Veriflo SC423XL Flow Controller

The Veriflo SC423XL flow controller is the heart of the canister sampling train. As canister vacuum changes during sampling, this high-quality device helps maintain a constant flow rate, which is critical in obtaining an accurate, time-integrated air sample. The entire sample flow path is made of stainless steel and can be Siltek treated for maximum inertness. The interchangeable critical orifice provides a flow range that can then be fine-tuned using the flow controller. Several flow ranges are available based on the ID of the orifice (Table I).

Table I: Sample time based on critical orifice ID and canister volume.

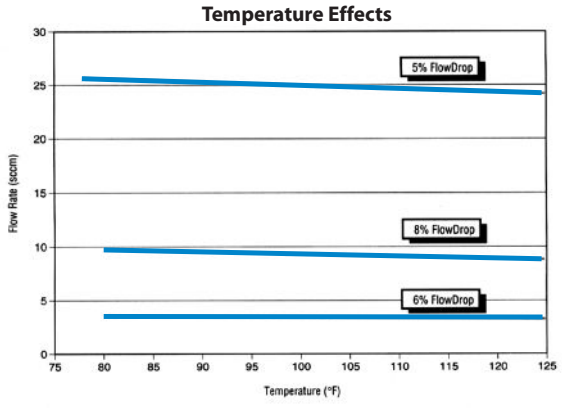
Canister Volume/Sampling Time								
400 cc	1 Liter	3 Liter	6 Liter	15 Liter	Flow	Orifice Size	Siltek Treated cat.#	Stainless Steel cat.#
8 hour	24 hour	48 hour	125 hour	—	0.5–2 mL/min	0.0008"	24232	24229
2 hour	4 hour	12 hour	24 hour	60 hour	2–4 mL/min	0.0012"	24255	24260
1 hour	2 hour	6 hour	12 hour	30 hour	4–8 mL/min	0.0016"	24256	24261
—	1 hour	4 hour	8 hour	20 hour	8–15 mL/min	0.0020"	24257	24262
—	—	2 hour	3 hour	8 hour	15–30 mL/min	0.0030"	24258	24263
—	—	1 hour	1.5 hour	4 hour	30–80 mL/min	0.0060"	24259	24264
—	—	—	0.5 hour	1 hour	80–340 mL/min	0.0090"	22103	22102

Veriflo SC423XL flow controllers are also available without a critical orifice (Siltek-Treated: cat.# 24238 and Stainless Steel: cat.# 24239).

Theory of Operation

A flow controller maintains a constant sample flow over an integrated time period despite changes in environmental temperature (Figure 1) and/or the vacuum inside the canister (Figure 2). With the Veriflo SC423XL flow controller, the critical orifice acts as a flow restrictor upstream of constant back pressure. Back pressure is created by the balance between the mechanical spring rate of the diaphragm and the pressure differential across the diaphragm. The latter is established by the difference between atmospheric pressure, the vacuum inside the canister, and the flow pressure through the critical orifice. The net result is constant flow.

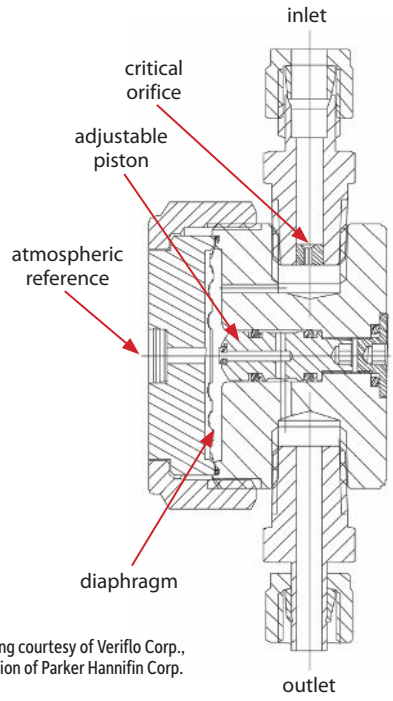
Figure 1: A flow controller will maintain a constant sample flow despite changes in environmental temperature.



