

Particulate Matter 2.5 Speciation SOP

Section I

Electronic Calibrations Branch

(ECB)

Responsibilities

SOP Approval Sign-Off Sheet

I certify that I have read and approve of the contents of the SOP 2.45 with an effective date of Sept. 1, 2015

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Table of Contents

2.45.1.1 General Information	5
2.45.1.1.1 Introduction	5
2.45.1.1.2 Specifications	5
2.45.1.1.3 Technical Description.....	6
2.45.1.2 ASSEMBLY	8
2.45.1.2.1 Unpacking, Inspection and Parts Inventory	8
2.45.1.2.2 Assemble the Unit	8
2.45.1.2.2.1 Tripod	8
2.45.1.2.2.2 Head Assembly	8
2.45.1.2.2.3 Control Unit.....	9
2.45.1.2.2.4 Temperature Sensor	10
2.45.1.2.2.5 Pump Box	10
2.45.1.2.2.6 Channel Cables	11
2.45.1.2.2.7 System Ground	11
2.45.1.3 Initial Setup and Operation of the SuperSASS Sampler.....	11
2.45.1.3.1 Canister Assembly and SCC Installation.....	11
2.45.1.3.2 Operational Checkout of System	13
2.45.1.3.2.1 Temperature, Pressure and Flow Test.....	13
2.45.1.3.2.2 Leak Check of System	14
2.45.1.4 System Verification and Calibration.....	14
2.45.1.5 Programming of System	15
2.45.1.6 Troubleshooting and Maintenance	15
2.45.1.6.1 Operator Maintenance Activities.....	15
2.45.1.6.1.1 System Cleaning	15
2.45.1.6.1.2 System Inspection.....	16
2.45.1.6.2 Contractor Maintenance Activities	16
2.45.1.6.3 ECB Maintenance Activities	16
ATTACHMENT 1	17
ATTACHMENT 2	18
ATTACHMENT 3 Two-Point Pressure Calibration	20

Revision	Date	Changes
1	August 1, 2013	<ul style="list-style-type: none"> • The two-point pressure calibration was replaced with a one-point pressure calibration (see Section 2.45.2.4.2.1 One-Point Pressure Calibration in the Operator’s Section); • The two-point pressure calibration procedure was moved to Attachment 3 for use in troubleshooting if needed; • The procedures for calibrating, verifying, and programming were removed and references were added to those procedures in the Operator’s Section; and • ECB maintenance items were added (see Section 2.45.1.6.3 ECB Maintenance Activities).
2	September 1, 2015	<ul style="list-style-type: none"> • In section 2.45.1.3.2.1, <i>Temperature, Pressure and Flow Test</i>, the flow reading stabilization period was changed from “several seconds” to “a minimum of 5 minutes” and acceptable deviations for the ranges were included per EPA recommendations; • In section 2.45.1.3.2.2, <i>Leak Check of the System</i>, the flow reading stabilization period was changed from “a few minutes” to “a minimum of 5 minutes” and an acceptable indicator for stability was included per EPA recommendations; • Instructions were included to document all activities on the AQ109 form and in the instrument maintenance logs at the ECB; and • Section 2.45.1.6.1 was clarified to indicate what the operator responsibilities are and that the ECB should inspect the equipment at least annually to ensure the operator is correctly performing these inspections and cleanings.

AMBIENT PM 2.5 CHEMICAL SPECIATION SAMPLER MET ONE MODEL SUPERSASS

2.45.1.1 General Information

Significant changes from Revision 1 are as follows:

- In section 2.45.1.3.2.1, *Temperature, Pressure and Flow Test*, the flow reading stabilization period was changed from “several seconds” to “a minimum of 5 minutes” and acceptable deviations for the ranges were included per EPA recommendations;
- In section 2.45.1.3.2.2, *Leak Check of the System*, the flow reading stabilization period was changed from “a few minutes” to “a minimum of 5 minutes” and an acceptable indicator for stability was included per EPA recommendations;
- Instructions were included to document all activities on the AQ109 form and in the instrument maintenance logs at the ECB; and
- Section 2.45.1.6.1 was clarified to indicate what the operator responsibilities are and that the ECB should inspect the equipment at least annually to ensure the operator is correctly performing these inspections and cleanings.

