STANDARD OPERATING PROCEDURE

Instructions for Calibration and Use of a Mechanical Regulator with a Summa Canister

KEY WORDS

Air sampling, Summa, Canister, VOC, Silonite, SilcoCan, TO-Can, Restek, Rasmussen, AeroSphere, Regulator, Flow controller

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1.0 INTRODUCTION

1.1 Purpose

This standard operating procedure (SOP) describes the methods used for collecting 24-hour passive air canister samples for the Air Monitoring Network and 1,3-Dichloropropene Air Monitoring (Study #309) using Veriflo® flow controller assemblies known as mechanical regulators. Mechanical regulators may be required when collecting samples for both the Air Monitoring Network (Study #257) and Study #309. The mechanical regulators are typically reserved for back-up sampling in case the primary equipment does not operate as expected in the field. Therefore, it is important to understand how to set-up, operate, and calibrate a mechanical regulator.

1.2 Scope

1.2.1 Passive sampling using a mechanical regulator for air monitoring requires air to be pulled through a flow controller into an evacuated Summa canister over a 24-hour period.

1.2.2 A flow controller on the mechanical regulator assembly maintains a constant sample flow over the sampling period, despite changes in the canister vacuum or changes in environmental conditions.

1.2.3 Mechanical regulator assembly consists of PTFE inlet tubing, a metal particle filter, a critical orifice, a flow controller, and a Summa canister.

1.3 Definitions

FDS – A Field Data Sheet used during sampling to record sampling data.

COC – Chain of Custody form used to check-in samples after collection.

Summa Canister – An electrochemical coated canister that is used for air sampling.

2.0 MATERIALS

2.1 Canister Sampling Equipment

2.1.1 6-L Summa canister

2.1.2 Veriflo® flow controller (mechanical regulator)

2.1.3 SilcoSteel® in-line filter (7µm)

2.1.4 1/8" PTFE tubing, 1/16" I.D.

2.1.5 Alicat low-rate mass flow meter

2.1.6 Calibration tubing and tip

2.1.7 Two 9/16" wrenches

2.1.8 Allen Hex key wrench, 3mm

2.1.9 Field data sheets (FDS) and Chain of custody forms (COC)

3.0 PROCEDURES

3.1 General

3.1.1 Label the Summa canister with the appropriate sample number for the study and site it will be set-up at.

3.1.2 Ensure that the Summa canister's valve is closed. Remove brass cap nut from canister valve using a 9/16" combination wrench.

3.1.3 Attach mechanical regulator assembly to canister.

3.1.4 The flow controller has been seated properly when the nut spins freely during finger tightening (Figure 1).

Figure 1. Mechanical regulator properly seated on Summa canister.

3.1.5 Using the 9/16" wrench, tighten the nut ¼ turn past finger tight. Do not over-tighten as this can cause leakage or damage to the canister.

3.1.6 Use two wrenches when tightening nut to prevent torquing the sample train. (Figure 2).

Figure 2. Proper technique to use when tightening the regulator onto the Summa canister.

3.1.7 Verify that the canister gauge and regulator gauge are in agreement. Record the initial vacuum reading (usually between -28" Hg and -30" Hg) from the regulator gauge, which has greater resolution. Also record canister # and regulator # on the field data sheet.

3.1.8 If the pressure readings from the regulator and canister are **not** in agreement, disconnect the regulator and connect it to a backup canister. Make a note of the canister that wasn't in agreement and set aside at the warehouse for inspection. Please let your supervisor and any of the field coordinators know of the problematic canister.

3.1.9 If the gauges are not in agreement or if the pressure readings are out of desired range, use a spare canister to conduct the sampling event. If both gauges continue to have issues, contact the field coordinator or your supervisor.

3.1.10 Open the canister valve by turning the knob counterclockwise. Record the starting time on the field data sheet.

3.1.11 Attach the flow meter tubing to the sample inlet.

3.1.12 Turn on the Alicat low-rate mass flow meter (Figure 3) and press the "TARE" key to zero the display.

Figure 3. Low-flow Alicat flow meter

3.1.13 Connect the Alicat flow inlet to the flow meter tubing and wait for the flow to stabilize. Once the flow has stabilized, record the initial flow on the field data sheet. This can be achieved by selecting the "NEXT" button on the flow meter and will take you to a screen that measures the average volumetric flow. Press the "RESET" button and take a one-minute average.

3.1.14 Alternatively, if the flow is stable enough, a live reading may also be recorded.

3.1.15 The flow should be between 2.8 to 3.4 ml/min (a target of 3.1 ml/min +/- 10%) for a 24-hour, 6-L canister sample. If the flow is not within this range, attempt to adjust the flow via the regulator (Section 3.2).

3.1.16 Return to the site approximately 15-20 minutes prior to the end of sampling period. Take a final flow reading approximately 5 minutes prior to sample completion. Record the final flow reading on the FDS.

3.1.17 At the end of the sample period, record the final pressure reading from the mechanical regulator's vacuum gauge on the FDS **(both the initial and final readings should be taken from the regulator's gauge)**. Close the canister valve by turning the valve's knob clockwise and record the ending time and the run time on the FDS. Fill out the relevant sample information onto the COC as well.

