STANDARD OPERATING PROCEDURE
Assembly of a Mechanical Regulator for Canister Sampling

KEY WORDS

Mechanical regulator, flow controller, tubing, fittings, canister sampling, assembly

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this SOP is to provide instructions on assembling a functional mechanical regulator that can be used for canister samples at the various air monitoring locations that the Air Program of DPR's Environmental Monitoring branch operates.

1.2 Scope

Mechanical regulators are one of many sampling tools available for use by the Air Program. Mechanical regulators are a reliable back-up option when other sampling tools are not available or operational. It is important that Air Program staff are aware of a mechanical regulator's components and assembly in case the need arises. These regulators are passive samplers and use the negative pressure inside of a Summa canister to draw in air.

1.3 Definitions

Mechanical Regulator – The informal term used to describe a fully assembled flow controller system that includes all the necessary parts to attach to a Summa canister. A functional regulator controls the flow rate of air into a Summa canister that is conducting passive air sampling. It is a standalone component that requires no power source and can be directly attached to the canister.

Passive Sampling - Refers to air pulled through a flow controller into an evacuated canister over a given time interval ranging from five minutes to 24 hours.

Time-integrated sampling - Produces a linear flow over time to ensure an "average" composited or time-weighted average (TWA) sample.

Sample Train - Consists of PTFE inlet tubing, metal particle filter, critical orifice, flow controller, and canister.

2.0 MATERIALS

2.1 Materials used in regulator assembly

2.1.1 Veriflo Flow Controller

2.1.2 SilcoSteel in-line filter (7µm)

2.1.3 Swagelok® tools and equipment set

2.1.4 Swagelok® reducer (SS-200-R-4)

2.1.5 PTFE back ferrule and front ferrule (T-200-SET)

2.1.6 1/4" hex nuts

2.1.7 1/8" hex nuts

2.1.8 7/16" wrench (for 1/8" hex nuts)

2.1.9 9/16" wrench (for 1/4" hex nuts)

2.1.10 An Installer's Pocket Guide for Swagelok® Tube Fittings (PDF)

2.1.11 1/8" PTFE tubing, 1/16" inside diameter.

3.0 PROCEDURES

3.1 Regulator Assembly

3.1.1 Gather the appropriate length of PTFE tubing required for the study (between 10 to 12 feet), the Swagelok® fittings, and the flow controller.

3.1.2 The (1) Swagelok reducer (SS-200-R-4) and (2) hex nut will form the connection point for the inline filter. The (3) PTFE back ferrule and (4) front ferrule (T-200-SET) are compression fittings that seal the connections between the (1) Swagelok reducer and (2) hex nut.

3.1.3 Attach the PTFE tubing to the (1) Swagelok® reducer (SS-200-R-4). To do this, slip the (2) nut onto the tubing, followed by the (3) PTFE back ferrule and (4) front ferrule (T-200-SET). Then insert the PTFE tubing into the threaded end of the reducer. Finger-tighten the nut (Figure 1.)

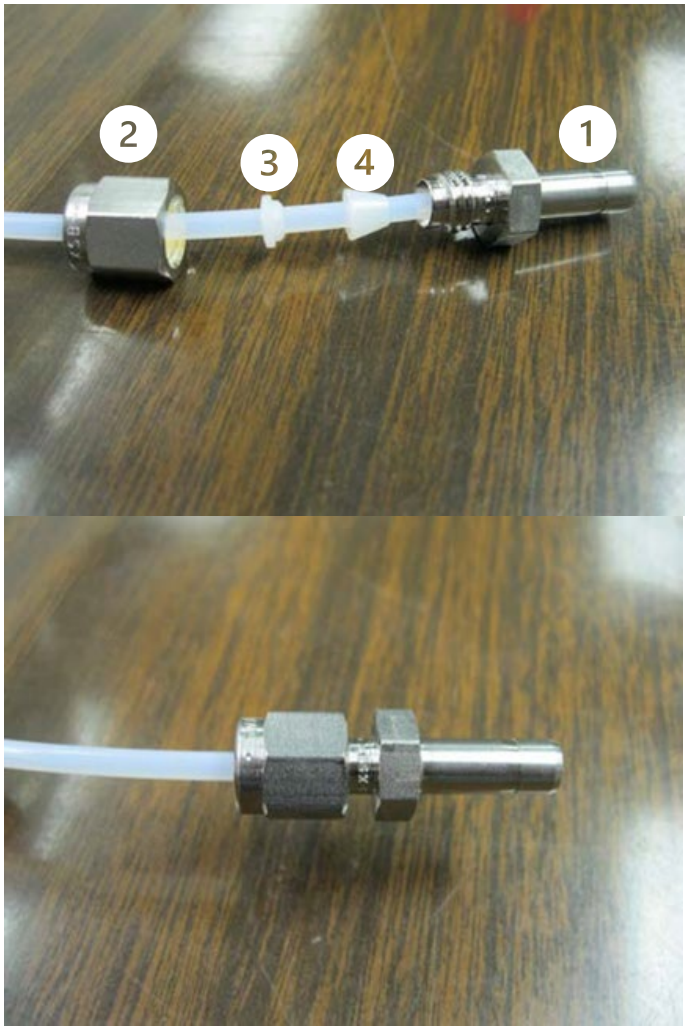

Figure 1. Before and after picture of a reducer and its ferrules being attached to PTFE tubing.