Courtesy of Veriflo Corp., a division of Parker Hannifin Corp.

Minor changes in flow rate due to temperature variations are well within the acceptable criteria of EPA TO methodology.

Veriflo SC423XL flow controller installed on canister with Restek's passive air sampling kit.

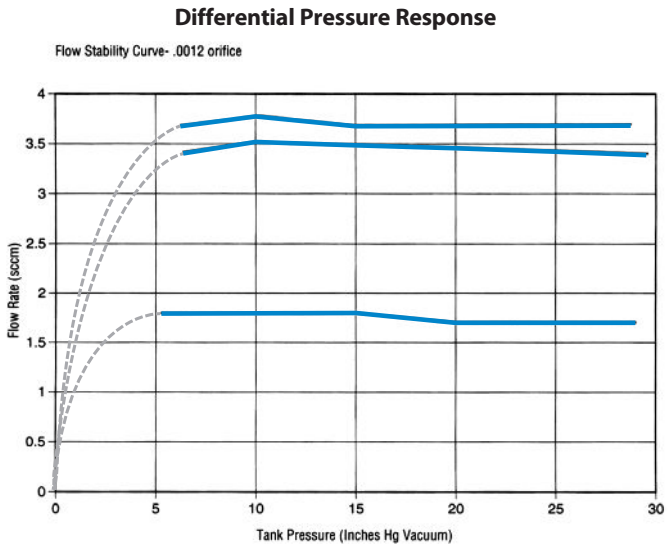


Drawing courtesy of Veriflo Corp., a division of Parker Hannifin Corp.

RESTEK
Pure Chromatography

An adjustable piston is used to set a specific flow rate within the flow range of the selected critical orifice. Adjusting the position of the piston changes the back pressure, which then changes the pressure differential across the critical orifice. If the piston is lowered away from the diaphragm, the flow rate will increase. If the piston is raised toward the diaphragm, the flow rate will decrease. The Veriflo SC423XL flow controller will accurately maintain a constant flow despite changes in vacuum over a range of –30" Hg to –7" Hg (Figure 2). Beyond this point, the flow controller is no longer able to maintain the pressure differential and the flow rate decreases. This level of control allows the user to collect approximately 5 liters of sample in a 6-liter canister, which is extremely important in obtaining valid time-integrated samples through passive sampling.

Figure 2: A flow controller will maintain a constant sample flow until it is unable to maintain a stable pressure differential across the critical orifice.



Courtesy of Veriflo Corp.,
a division of Parker Hannifin Corp.

Preparing for Use

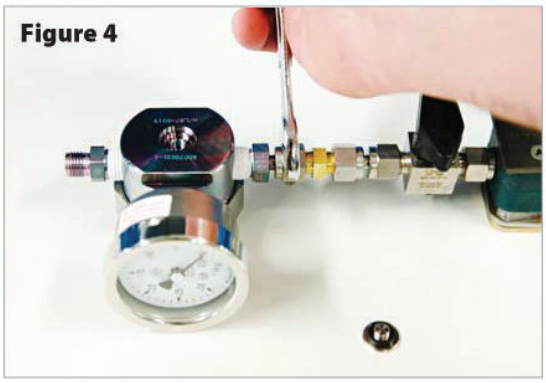
Before using the Veriflo SC423XL flow controller, you must perform the following steps:

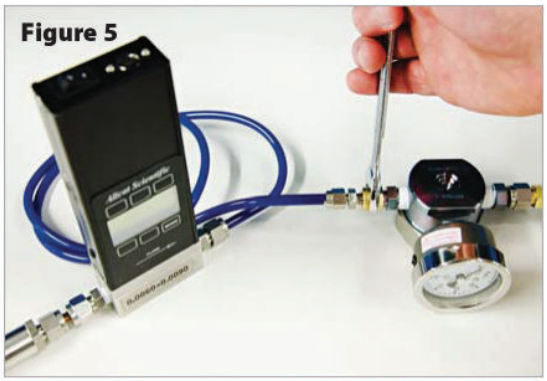
1. Select the proper critical orifice size for your desired flow rate range (Table I).
2. Certify the entire sampling train as clean (<0.2 ppbv of any target VOC). Request Technical Guide EVTG1073 for detailed information on certifying your sampling train.
3. Leak test the sampling train (<2 psig loss over 24 hours).