2.45.1.1.1 Introduction

Met One Instruments developed the SuperSASS (Speciation Air Sampler System) chemical sampler under contract from the United States Environmental Protection Agency (USEPA) for the purpose of collecting samples for the chemical and gravimetric analysis of ambient air PM_{2.5} particles (airborne particles with diameters smaller than 2.5 micrometers (μm)). These particles are comprised of sulfates, nitrates, ammonium and metals. (Since 4th quarter 2009 organic and soot-like carbon are collected using a URG 3000 N sampler.)

2.45.1.1.2 Specifications

The SuperSASS can accommodate eight (8) sampling canisters used in groups of up to four, each with active flow control. Each individual canister has its own PM_{2.5} sharp cut cyclone (SCC) inlet, denuder ring and tandem 47 mm FRM filter holders. As such, each canister contains all necessary components for excluding particles above 2.5 μm , for removing interfering gases, and for collecting ambient fine particles.

The canisters are mounted in a wind aspirated radiation shield that maintains sampler temperature close to ambient. Inlets are approximately 72 inches above the ground. The sample flow rate is controlled at 6.7 L/min per canister depending on filter media and denuder material pressures.

The PM_{2.5} separation is produced by the SCC, which removes both solid and liquid coarse particles with equal efficiency without the use of impaction grease or oil. The denuders are multi-cell configured, 25mm in length, and are housed in a 47mm O.D. aluminum sleeve. The nitric acid denuder is made of aluminum with 350 parallel, hexagonal channels, and is coated with Magnesium Oxide. Empty sleeves are used when sampling doesn't require the use of a denuder.

The filter size used in the sample canister is 47 mm O.D. Each canister can hold either one or two filters in tandem. The collection media used for each canister varies, depending on the types of analysis to be performed. The FRM designed cassettes are used with the speciation filters.

The SuperSASS contains a solar and heat radiation shield that is designed to maintain the samples at near ambient temperature. The temperatures for both the sample filter and the ambient air are logged throughout the sampling period. The filter temperature is measured immediately downstream of the filter media in each canister.

The SuperSASS is standard with four active volumetric flow controllers. Each sampling line has a check valve to shut off the flow if the sampling line is not used, or for performing a dynamic field leak check. Volumetric flow rate measurement is made independently for each of the active flow channels, displayed instantaneously and logged with five-minute averages. Flow rate errors are flagged both on the display and in the data logger. Volumetric flows are measured and recorded with four independent electronic mass flow sensors. The mass flow sensors in conjunction with ambient temperature and barometric pressure readings are used by the control unit microprocessor to calculate the actual volumetric flow. This provides site-specific flow measurements so no correction is needed for true volumetric readings.

All routine maintenance can be done in the field. Sampling canisters are transported to the EPA contract laboratory for inspection, cleaning and changing of sampling substrates. Every element of the sampler that is contacted by the sampled air stream ahead of the filter, including the inlet can be cleaned with each sample change. This approach eliminates possible contamination problems.

2.45.1.1.3 Technical Description

The SuperSASS sampler is shown in Figure 2.45.1.1. 1. There are eight possible canister positions mounted within the solar radiation shield, each being selectively controlled to collect particles 2.5 μ m or less. Canisters may be equipped with a diffusion denuder ahead of the filter to remove selected gaseous compounds. The SuperSASS has individual SCC inlets.

A set of eight (8) solenoid valves is used to select which of the canisters are used during each test sequence. Vacuum lines for each orifice leads to an electronic mass flow monitor. The lines are then connected to a common manifold. A vacuum line from the manifold leads to the pump, which is housed in a fan-ventilated box.



Figure 2.45.1.1.1 Assembled SuperSASS Sampler

2.45.1.2 ASSEMBLY

2.45.1.2.1 Unpacking, Inspection and Parts Inventory

The SuperSASS is shipped in five (5) cardboard boxes. The contents of each individual box are listed in Attachment 1. Each box should be opened and its contents visually inspected for obvious damage from shipping. If items are missing or damaged, Met One Instruments, Inc. should be notified immediately so as to assure that the proper parts are received for installation.