3.1.4 Slide (1) nut and (2) ferrule set onto the (3) tubing/reducer assembly. Then slide back ferrule and front ferrule onto the reducer (Figure 2). The (1) hex nut and (2) ferrule set will become the connecting point for the inline filter that is installed in the next steps. The (2) ferrule set act as compression fittings when the filter is fully tightened onto the assembly.

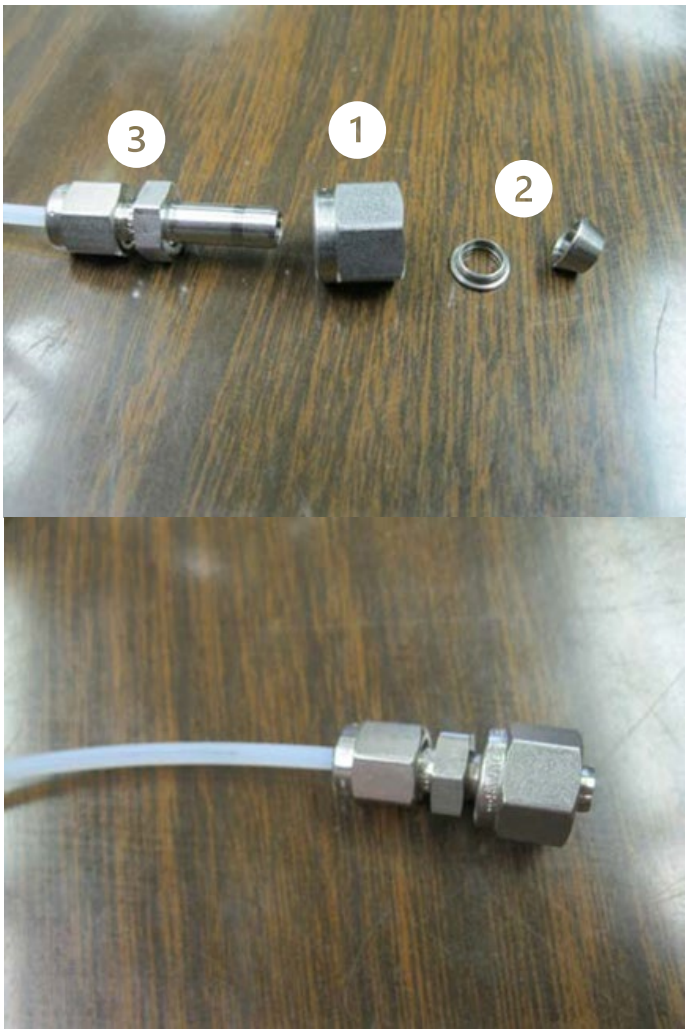

Figure 2. Before and after picture of a nut and its ferrules being attached to the reducer from the previous step.

