

5.0 Audit Procedure for the URG Mass 400 and 450 Speciation Sampler



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5.1 Background

The URG MASS 400 and 450 chemical speciation samplers were developed in order to collect samples for the chemical and gravimetric analysis of PM_{2.5} ambient air particulate matter.

The MASS system pulls ambient air through an inlet, which removes particulate matter larger than 10 micrometers. The air sample then passes through a 4-channel, Teflon coated, Stainless Steel Annular Denuder. The air sample is then directed via the downtube denuder to the WINS impactor, which removes particulate matter greater than 2.5 micrometers. The remaining particulate is collected using a 47mm Teflon filter pack. The flow rate of the system is maintained at 16.67 L/min (ambient) by a digitally encoded dry gas meter and a diaphragm vacuum pump. Temperature and pressure corrections are made to correct for temperature and pressure differences between ambient and dry gas meter conditions. The barometric pressure, meter drop pressure, ambient temperature, filter temperature, meter temperature are measured by the MASS control system.

The field audit of this sampler includes the determination of the accuracy of the total flow rate reading under normal operating condition, ambient and filter temperature readings, and the barometric pressure reading as compared to those measured with a NIST traceable audit device (that must be recalibrated on an annual basis). Prior to performing an audit, verify that the annual calibration and maintenance procedures have been performed according to the required frequencies specified in Section 16 of the STN QAPP.

5.2 Calibration Equipment

A TriCAL Laboratory/Field Audit Calibrator (Figure 5-1), leak check adapter, and a flow audit cartridge are necessary for conducting audits of the URG MASS.

Figure 5 -1: TriCAL calibration unit.



The TriCAL's ancillary equipment is illustrated in Figure 5-2. The audit sample cartridge, and leak check adapter are illustrated in Figure 5-3.

It is important to ensure that the equipment is in thermal equilibrium with the ambient environment of the sampler. It is recommended that the TriCAL be set out (of its

carrying case) for an hour prior to any tests being conducted. If the unit experiences temperature variances greater than 5° during its use, it should be rebooted.

Battery capacity should be in excess of 10% (this ensures that at least one hour of power is available). If this is not the case, the battery in the TriCAL unit shall be charged prior to use. Before using the TriCAL audit device, the auditor must check the calibration tag on the instrument. If the instrument is out of calibration, **do not use**. Use one that is in calibration.

Figure 5 -2: Calibration equipment.

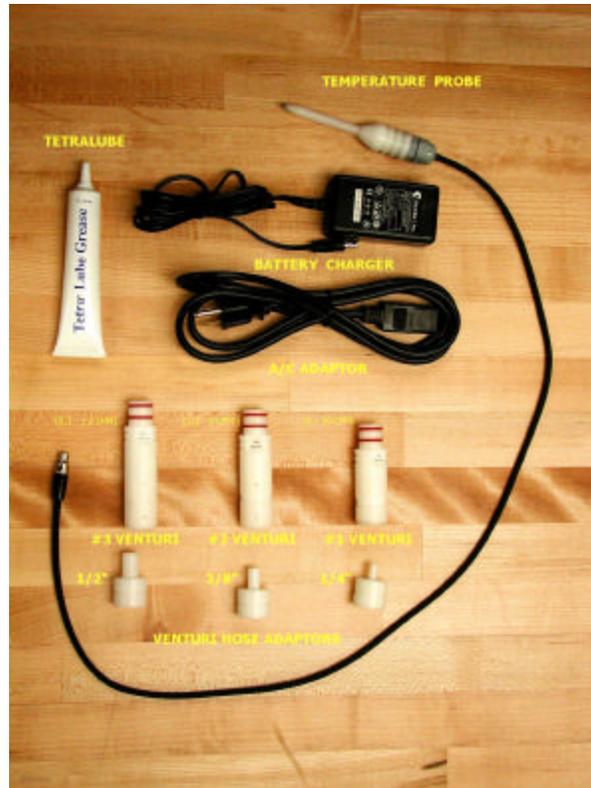


Figure 5 -3: Leak check, flow audit adapters, and audit cartridge.



5.3 Audit Procedure for the URG MASS

Upon arrival at the site location, the auditor must fill in all information listed below on the Performance Audit Worksheet (Attachment 1). This worksheet will also be used to record other required information throughout the audit procedure/process.

