SEAL POT/RESERVOIR

INSTALLATION AND OPERATION MANUAL

INTRODUCTION

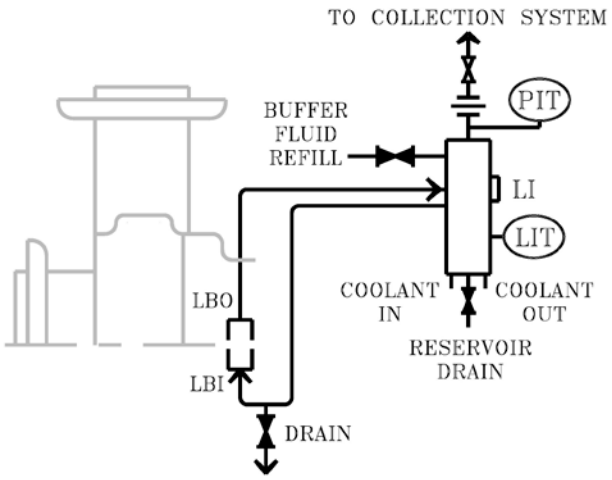
This guide provides instructions for installing, operating, and maintaining seal support systems for Tandem Seals (Plan 52) and Double Seals (Plan 53A). It includes information on system types, buffer and barrier fluid selection, installation requirements, startup procedures, and maintenance practices.

SUPPORT SYSTEM DESCRIPTIONS

Plan 52 – Non-Pressurized Tandem Seal System

Plan 52 is a dual mechanical seal arrangement that uses a buffer fluid between the inboard and outboard seals. The buffer fluid is contained in a vented seal pot, which maintains pressure near atmospheric levels. Any leakage from the inboard seal enters the buffer fluid; a small amount of leakage is expected under normal operation.

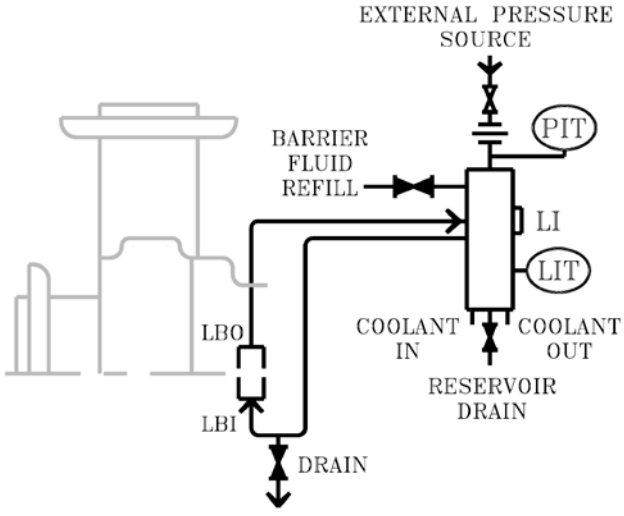
This plan is best suited for clean, non-polymerizing process fluids with a vapor pressure higher than the buffer fluid. In such cases, leakage flashes in the seal pot and vapors are vented. If vapor pressure is lower, leakage remains liquid, contaminating the buffer fluid. Undetected inboard leakage can allow heavier process fluid to displace the buffer fluid, increasing seal wear.



Plan 53A – Pressurized Double Seal System

Plan 53A uses a barrier fluid between the seals, stored in a seal pot maintained at a pressure typically 20–25 PSIG above the seal chamber pressure. This arrangement forces any leakage across the inboard seal into the product, preventing process fluid ingress into the barrier fluid system. A small amount of barrier fluid loss between seal faces is normal.

Plan 53A is preferred for processes that require better face lubrication or cooler running than a Plan 52 system, or for dirty, abrasive, thermally sensitive, or polymerizing process fluids that could damage seal faces. It can also be used to mitigate product flashing issues. Disadvantages include continuous, minor barrier fluid loss into the process, requiring compatibility between the product and barrier fluid and dependence on proper seal pot pressure. If the seal pressure drops below the process pressure, product can contaminate the barrier fluid by moving across the faces and lead to a seal failure.



