
Appendix E:

Vacuum/Volume System Operation



Mountable Vacuum/Volume System was designed for extraction of soil gas samples from probe cavities.



Vacuum\Volume System – Operation

Operating Instructions for Vacuum/Volume System

The Vacuum/Volume system allows the operator to perform several functions necessary for the successful sampling of soil gas and thereafter, the interpretation of soil gas data. These functions include:

- Measurement of the volume of gas extracted at a sample point.
- Measurement of the initial vacuum applied to a sampling point.
- Measurement of the time for a sampling point to return to atmospheric pressure after a vacuum has been applied.

Note that the vacuum pump is not operated during the sampling process. Instead, the vacuum pump is operated between sampling points to return the vacuum tank on the system to the initial vacuum pressure. The change in pressure of the vacuum tank is then used to indicate the volume of sample gas being added to the tank. This change in gas volume is indicated on the outer scale of the tank pressure gauge.

Instructions provided in this section are for the operation of the Vacuum/Volume system only and assume that the operator is educated in the proper connection of the sampling train to a soil gas sampling point.

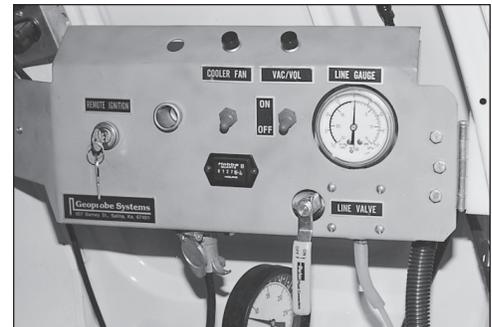
Operation

Follow these steps after probe rods have been driven to sampling depth and the expendable or retractable point has been disengaged, or after the PRT tubing has been attached.

1. Turn the vacuum pump on and allow vacuum to build in the vacuum tank. Make sure that the line valve is closed before starting the pump. The inside scale of the vacuum gauge is calibrated in kPa or in. Hg. The outside scale is calibrated for volume in liters (at standard temperature and pressure). Pump the tank down to the desired vacuum and turn the switch off.
2. Attach vacuum hose to the top of the soil vapor sampling train (i.e. to sampling cap on top of probe rods or to PRT tubing).
3. Open line control valve. If sampling through probe rods, evacuate 100 mL of volume for each rod used. Some protocols may call for a minimum of 3 purge volumes to be evacuated before sampling (i.e. 9-foot [3 m] depth = 3 rods x 100 mL x 3 = 900 mL). If using PRT tubing, evacuate appropriate volume to purge ambient air in the system. You may choose to purge a standard volume at each sample location.
4. After achieving sufficient purge volume, quickly close the line valve and allow sample line pressure to return to zero (0). This returns the sampling train to atmospheric pressure. The sample can be collected at this time.
5. Syringe aliquots of soil gas sample are normally sampled from a silicone tubing adapter inserted in the sampling train between the top of the probe rod and the system line valve.



Vacuum/Volume System mounted in a Geoprobe-equipped standard cargo van.



Vacuum/Volume control panel with line control valve and line pressure gauge from Geoprobe-equipped standard cargo van.



Vacuum/Volume control panel from Geoprobe-equipped pickup truck.

