

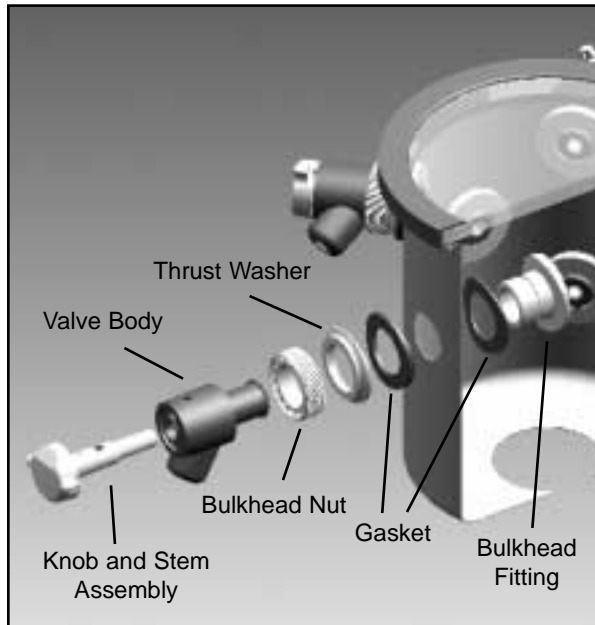
# Freeze Dry Vacuum System Troubleshooting

This guide was developed to help solve vacuum leak problems. Labconco Freeze Dry Systems should reach a vacuum of  $133 \times 10^{-3}$  mbar within 10 minutes and should achieve an ultimate vacuum of  $33 \times 10^{-3}$  mbar within 18 hours. If the freeze dryer does not obtain a satisfactory vacuum, perform the following maintenance tests.

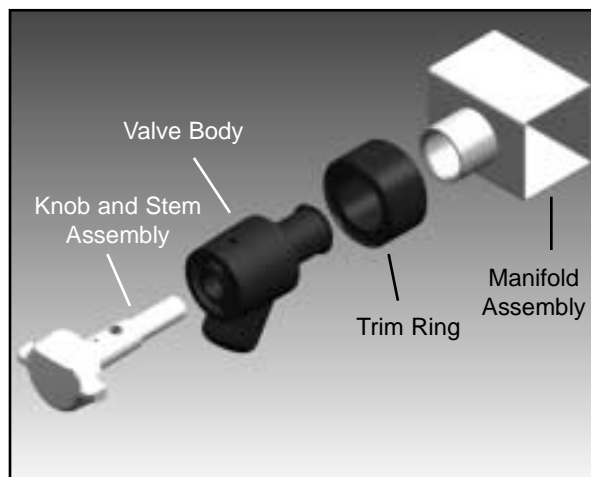
## I. Gaskets, Tubing, Connections, Sample Valves

- A. Inspect gasket(s) for cracks or defects. Ensure the gasket is clean. Apply a thin coat of vacuum grease to the gasket. Keep in mind too much vacuum grease can actually cause leaks.
- B. Check the drain line and ensure the drain plug is installed and the tube appears to be in good condition.
- C. Check all rubber vacuum tubing for signs of deterioration or cracking.
- D. Check all connections and make sure they are secure and leak tight.
- E. Check all sample valves on the drying chamber/manifold and ensure all valves are closed or in the vent position. Check to ensure all fittings are tight and sealed properly against the chamber. Inspect valves for cracks or cuts.
- F. When checking the sample valves, pull as much vacuum as possible. If a vacuum indication is displayed, wiggle or rotate the valves and watch the gauge for any fluctuations. Fluctuations can indicate a potential vacuum leak. If the valve seems to be in good condition, remove the valve and apply vacuum grease and reinstall the valve. **DO NOT APPLY VACUUM GREASE TO THE GASKETS ON A DRYING CHAMBER SAMPLE VALVE.** If the valve still seems to be the source of the problem, remove the valve and stopper the hole with a rubber stopper. Continue checking the other valves.

The illustrations below show how the sample valve installs on a chamber and a manifold.