2.45.1.2.2 Assemble the Unit

2.45.1.2.2.1 Tripod

The SuperSASS tripod comes as an assembled item. Upon removal from the shipping container, the 3 ringed pins from the tripod leg brackets are removed and the legs folded down. The pins are then reinserted to hold the legs in position. Holes are provided in the tripod feet and commercial hardware can be used to anchor the tripod to the sampling site. It is recommended to use spikes driven through the tripod mounting feet. Due to lack of cable length, running from the pump box to the tripod, it will be necessary to place the tripod as close to the FRM platform as possible. The sampler must be installed at a minimum distance of 1 meter from intake to intake from the FRM and URG samplers and 2 meters from the PM10 sampler. The inlets should be installed within 4 meters horizontally of the inlets for the FRM and URG samplers. All of the inlets should be within 1 meter of each other vertically.

2.45.1.2.2.2 Head Assembly

Locate the complete head assembly (Box 5) and remove from shipping container. Place the head assembly on the floor with the solar shield down. Remove the bottom shield by pulling up. Inside is the canister mounting of the upper shield. There is a gray PVC shipping tube that needs to be removed from the center of the sampling head assembly. It is used only during shipping, and is no longer required as part of the installation of the sample head. Once PVC tube is removed, place the detached portion of the bottom shield onto the tripod mast, sides pointing upward. Allow the bottom shield to rest on the mast. Unwind the cable of the upper shield. Using the assistance of a second person feed the cable and electrical wires into the mast until all has been pulled through to the bottom. As the cable reaches the bottom of the mast, place the upper shield onto the top of the mast. Use the 8-32 x 3/16" long socket-head screws to secure the upper shield in place, as shown in Figure 2.45.1.2.1. These screws provide upper and lower shield orientation. Next, tighten the setscrews of the upper shield to secure to the mast. Raise the bottom shield while aligning the slot with screw head in mast and pin in place. Leave head assembly in this position (Figure 2.45.1.2.2) while installing the next portion of the unit.

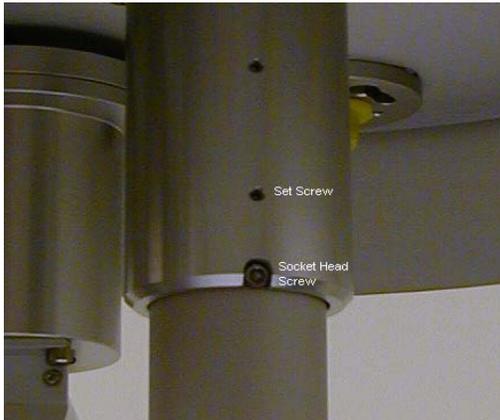


Figure 2.45.1.2.1 Head Assembly Mounting Screws



Figure 2.45.1.2.2 Head Assembly

2.45.1.2.2.3 Control Unit

Locate the control unit (Box 1), and remove from the shipping container. Locate the two metal U-Bolt hardware clamps that have been provided. Using a wrench or a 7/16" socket, connect the control unit to the lower portion of the mast, just above the top of the tripod legs. Proper orientation of the control box is with the hinged side of the box facing the left (from the front) and in the middle of two legs of the tripod. Once the unit is positioned, tighten the U-Bolt clamps. See Figure 2.45.1.2.3 for mounting details.



Figure 2.45.1.2.3 Control Unit and Temperature Sensor Assembly

2.45.1.2.2.4 Temperature Sensor

Locate the temperature sensor (Box 1) and remove from shipping container. The sensor is mounted just above the control box, about 3 inches above the lower control unit U-Bolt, facing the opposite direction (see Figure 2.45.1.2.3). The sensor is mounted using the one U-Bolt and two 7/16" nuts with washers that have been provided. The sensor should be mounted on the mast with the flat top plate facing up and the cable connector facing the ground. The top of the shield should be about the same level as the top of the control box. This will allow the bottom shield of the sampling head to be lowered without hitting the top of the temperature shield.

Attach the cable and connector to the ambient temperature sensor from the pump control box. The cable is labeled Amb. Temp. (8838-6). It is impossible to misconnect the cable since the connections are keyed.

2.45.1.2.2.5 Pump Box

Locate the pump box (Box 3) and remove from shipping container. The dual diaphragm AC vacuum pump is contained in its own environmental shelter isolated from the SuperSASS to prevent vibration, noise, heat and any potential of exhaust contamination. The vacuum pump is a dual head Thomas Co.TM diaphragm vacuum pump mounted with four bolts through the bottom of the cabinet.