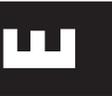


12 VDC Vacuum Pump.

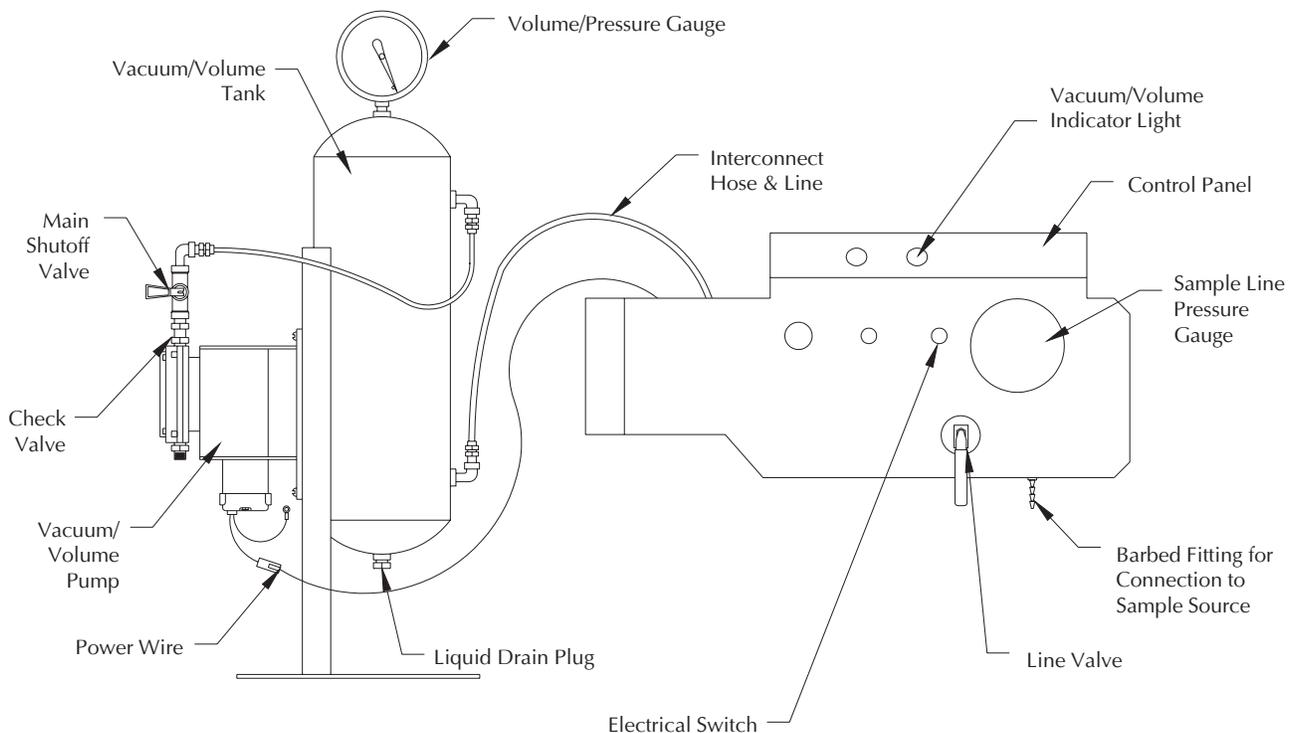
Vacuum\Volume System – Operation

Application Tips

1. It is advisable to always begin the sampling process using the same initial tank pressure. As an example, many operators begin the sampling process with the initial tank vacuum pressure set at 70 kPa or 21 in. Hg (70 centibars). This method creates equal disturbance with respect to the applied pressure change at each sampling point.
2. If the sampling point does not yield (tank volume does not change over time), then the probe rods should be pulled up while the vacuum system is still attached. This is best performed using the PRT system (Section 8) and a split pull cap. Pull the probe rods up until the tank pressure begins to change.
3. Once the prescribed volume of soil gas has been removed, the line valve is shut and the sampling train is allowed to return to atmospheric pressure. The time required for the return to atmospheric pressure to occur is dependent upon the soil permeability. It is a good idea to record the time required to return to atmospheric pressure in the field notes.
4. Be sure to watch the sample line and shut off the line valve at first sign of water coming up the line. Sucking water up the line is not uncommon, especially in cases where the position of the water table is not well known.
5. Always have a method for checking the integrity of the sampling train for leaks. Assemble the sampling train, plug its sampling end, apply vacuum, and monitor for decay of vacuum as a sign of leakage.
6. The drain plug at the bottom of the Vacuum/Volume tank should be periodically removed to check for water in the tank.
7. The Vacuum/Volume tank should be periodically pumped down and the system shut in (the line valve closed). Monitor the tank pressure for one-half hour. This pressure will remain constant if the system is free of leakage. If leakage does occur it may be the result of damaged tubing or loose fittings. Leakage through the valves of the pump can be diagnosed by closing the Main Shut-off Valve on the pump.



▼ Mountable Vacuum Volume System (AT-1001)



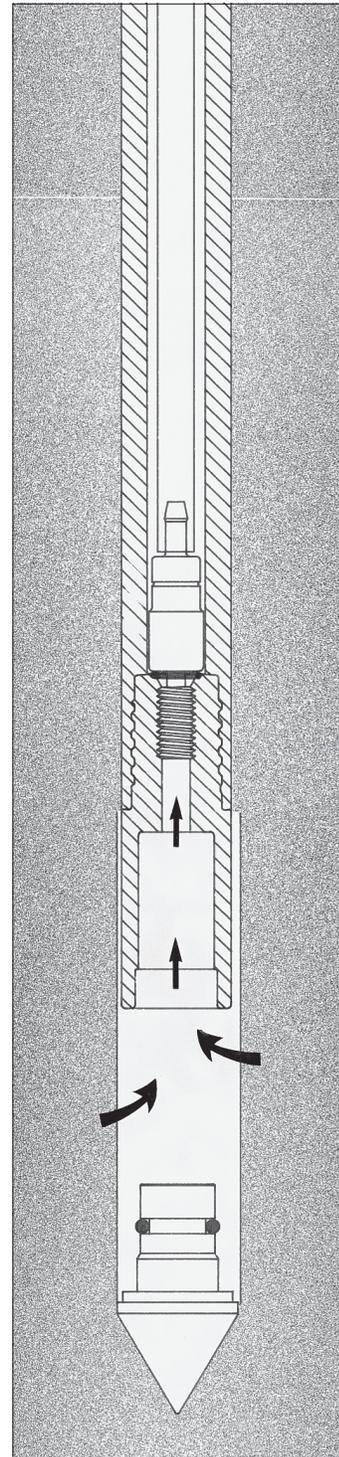
Vacuum\Volume System – Operation

Pointers

If the needle on the line gauge does not return to atmospheric pressure after the line valve is shut (which disconnects the vacuum source), it may indicate that the soil at the sampling depth is saturated or that the pore space is too tight to yield a sample. It could also indicate that the sampling train is plugged.

If the needle moves back to zero very quickly, it indicates that the soil at the sampling depth is very permeable or that there is a leak in the sampling train. You can check for leaks by laying out the sampling train and plugging the sampling end with a rubber stopper and applying a vacuum to it. You may want to do this before sampling.

In some soils, the needle may return to zero very slowly once the valve line is shut. The time it takes for the needle to return to zero is called the "recovery" time. It should be noted for each sample taken. This information will allow relative comparison of soil permeability. Recovery times greater than 10 minutes should be considered suspect. The effect of any leakage in the sampling system is increased with longer recovery times. After 10 minutes, the operator should consider either changing the sampling depth, location, length of pullback from the sampling tip, or switching entirely from soil gas sampling to grab sampling and analysis of soil.



A cross section of the PRT System showing how soil gas (arrows) is drawn through the inner tubing system

Appendix E

E



Vacuum gauge calibrated in kPa and volume in liters.



Vacuum/Volume System tank and gauge.