Valve Assembly (Chamber)



Valve Assembly (Manifold)

## II. Vacuum Pump

If the above steps did not solve the problem, check the vacuum pump as described below:

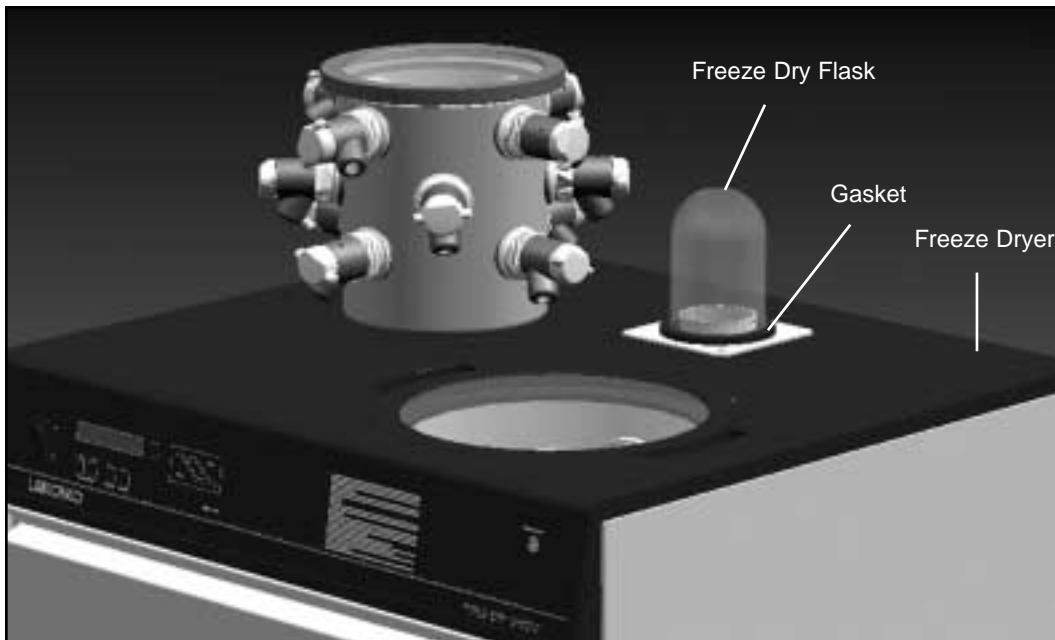
- A. Check the oil and ensure it is clear and clean. If the oil looks cloudy or has any particulates, replace the pump oil. Sometimes it may be necessary to flush the pump with clean oil several times. To flush the pump, run the pump 5 or 10 minutes to allow the oil to warm up. Drain the oil and refill with clean oil. Repeat as necessary.
- B. Check the oil level in the pump. Ensure it is filled to the correct level.
- C. Check vacuum hose connections from the pump to the freeze dry system and try running the unit again.

If vacuum problems continue, consider obtaining a second vacuum gauge capable of reading a vacuum of  $10 \times 10^{-3}$  mbar. It is often useful in determining if the vacuum pump is good and the vacuum sensor reading is accurate.

- D. Isolate the pump by disconnecting the vacuum hose from the freeze dry system. Deadhead the pump by inserting the vacuum sensor from a secondary vacuum gauge into the end of the vacuum hose and observe the vacuum reading obtained. Confirm that the pump is capable of achieving an ultimate vacuum less than  $10 \times 10^{-3}$  mbar or approximately 10 microns. If an inadequate vacuum reading is obtained, the pump has most likely failed and may need to be replaced or rebuilt.

## III. System Components and Collection Chamber Isolation

- Remove the drying chamber or manifold.
- Leave the gasket on and turn a large freeze dry flask upside down and cover the connection port.