3.1.5 Screw this assembly onto the 7-micron inline filter until it is finger-tight.

3.1.6 Make sure the inline filter has the arrow indicating airflow pointing towards the flow controller.

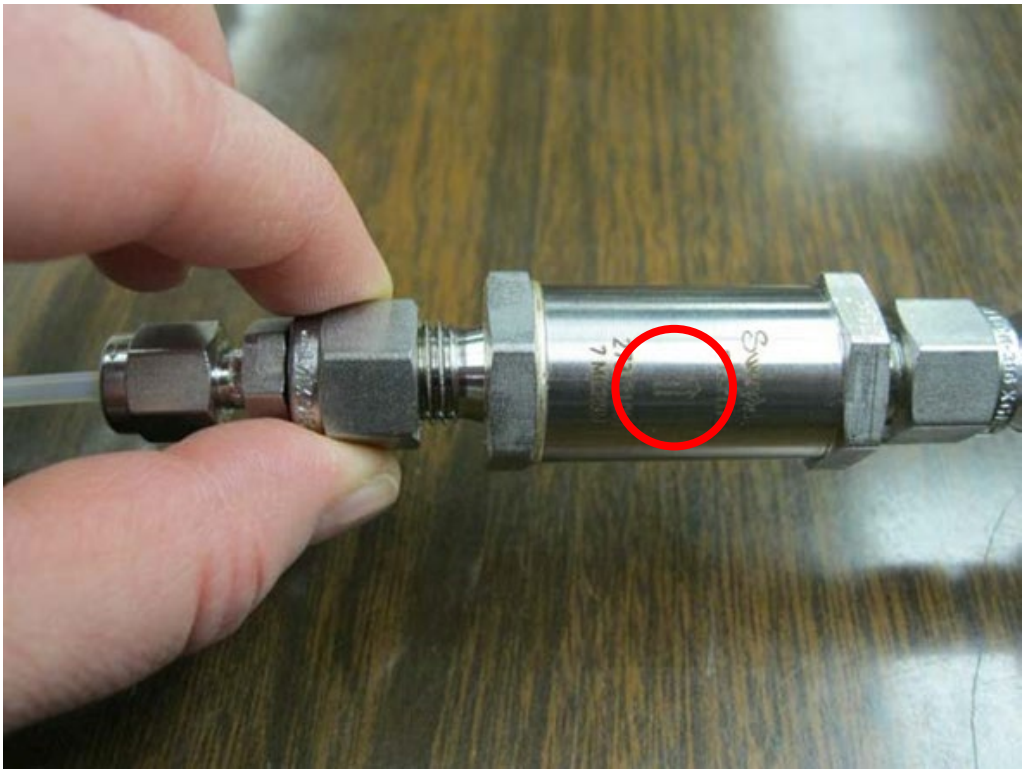

Figure 3. Picture of the 7-micron inline filter attached to the adapter that was constructed in the previous two steps.

3.1.7 Per the instructions on page 14 of "An Installer's Pocket Guide for Swagelok® Tube Fittings," use a marker to draw a line on the nut. Then, using a wrench to hold the inline filter steady, use a second wrench to turn the nut one and one-quarter turns. Now the nut is permanently attached to the reducer.

Figure 4. Wrenches are used to further tighten the connection between the adapter and inline filter.

3.1.8 Use a (1) metal Swagelok® tube, (2) two hex nuts, and a (3) ferrule set to create the two-way adapter to allow for connection to the flow controller. When fully assembled, the (1) Swagelok tube and (3) compression fittings create a seal between the inline filter and the flow controller.

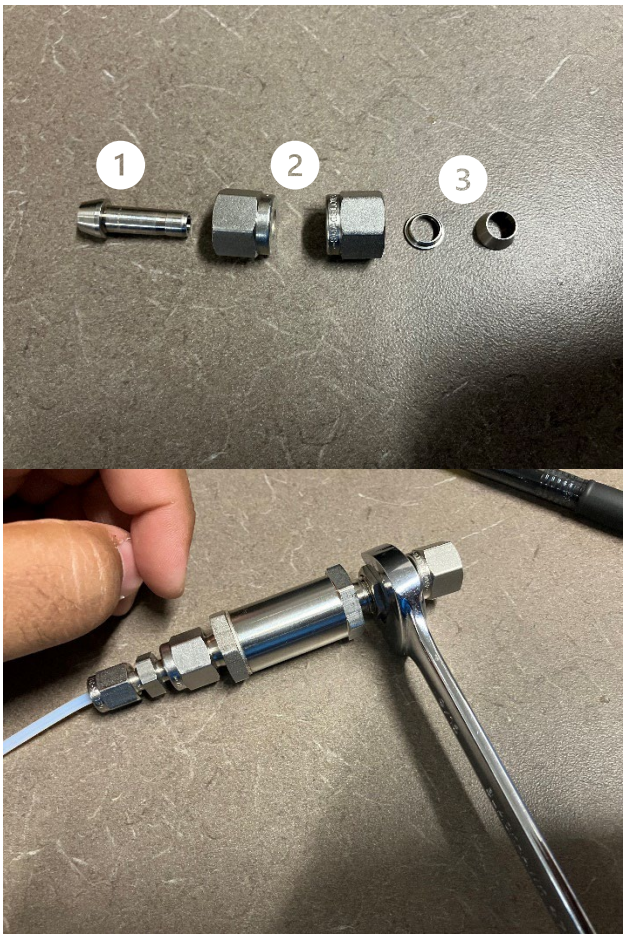

Figure 5. Swagelok® parts needed for flow controller adapter assembly.

3.1.9 Use a wrench to tighten the nut that has the compression fitting. Depending on how the adapter is oriented, it may be connected to the inline filter or the flow controller. Either configuration is acceptable.

3.1.10 Attach the fully assembled regulator to a Summa canister to conduct sampling.

Figure 6. Inline filter attached to the flow controller. When fully assembled, this is what a usable mechanical regulator will look like.

Figure 7. Mechanical regulator attached to a Summa canister.

4.0 REFERENCES

https://www.swagelok.com/downloads/webcatalogs/en/ms-13-151.pdf "An Installer's Pocket Guide for Swagelok® Tube Fittings"