BUFFER/BARRIER FLUID SELECTION

When choosing a barrier or buffer fluid, several important factors must be evaluated to ensure proper system performance and longevity.

First, the fluid must be chemically compatible with the process fluid to prevent reactions that could produce gels, sludge, or other deposits when the two fluids mix. It is also essential to confirm that the selected fluid is compatible with the materials used in the seal and flush system, including metals, elastomers, and other components.

For Plan 53A systems that use a gas blanket to pressurize the barrier fluid, the fluid selection and application conditions require special consideration. Gas tends to dissolve more readily in the fluid as pressure increases. When pressure is released, dissolved gases can come out of solution, causing foaming and disrupting fluid circulation. This issue is particularly common with higher-viscosity barrier fluids such as lubricating oils operating above 150 PSIG.

Viscosity is a critical property to check across the full range of operating temperatures, with particular attention to start-up conditions. The viscosity of the barrier or buffer fluid should remain below 500 centistokes (cSt) at the system's minimum operating temperature.

Typical guidelines for fluid viscosity are as follows:

- For systems operating above 50°F, hydrocarbon-based fluids with viscosities under 100 cSt at 100°F and between 1 and 10 cSt at 212°F have proven effective.
- For colder applications below 50°F, suitable fluids typically have viscosities between 5 and 40 cSt at 100°F and between 1 and 10 cSt at 212°F.
- Aqueous services generally use mixtures of water and ethylene glycol or propylene glycol between 70/30% and 50/50%. Automotive antifreeze products should be avoided due to additives that can deposit on seal parts and lead to gel formation and failure.
- The fluid selected must not freeze at the lowest expected ambient temperature on site.

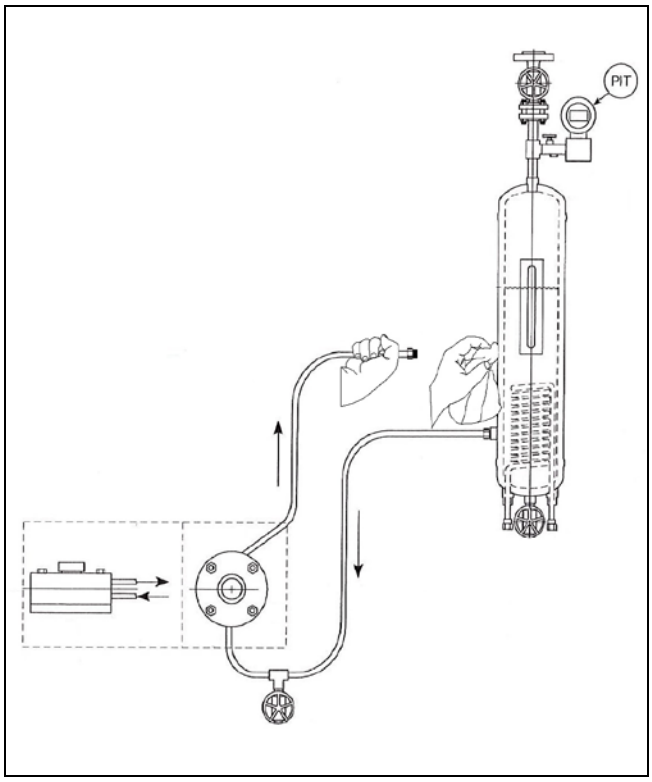
Environmental and safety concerns are also important. The fluid's volatility and toxicity must be low enough to prevent environmental harm if leakage or disposal occurs. Specific criteria include:

- An initial boiling point at least 50°F above the highest temperature expected in service.
- A flash point higher than the operating temperature when oxygen is present.
- Awareness that ethylene glycol may be classified as a hazardous material or waste in some jurisdictions. End users may consider changing to propylene glycol.

Longevity and stability are key to reliable operation. The fluid should support continuous seal operation for at least three years without degrading, polymerizing, coking, or forming sludge. For hydrocarbon-based fluids, high-purity paraffin oils with minimal additives or synthetic oils have been used successfully. However, additives designed to improve wear resistance or oxidation stability, such as those in some turbine oils, have caused deposits on seal faces and should be avoided.

