

**Water:** Cheap, safe, available, excellent heat transfer characteristics (high specific heat, low viscosity, high thermal conductivity). Don't use in freezing conditions.

**Water/ethylene glycol mixture:** Almost as good as water for heat transfer; doesn't freeze in outdoor applications. 50/50 mix by volume is easiest to mix, and gives good freeze protection. Use corrosion-inhibited industrial grade.

**Water/propylene glycol mixture:** Like water/ethylene glycol, but usable in food applications.

**Light mineral and synthetic oils:** Generally good. Within synthetics, polyalphaolefin (PAO) based fluids are usually better than ester-based. Synthetic oils specifically formulated for use as mechanical seal barrier fluids are available, including grades accepted by FDA and USDA.

**Kerosene or Diesel fuel:** Good where an oil is required. Low enough viscosity to flow well and transfer heat, and a good lubricant. Vapor pressure low enough that emissions aren't a problem.

Some common, but bad, choices:

**Automotive antifreeze:** Contains additives to prevent corrosion of automotive engine components and to stop small radiator leaks. These additives cause excessive seal face wear.

**Uninhibited ethylene glycol:** Without corrosion inhibitors, can attack seal parts, notably the nickel binder in tungsten carbide.

**Automatic transmission fluid (ATF):** Contains additives to increase friction in the bands and clutches in automatic transmissions. These also increase wear and friction in seal faces.

**Silicone oils:** Inert, but often form glassy particles that abrade and clog seals.

**Turbine oils:** Additives can plate out on seal faces. 6/2007



# ADVANCED SEALING TECHNOLOGY

## BARRIER/BUFFER FLUID SELECTION

	Heat Transfer	Temperature Range		Food Use	Cost	Notes
		°F	°C			
Water	Best	40/180	4/80	OK	Low	Can freeze Rusts steel
Water/ Ethylene Glycol	Very good	-50/220	-46/104	No	Moderate	May be classed as hazardous Use inhibited grade Don't use automotive antifreeze
Water/ Propylene Glycol	Very good	-20/220	-32/104	OK	Moderate	
Kerosene	Good	0/300	-18/150	No	Moderate	Attacks EP
Diesel Fuel	Good	10/300	-12/150	No	Moderate	Attacks EP
Methanol	Good	-93/30	-70/0	No	Moderate	Attacks Viton Classed as VHAP
Propyl Alcohol	Good	-127/157	-88/69	No	Moderate	
Mineral Oil	Good	-13/400	-25/204	OK	Moderate	Attacks EP
Synthetic Oils	Good	-60/450	-51/232	Some	High	Grades vary widely Attacks EP

Temperature range depends on

- mixture strength (water/glycol mixes)
- local formulation (diesel fuel, kerosene)
- grade (synthetic and mineral oils). 0798



# ADVANCED SEALING TECHNOLOGY

## MECHANICAL SEAL RESERVOIR

Dual mechanical seals require that a barrier or buffer liquid be introduced between the seals for cooling and lubrication. The most economical and commonly used method to provide this liquid to the seal is a reservoir piped to the seal. The reservoir can be used in remote locations without elaborate piping systems.

A dual seal with barrier fluid pressure greater than process pressure is often called a double seal. This mode of pressurization prevents leakage of product into the reservoir or to the environment. Reservoir pressure is usually maintained at 15-30 psi (1-2 bar) greater than process pressure. Nitrogen or compressed air available in the plant are common sources of pressure.

If process pressure exceeds buffer pressure, the seal is said to be operated as a tandem seal. The reservoir may be pressurized to split the pressure loading between the inboard and outboard seals or to force buffer liquid between the outboard seal faces for lubrication. Any product leakage is contained by the reservoir.

A process fluid that is pumped as a liquid but exists as a gas at atmospheric conditions, such as a light hydrocarbon, may be sealed using a dual seal with an unpressurized buffer fluid. An immiscible buffer fluid such as diesel fuel is used. Any product that leaks through the inboard seal bubbles up through the buffer liquid in the reservoir, where it can be vented to a flare or vapor recovery device.

Since the AST 80 has a double-balanced inboard seal, it may be pressurized as either a double or tandem seal.

### INSTALLATION:

Locate the reservoir not more than four feet (1.2 m) from the seal, with the center of the reservoir sight gauge 36 inches (90 cm) minimum above the centerline of the pump shaft. Mount the reservoir to a rigid support where the sight gauge is easily visible for inspection and where the fill ports are accessible. Use 1/2 inch 300 series stainless tubing to connect reservoir to seal. Slope lines up from seal.

Fill the reservoir to the center of the sight gauge. This provides enough barrier liquid to allow for losses, while leaving headspace in the reservoir to allow for thermal expansion. Eliminate any air trapped in the seal or piping by loosening the fittings on the seal gland temporarily.

### MONITORING:

Reservoir pressure variation caused by thermal expansion is normal. Rising liquid level in the reservoir indicates leakage of product past the inboard seal of a tandem seal. If the level drops slowly, the barrier liquid should be replenished. Rapidly dropping liquid level without visible leakage of the outboard seal or piping indicates inboard seal leakage into the product. 03 00