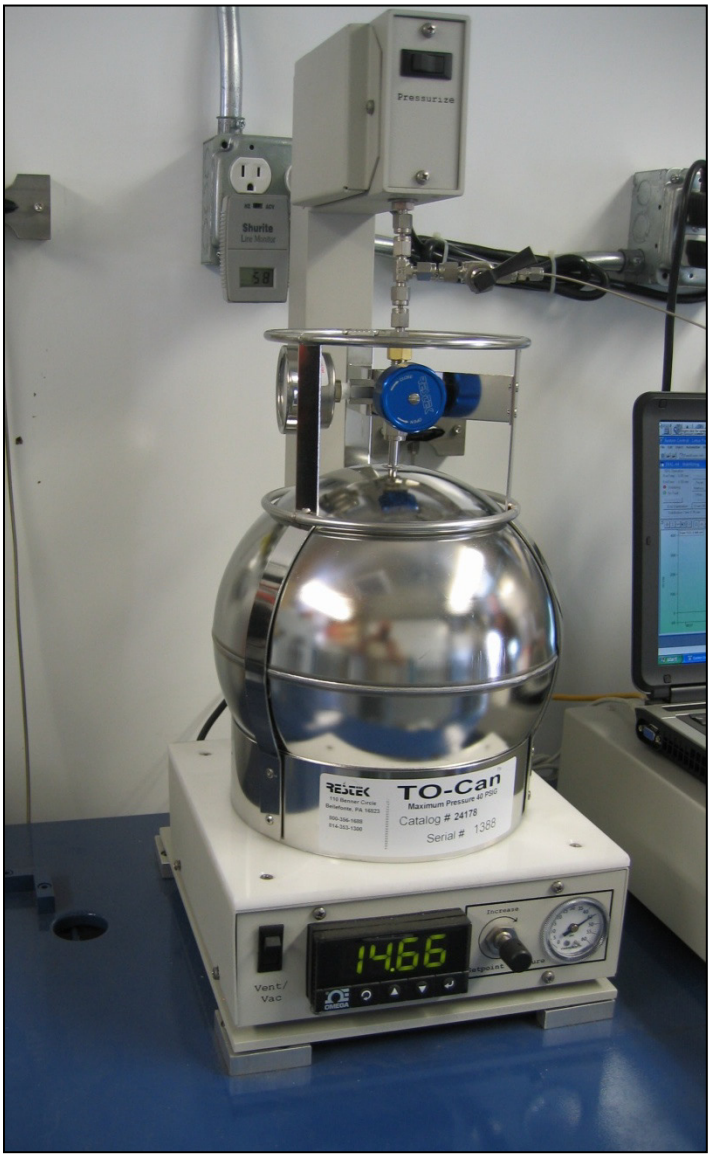
Pressure Station by Lotus Consulting

Air samples are often collected in either Tedlar bags or into stainless steel canisters for transport back to the analytical laboratory for analysis. Tedlar bags work well for sample collected near the laboratory, but they do not transport well, especially by air, due to their fragility.

Canisters are much sturdier and can withstand the rigors of air transport. However, to be properly processed through most analytical processes, they should possess positive pressure above atmospheric for the sample, to better extract a sample aliquot from the canister.



Subambient Canister Pressure

If the canister does not have some positive pressure, the sample aliquot to be measured will not be fully accounted, as either a fixed sample loop will be below atmospheric pressure and most likely will not match the pressure for standards, thus yielding improperly low results. Or, if a mass flow controller is employed to dose in the sample into the measuring system, its calibration is suspect as the conditions are very likely to be radically different than the calibration certificate and will yield a systematic error, lowering the predicted volume to be measured. The problem is rectified by taking advantage of Boyles' Law that accurately predicts that concentration is directly proportional to pressure. By noting the initial sample pressure and then pressuring the canister to a final reading above atmospheric, the ratio of the initial and final becomes a dilution factor that must be applied to all results to correlate the final results with the condition of the original sample.

Sample Dilution

Occasionally, samples in canisters are too concentrated for the operating limits of the analytical tool and need to be diluted to bring with the linear range of the system. An extremely easy method for dilution is by pressure. First, the initial sample pressure is recorded. Then the diluent gas is dosed in to achieve a sufficient dilution to bring the effective concentration within range. Again the ratio of initial and final pressures becomes a dilution factor that must be used to correct final results.

Preparation of working gas standards

Most analytical measurements mandate use of a multi-level series of standards to validate the operating conditions of the technique, especially its linear range. Liquid standards generally can be made easily through a serial dilution process with pipettes and volumetric flasks - gases are a different story. Attempts at serial dilutions with pipettes and flasks are fraught with serious errors from contamination with room air or loss of analytes during the transfer. If instead the dilution is performed by pressure monitoring, these problems can be avoided. By starting with an evacuated canister, the initial step is to dose in a known pressure of the stock standard and note the pressure. Then, by adding in the dilution gas and noting the final pressure, the concentration of the working standard is the ratio of the initial and final pressures times the stock standard concentrations. Different concentrations can be created by varying the initial and final pressures. Also, secondary standards can be made by dilution of the first working standard.

Automated Creation of Varian Workstation SampleList with Dilution Factors

Proper use of the Pressure Station ensures that each canister has positive pressure prior to analysis. Every can is first installed on this station for its initial pressure to be recorded. Then, by activation of a solenoids switch on the front panel, the canister is pressurized to a preselected value and this final pressure is also noted. The dilution factors are then automatically inserted into a Varian Workstation SampleList for immediate use. No transcription of numbers, with possible errors, is required.

Specifications

Pressure Readout

Range: 0.01 psi Absolute to 100 psi Absolute
Accuracy: 0.25% BFSL
Calibration: 5 point NIST Traceable
Compensated Temperature Range: -20 to +80 ^{o}C
Gage Type: diffused silicon strain

Maximum Pressure Limit:

Set by included pressure regulator
or gas supply, whichever is lower

Includes:

- Dual Stage Vacuum Pump for evacuation of interconnecting tubing between samples
- Software to construct Varian Workstation SampleList with dilution factors automatically inserted
- Dosing valve for addition of high level standard for preparation of working standards
- Serial communications cable

Requires, but does not include:

- Clean nitrogen gas supply, recommend use of headspace liquid nitrogen
- Varian Workstation and computer

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