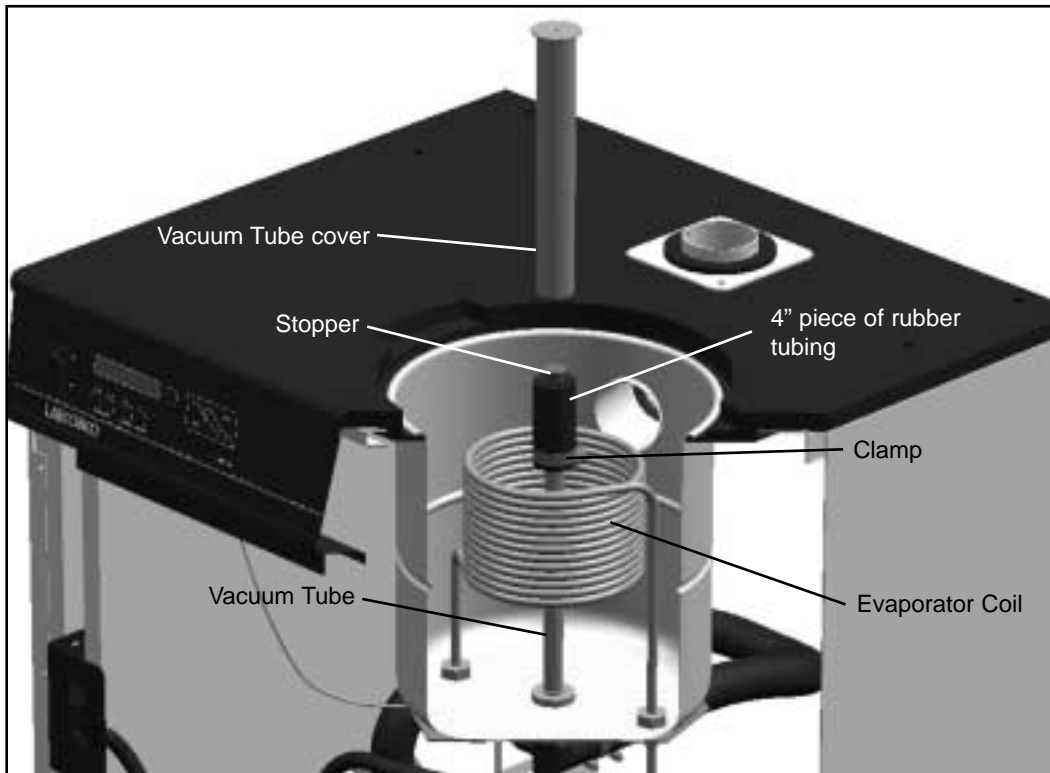


Isolating the freeze dry system from the accessory chamber/manifold

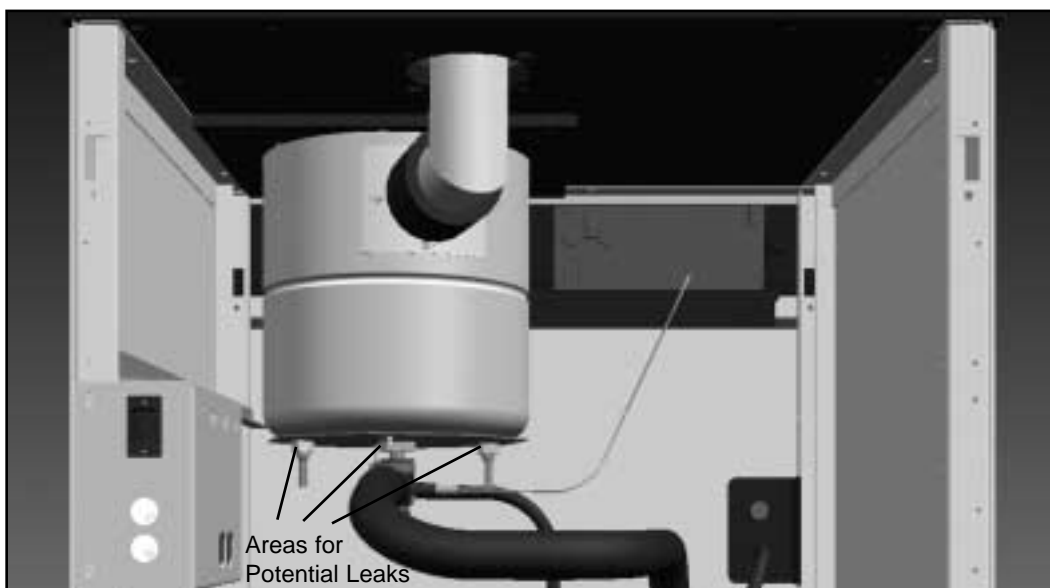
- Start the freeze dryer and observe the vacuum indication. If the vacuum indication is good then the problem is in the drying chamber and you should return to Section I on page 1.

The next test allows you to check the pump and the connections from the pump to the vacuum tube.

