Sampling Kits a Common Sense View (updated 6/2001)

A Quick Summary Bulletin #10

Portable HP compressors supply fill air at 2-8 SCFM, large air systems flow air at 13 – 20 SCFM, and LP systems can supply air in excess 100 SCFM. In order to get a true picture of your air system, you must sample under conditions that mimic normal charging conditions. Not all sampling kits can do that.

The Challenge

The two most common compressors are LP and HP, and both are available in various flow rates. To obtain accurate data, the sample **must** be taken under normal charging or end use conditions. The average flow rate for charging single SCUBA tanks directly with small compressors is about 2-9 SCFM. More commonly, these compressors and larger ones are generally used to fill banks of high pressure storage flasks to allow rapid filling of numerous SCUBA and SCBA flasks all at the same time. Filling SCUBA or SCBA bottles from HP storage banks is usually done at 13 – 20 SCFM.

In contrast to SCUBA charging, large LP compressors do not store large amounts of air, but rather deliver air directly to the end use at flow rates that can exceed 1500 SCFM. Sampling gas at high pressure or very high flow rates is inherently dangerous, and this has caused laboratories to rely on two basic sampling kit designs to provide safety.

Air Kit Designs for Controlling Pressure

Most sampling kits use the " Full Pressure " design which reduces the air flow (and therefore the pressure) within the sampling kit itself. Driven by economics, most kits accomplish this with a critical orifice inlet (a tiny hole typically 0.008 - 0.030 inches in diameter). In the critical orifice design, the tiny hole allows volatiles and at least some of the oil mist to pass through it for subsequent discovery. However, not all of the particulate from a dirty air source can reach the test filter because those tiny inlet orifices cannot let large particles or clumps of particles to pass through. (See Sampling for Oil Mist + Particulate). Plugging is also a problem, and some labs even supply a wire to help you clean out the tiny inlet hole in their sampling kits.
Our Air Sampling Kits are the only ones in the U.S. that do not use a critical orifice, and we do not have any of those problems. We have two basic kits: a simple light weight dedicated Sport/Fire Department kit for sampling HP air (10 - 5000 psi) for SCUBA/SCBA charging at 2 – 20 SCFM, and our Universal kit which allows sampling of nearly any air system at very high flow rates (2-200+) and pressures up to 5000 psi. (The largest air system we have sampled was a 1500 SCFM Rotary Screw compressor which delivered air to a Navy ship in a dry dock.)

Determining Air Volume Passing Through the Filter

All sampling kits determine the volume of air passing through the analytical filter by multiplying the flow rate by the duration of flow. One design uses a flow meter attached to the analytical filter outlet. Although tedious to use (especially when the compressor is pulsing), our experience with flow meters is that they are effective as long as they are closely watched and held steady in a vertical position. We have found that flow meters used outside the lab are more prone to needing cleaning to remove tiny debris that collects on the flow meter's interior walls. (This is especially true air kits that use flowmeters with color indicator tubes.) A sticky flow meter cannot provide accurate flow rate data.

The other way to determine the air flow rate is to place a flow-calibrated pressure gauge in the air path. Our air kits use the pressure gauge approach. Each pressure gauge is independently calibrated against a flow meter in the laboratory. Pressure gauges are about 5% less accurate than flow meters, but this has little significant effect on the data. Flow calibrated pressure gauges are much easier to use, are more rugged and allow a wider range of flow rate use. When the sample kit is received back from the client, we calculate the flow rate used from the pressure and time reported by the client.

How Much Air Should be Sampled

Most kits pass 18 – 36 cubic feet of air through their air kit. Where possible, we sample 90 - 160 cubic feet of air because that represents the entire contents of a SCUBA flasks. When we check oxygen compatible air, we also try to pass 160+ cubic feet of air through our filters because of the need for greater sensitivity and the goal of more thoroughly discovering particulate in the piping.

Other Considerations: Sampling for Gases and Hydrocarbons

A bulk sample is taken for lab analysis of fixed gases, carbon monoxide, carbon dioxide and volatile hydrocarbons. The choice of a container is not trivial, and ours is especially unique; it is discussed in the section Sampling for Gases and Hydrocarbons.

Other Considerations: Sampling for Oil Mist + Particulate

The choice of filter is also important. If the available surface area of the filter is too small, the flow rate will either be seriously reduced, or the ability of the filter to trap oil mist will be dramatically reduced. In either situation, the accuracy and usefulness will preclude a valid sample, and conclusions developed from the data will be invalid. After testing a number of filters, we found the most effective filter was a sub-micron depth filter.