3.1.18 **Acceptable ending pressures range from -10 inHg to -4 inHg.** If a sample pressure falls outside this range, another sample must be set-up to replace the invalid canister. This replacement sample should be started immediately. Inform your supervisor about the invalid sample.

3.1.19 Remove flow controller (with the tubing attached) from the canister and replace the brass cap nut on the canister.

3.1.20 Place the regulator with PTFE tubing inside the shelter and loosely coil the tubing, making sure not to kink the tubing (Figure 4).

Figure 4. Properly stored mechanical regulator

3.1.21 Return to the warehouse with all collected samples. Place valid canisters in proper canister storage cabinets (Figure 5) and set aside invalid canisters for future cleaning.

Figure 5. Study 257 and 309 canister sample cabinets. Cabinet 3 is used for study 309 and cabinet 4 is used for study 257.

3.2 Setting the flow rate on the mechanical regulator [Skip these steps if the regulator's flow rate is within range].

3.2.1 Remove the dust cover on the side of the mechanical regulator using a 3 mm hex key wrench (Figure 6).

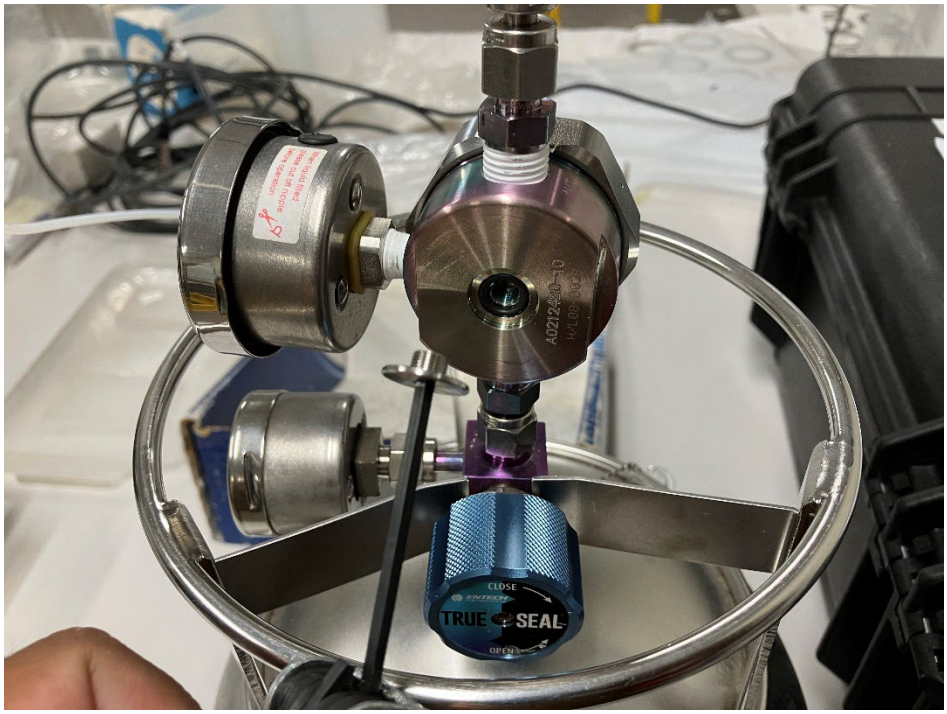

Figure 6. Flow controller with dust cover removed to expose piston gap screw.

3.2.2 Connect the mechanical regulator to an evacuated canister and tighten the nut with a 9/16" combination wrench. Use two wrenches, one as a brace to prevent torquing the sample train.

3.2.3 Open canister valve by hand, turning the blue knob counterclockwise.

3.2.4 Tare the Alicat low-rate mass flow meter to zero out the display. Connect the flow meter to the inlet of the PTFE tubing.

3.2.5 Use the 3 mm hex key wrench to adjust the piston gap screw to achieve the desired flow rate (Figure 7). **Turn the hex key wrench clockwise to reduce flow and counterclockwise to increase flow.** Allow the flow to stabilize between adjustments.

Figure 7. Using a 3mm hex key wrench to adjust piston gap screw.

3.2.6 If the measured flow rate is within +/- 10% of the desired flow rate, the flow controller is ready for use in field sampling. When taking a 24-hour sample with a 6-L canister, flow should be 2.8 to 3.4 ml/min.

3.3 Reporting Requirements

A field data sheet (FDS) and Chain of custody (COC) form should be completed for each sample according to SOP ADMN006.01. The following information should be recorded on the FDS and COC at the start and conclusion of the air sampling event when a mechanical regulator is used:

3.3.1 Study #

3.3.2 Sampling Dates

3.3.3 Sample Number

3.3.4 Site Name

3.3.5 Location Code

3.3.6 Station Operator(s)

3.3.7 Operator(s) Agency

3.3.8 Sample Type

3.3.9 Equipment Type

3.3.10 Canister Number

3.3.11 Flow Meter Serial Number

3.3.12 Start/End Time

3.3.13 Total Run Time

3.3.14 Sampler/Machine ID/Serial #

3.3.15 Starting Flow

3.3.16 Ending Flow

3.3.17 Starting Canister Pressure

3.3.18 Ending Canister Pressure