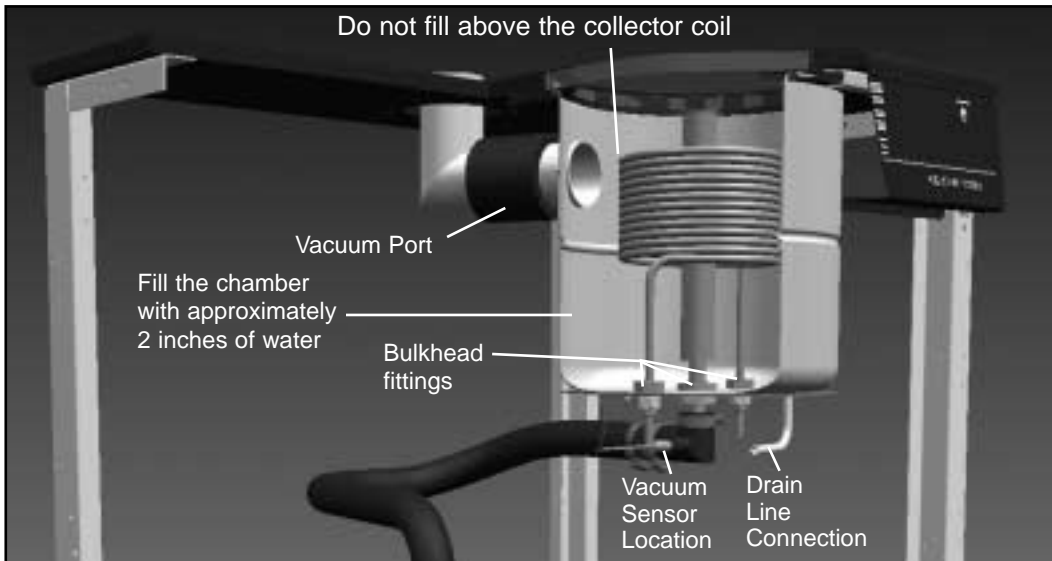
- Remove the screw from the center of the vacuum tube cover and slide the cover off.
- Take a 3 or 4 inch piece of vacuum hose and place it over the vacuum tube. Stopper and clamp the vacuum hose to the tube. Restart the system and check your vacuum indication. Insufficient vacuum indicates a bad pump or a leak in the connections from the pump to the bottom of the chamber.



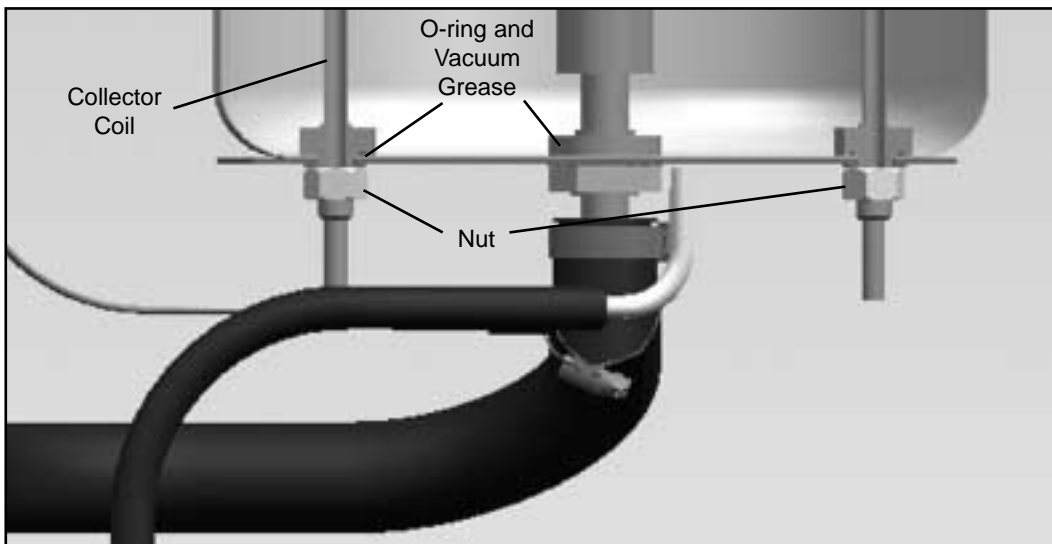
The next test is used to check the collection chamber integrity and connections. The figure below points out potential areas to locate a leak.



- Fill the collection chamber with approximately 2 inches of water, enough to cover all fittings. Replace the collection chamber lid and turn on the vacuum pump. Allow the vacuum pump to run for approximately 5 to 10 seconds. (If the vacuum pump is left on, the water will begin to boil and the test will not be correct.) Look inside the chamber while the pump is running and after you shut the pump off for any bubbling.
- If desired, you may check the vacuum port connection. This is done by filling the chamber with water to the top of the collector coil. **Do not fill above the holes in the vacuum tube as damage to the vacuum pump may occur.**



- If bubbling is observed around the bulkhead fittings, access the bottom of the chamber and remove the insulation. Tighten the appropriate fitting by placing a wrench on the fitting inside the chamber and use a second wrench to turn the nut on the bottom of the chamber. **Be careful not to damage the evaporator coils or the brazed joints to the refrigerant system.** Once the fitting is tightened, perform the test again. Should the bubbling still be present, loosen the bulkhead fittings and apply vacuum grease to the O-rings, then reassemble and test.



- If bubbling was observed on the chamber surface, the chamber must be replaced. This type of leak cannot be successfully repaired. The leading cause of a chamber surface leak is corrosive residue left in the chamber after use.

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