INSTALLATION

1. Mount the reservoir vertically, 12–24 inches above the pump horizontal centerline, as close as possible to the pump but not directly above it.
2. Ensure all piping slopes upward toward the reservoir (minimum 1/2 inch per foot) with large-radius bends; use at least 1/2-inch pipe or 3/4-inch tubing.
3. Connect the reservoir's bottom (supply) port to the seal gland inlet.
4. Connect the reservoir's top (return) port to the seal gland outlet.
5. Confirm gland connection orientation per manufacturer's instructions and/or drawings.
6. Keep all isolation valves between the seal and reservoir fully open during filling and operation.
7. Connect cooling coil water lines if equipped.
8. Wire all instrumentation (e.g., pressure switches, level switches).



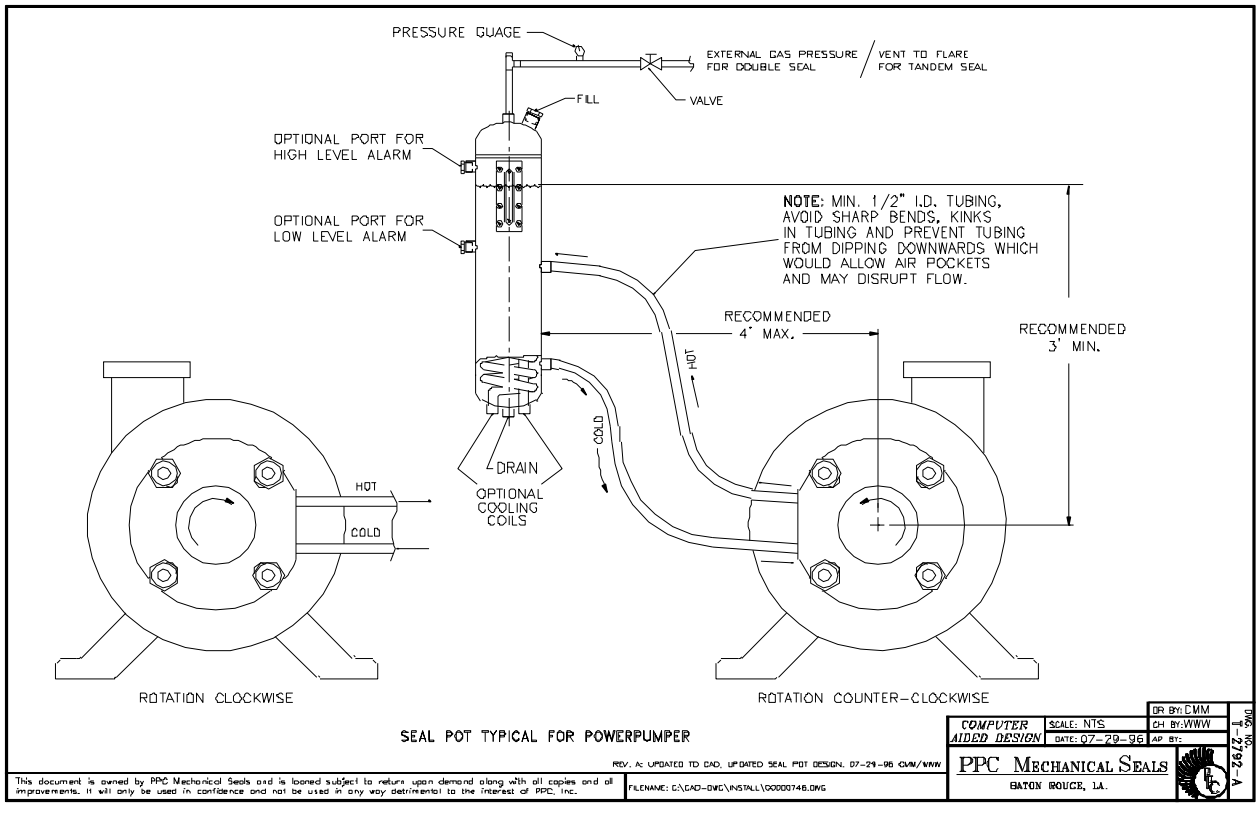
9. For weld pad level gauges, torque cover bolts to 20 ft-lbs in 5 ft-lb increments, working from the center outward.
10. Connect vent to flare or vapor recovery system but keep the vent valve closed until the reservoir is filled.
11. Ensure the system is depressurized and disconnect the seal return line from the reservoir port as seen in the figure above.
12. Begin filling reservoir while holding a rag against the open connection of the return port to prevent barrier fluid from flowing out.
13. Hold the disconnected seal return line horizontally at or slightly above the connection port.
14. Continue filling the reservoir. The barrier fluid will begin to flow into the seal, forcing out any entrapped air.
15. When the barrier fluid flows generously out of the return line, reconnect the line to the reservoir port.
16. Continue to fill the reservoir with fluid until the liquid level is between the half and three-quarter marks of the sight glass, leaving about 25% gas space in the reservoir for thermal expansion.
17. For Plan 53A, connect external pressurization and set regulator to 20–25 PSI above seal chamber pressure after filling. Note that higher pressures may be required for certain applications.