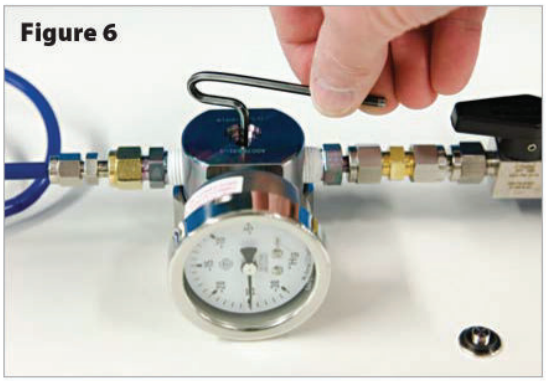
Setting the Flow Rate

Once you are certain that the sampling train is clean and leak free, perform the following steps to set the sampling flow rate:

1. With a 3 mm hex (Allen) wrench, remove the protective cap from the back of the flow controller (Figure 3).
2. Connect an evacuated canister or a vacuum source to the outlet of the sampling train (Figure 4).
3. Connect a high-quality, calibrated flowmeter (i.e., mass flowmeter, rotameter, or GC-type flow sensor) to the inlet of the sampling train (Figure 5).
4. Apply vacuum by opening the canister or turning on the vacuum source.
5. With a 3 mm hex (Allen) wrench, turn the piston gap screw to adjust the flow rate (Table I). Between adjustments, allow the flow to equilibrate for several minutes (Figure 6).
6. Remove the flowmeter and the evacuated canister or vacuum source. Replace the protective cap on the back of the flow controller.







Sampling

Collect your sample until the vacuum reaches –7" Hg to –4" Hg. If you stop before you reach –7" Hg, you will get less sample than would otherwise have been possible, and that may increase your detection limits. However, if you stop after –4" Hg, the flow rate may have decreased at the end of the sampling period, which may reduce the accuracy of your time-integrated sample.

Cleaning

The critical orifice and flow controller can be cleaned in either of two ways.

Option 1 (Disassembled):

Disassemble the flow controller. Clean all metal parts (except as noted in bold below) by rinsing or sonicating in methanol to remove any high-boiling-point compounds that may have condensed onto the wetted areas of the flow controller. Then, place the cleaned metal parts in an oven and heat them to 130 °C to remove residual organic vapors. Reassemble and leak check, then attempt to recertify the sampling train.

DO NOT sonicate the critical orifice or O-rings.

DO NOT heat nonmetallic parts, such as the O-rings.

DO NOT clean with solvents other than methanol or water.

Option 2 (Assembled):

Keeping the flow controller assembled, apply low heat from a heating jacket or heat gun while purging the system with nitrogen. As organic compounds are heated and desorbed from the interior surfaces, the nitrogen gas sweeps them out of the sampling equipment.

After cleaning, if the critical orifice is still too plugged or contaminated to certify the sampling train, it should be replaced. (Replacements are available at **www.restek.com**) When replacing the critical orifice, you should also change the sampling train prefilter.

Repair and Service

Normal wear and tear on canisters, flow controllers, and other components can result in damage and leakage. Restek's repair service allows you to extend the life of your equipment for much less than you would pay for new replacement products. Contact Customer Service at 800-356-1688 or call your Restek representative to take advantage of this service. You will be given instructions and an SRV# to return parts to us for repair.

Sampling Kit/Flow Controller Repair
Includes all new rubber seals in flow controller and orifice and frit replacement
cat.# 550131

Canister Repair
Includes valve replacement, leak test & cleaning
cat.# 569419

For more detailed information on using your Veriflo SC423XL Flow Controller, request Technical Guide EVTG1073.

Questions about this or any other Restek product?
Contact us or your local Restek representative (www.restek.com/contact-us).

www.restek.com

#500-03-003 Rev. date: 10/19

RESTEK
Pure Chromatography