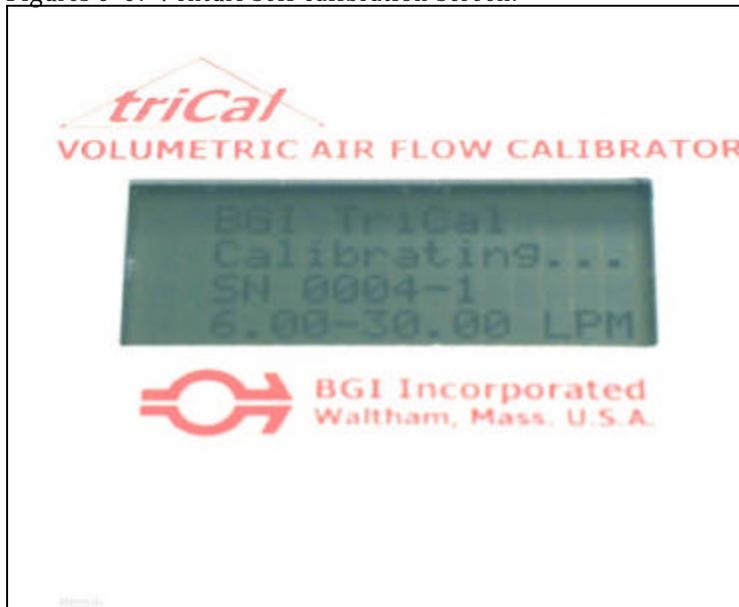
1. location of the sampler;
2. date of audit;
3. auditor (s) and agency affiliation;
4. operator (s) and agency affiliation;
5. sampler model and serial number (SN);
6. MASS or sampler calibration due date;
7. reference model, calibration date, and serial number.
8. location sampler operating agency, sampler operator's name, auditor's name.

Unpack the TriCAL and turn it on by pressing the on/off switch. The menu will prompt the user to insert venturi #1, #2, or #3. The venturi that will be used is determined by the flow rate of the air sampler being audited (this audit requires venturi #1 since the flowrates for this venture range between 6 and 30 L/min.). After a venturi has been inserted the TriCAL will perform a self-calibration of the venturi (Figure 5-4 and 5-5).

Figure 5 -4: Inserting venturi into TriCAL.

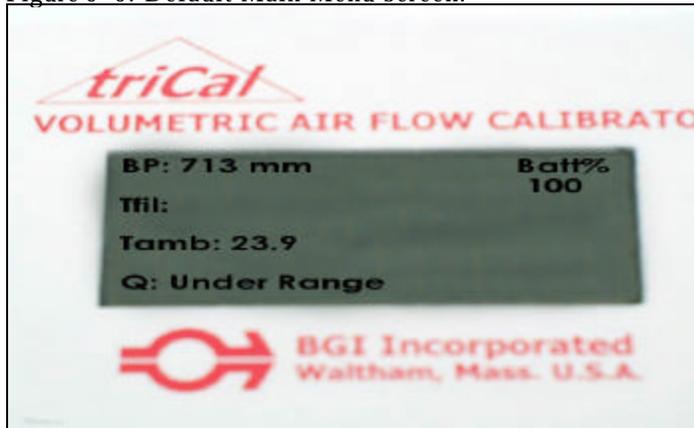


Figures 5 -5: Venturi self-calibration screen.



Once the venturi has been calibrated, the TriCAL will default to the Main Menu displaying barometric pressure, battery capacity, temperature, and flowrate (Figure 5-6).

Figure 5 -6: Default Main Menu screen.



Attach the temperature probe to the TriCAL (Figure 5-7). A value for the T_{fil} will then be displayed. (T_{amb} is the internal temperature sensor of the TriCAL, T_{fil} is the external temperature reading of the temperature probe.) Next, attach the tygon tubing to the venturi hose adapter, then attach the hose adapter to the venturi. (Figure 5-8) (**Note: The correct venturi hose adapter is determined by the size of the venturi that was inserted into the TriCAL.**)

Figures 5 -7 & 5 -8: Inserting temperature probe and venturi hose adapter.



The data required for the next five sections (*Clock Test, Leak Test, Flow Test, Temperature, Pressure Test*) can be obtained from the Main Menu (Figure 5-9) of the URG Sampler Control Box through a series of keystrokes listed later in this section.

5.3.1 Clock Test

Turn the sampler on by pressing the power switch to the *ON* position. From the *Main Menu* (Figure 5-9) select *View Run* (Figure 5-10) and *Current Sample*. Scroll down the screen, using the 'Up' and 'Down' arrows, to find the current date and time on the MASS sampler. Time and date should be displayed in the format in Figure 5-11.

Record this and the time from the audit clock on the Performance Audit Worksheet. Press Cancel to return to the Main Menu.

Figure 5 -9: Main Menu

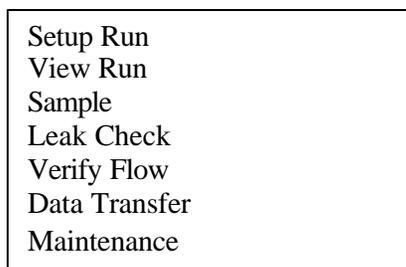


Figure 5 -10: View Run Menu.