STARTUP

1. **Plan 52** – Depending on the configuration of the system, gradually pressurize the seal to between 5 and 15 psi to force the buffer fluid onto the outboard faces, or slowly open the vent or flare valve.
2. **Plan 53A** – Gradually open valve from external pressurization source, increasing pressure slowly to avoid gas ingestion. Monitor for leaks; maintain at least 20–25 PSI above seal chamber pressure.
3. If cooling coils are installed, open water supply valve.
4. The pump can now be started.
5. Check circulation: return line should be warmer than supply line. If no flow is detected after several minutes, shut down the equipment, inspect for blockages or air pockets, and bleed lines as necessary.

MAINTENANCE

During planned plant shutdowns, drain the buffer or barrier fluid, flush the reservoir thoroughly, and refill with fresh fluid. If possible, scope the reservoir tank for contamination. Ensure that no fouling or scaling has built up on the cooling coils and inspect the seal lines for blockage or buildup as these can severely reduce seal life. This process maintains fluid quality, ensuring effective lubrication of the seals and removal of any accumulated particles inside the reservoir. When replacing or cleaning the glass on armored sight gauges (weld pad level gauges), always use new gaskets and retighten bolts to the specified torque value to ensure a proper seal.



REFILLING

The barrier or buffer fluid level will gradually drop over time as the seal consumes fluid. Replace the fluid whenever the level falls below the midpoint or marked low level of the sight glass. Maintaining proper fluid level is critical because low fluid levels can restrict circulation, potentially causing seal failure.

Option 1 Refilling

This procedure requires opening the reservoir to add fluid. Because Plan 53A systems are pressurized, and Plan 52 systems can become pressurized if a seal fails, strict safety steps must be followed to prevent pressure reversal and ensure safe operation:

1. Shut down all equipment following standard procedures.
2. Close valves on all pressure sources to the equipment, including suction and discharge lines.
3. Release any residual pressure inside the equipment.
4. Close valves on all pressure or potential pressure sources to the reservoir.
5. Release any residual pressure inside the reservoir.
6. Open any valves on the seal supply lines.
7. Open the reservoir fill and add fluid until the sight glass reads between half and three-quarters full.
8. For Plan 53A systems, restore pressure to the reservoir to the specified value.
9. Open suction and discharge valves as needed to resume normal operation.

Option 2 Refilling with Hand Pump

Many reservoirs include a refill hand pump that allows fluid to be added without shutting down the equipment. This refill pump may be dedicated to a single unit or portable for use with multiple units. In all cases, preventing fluid contamination is critical. Always use the specified barrier fluid recommended for the specific application.

1. Connect the hand pump and gradually operate after opening any refill valve(s) between the hand pump and the seal pot.
2. For Plan 53A systems, maintain proper pressure. For Plan 52 systems, avoid pressure buildup.
3. Once the reservoir is adequately filled, close the refill valve and release pressure from the hand pump line before disconnecting from the equipment.

Other refill methods exist, but these two approaches are common and widely accepted.