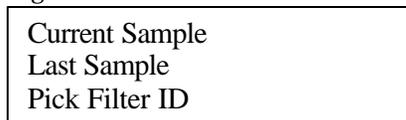
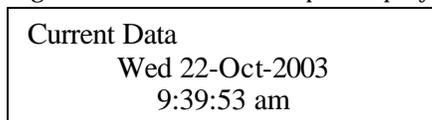


Figure 5 -11: Current Sample displayed time and date.



5.3.2 Leak Test

Detach the sample cartridge in the cabinet, if one is installed, and attach the assembled flow rate audit cartridge in its place (Figure 5-12). Ensure that while you're doing this, the WINS Impactor is not loosened. To verify this, make sure that the dot and line (on the WINS Impactor) are not aligned.

Remove the inlet assembly from the down tube on the top of the first MASS cabinet box (Figure 5-13). Attach the leak check adapter to the tube (Figure 5-14) and turn the valve lever to the off position (Figure 5-15). From the Main Menu, select Leak Check (Figure 5-9). Allow the flow to stabilize and record the leak flow rate on the Performance Audit Worksheet. Press the Cancel button to stop the test and return to the Main Menu.

Figure 5 -12: Attachment of flow audit cartridge.



Figure 5 -13: Removal of inlet assembly from down tube.



Figure 5 -14: Attachment of leak check adapter.



Figure 5 -15: Leak check adapter on the 'Off' position.



5.3.3 Flow Test

Attach the hose from the audit flow meter to the inlet (Figure 5-16) of the leak test adapter and turn the lever to the on position (Figure 5-17). Attach the 4' hose to the venturi hose adapter (which attaches to the flow audit device - TriCAL). (Figure 5-18 & 5-19) From the "Main Menu" select "Verify Flow". Allow the pump time to reach a stable flow rate. Record the sampler flow rate and the audit meter flow rate on the Performance Audit Worksheet. Press the Cancel button to stop the test and return to the "Main Menu". Remove the adapter, flow rate meter, and audit cartridge and replace the sample cartridge and the inlet assembly as in the sampler's original state.

Figure 5 -16: Attachment of hose from audit flow meter to inlet.



Figure 5 -17: Leak check lever on the on 'On' position.



Figure 5 -18: Venturi hose audit adapter.



Figure 5 -19: Flow audit device connected to inlet.



5.3.4 Filter Temperature

From the “*Main Menu*” select “*Maintenance*” and press the [Enter] key. From the “*Maintenance Menu*”, select “*Monitor*” and press [Enter] to view the current sampler temperature and pressure readings. Move the temperature probe to the location of the cabinet temperature sensor (Figure 5-20) and allow the reading to

stabilize. Record the audit cabinet temperature and sampler temperature on the Field Audit Worksheet.

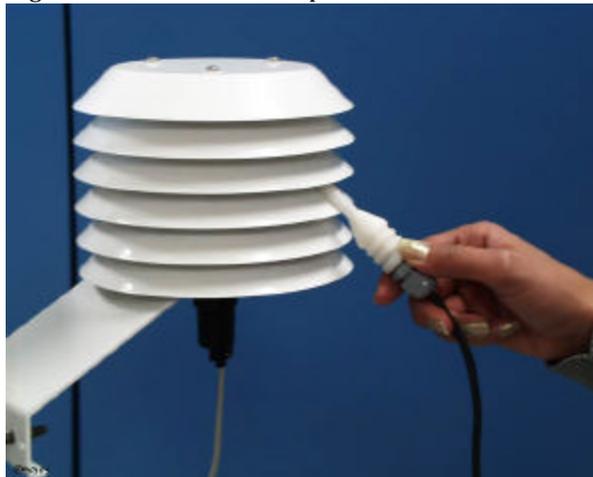
Figure 5 -20: Temperature probe and cabinet temperature sensor.



5.3.5 Ambient Temperature

Carefully insert the temperature probe into the gill screen of the MASS ambient temperature sensor, avoiding contact with the sides of the gill screen, and direct sunlight (Figure 5-21). **Note: Contact with a gill screen that has been exposed to direct sunlight may result in non-representative/erroneous readings due to possible elevated temperatures of the gill screen.** Allow the TriCAL temperature reading to stabilize. Record the air sampler ambient temperature and the TriCAL ambient temperature.

Figure 5 -21: Ambient temperature audit.



5.3.6 Ambient Pressure Test

Record the ambient barometric pressures from the TriCAL and the MASS. Press *Cancel* twice to return the MASS controller to the “*Main Menu*”.

Once the ambient pressures have been recorded the audit procedure is completed. Restore the air sampler to its original condition ensuring that the display screen is

returned to the Main Menu and replace any routine samples to their original positions. Return all the audit instrumentation to their cases.

5.4 Other

Record any applicable observations on the back of the Performance Audit Worksheet. This may include information such as the following:

1. obvious vandalism;
2. known power outages/failures;
3. any interrupted sample events;
4. inclement weather conditions;
5. and any other pertinent information that might have adverse impacts on data generation/collection.