The pump box contains a filter screen under the pump and an aspiration fan on the side. Heat is exhausted from the box by pulling ambient air in the base and through the fan and exhausting on the right. The pump will be located in a position that is close to the base of the tripod. The pump box ideally will be secured to the existing FRM platform, given there is ample room to keep the minimum 1-meter distance intake to intake from the FRM sampler. If securing to the existing platform is not possible, a smaller version of the platform will be constructed specifically for the pump box alone. The platform should be a minimum of 12" x 18", and should be approximately 1.5 to 2 feet high. This will increase the accessibility of the pump box by the technicians to perform routine maintenance. The pump box can be mounted using 1/4" bolts or lag screws to the platform. The pump box will ultimately be located as close to the tripod as possible.

The pump box contains three cables. One is the 110VAC 60 HZ power cable, which is connected to the AC grounded service. The second is a signal cable with a screw type connector that attaches to the ambient temperature sensor. The third cable from the bottom of the pump box (labeled 8833) connects to the center connector on the bottom of the control unit. Once this cable is inserted rotate the outer ring on the front of the connector to lock it in place on the control unit. A multi-pin connector on the side of the pump box connects to a multi-conductor cable that runs down the center of the mast from the sampling head assembly (gray cable, 8896).

There are only four flow controllers for the SuperSASS. The same four are used for all eight channels. The sampler will run channels 1 through 4 simultaneously or channels 5 through 8 simultaneously. This means that, if for some reason one channel in the first group of four are not functioning properly, then the corresponding channel in the last group of four will also not function properly. For example, if channel 3 is not functioning properly, neither will channel 7.

2.45.1.2.2.6 Channel Cables

Each channel has its own individually identified cable that runs down the center of the mast. Connect all eight cables to the corresponding position on the pump box (cable #1 connects to valve #1, etc.). A Quick-Disconnect valve on the side of the pump box connects each cable. Secure the cables to the tripod leg with tie wraps or electrical tape.

2.45.1.2.2.7 System Ground

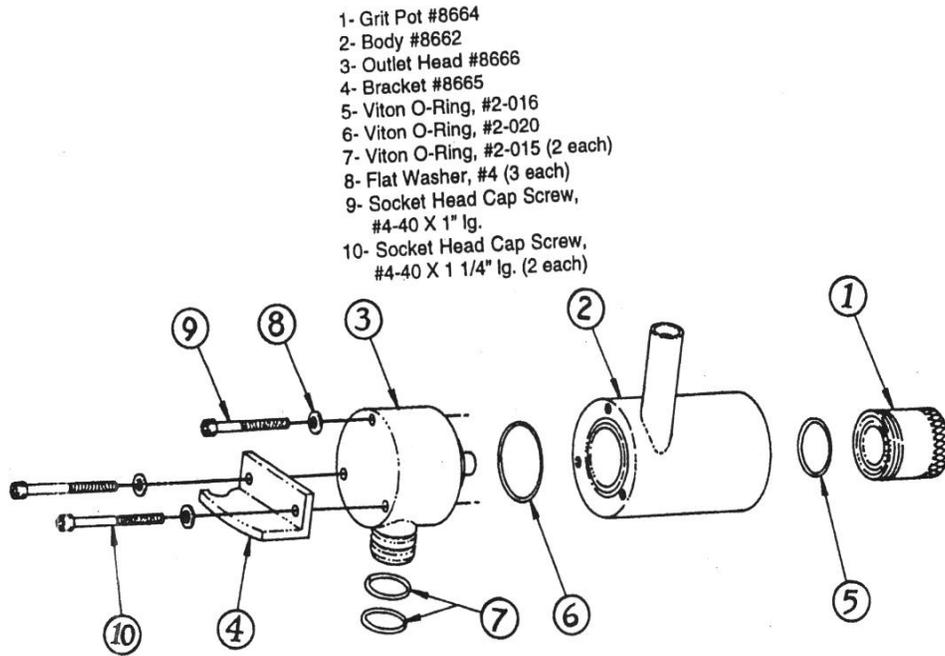
The SuperSASS is equipped with a heavy green/yellow ground cable that should be connected to a nearby earth ground rod. It is recommended that one leg of the tripod also be grounded to the same earth ground used to ground the pump box. For maximum effectiveness, a copper cable of AWG # 6 or larger should be used to ground the tripod. The AWG cable is not provided.

2.45.1.3 Initial Setup and Operation of the SuperSASS Sampler

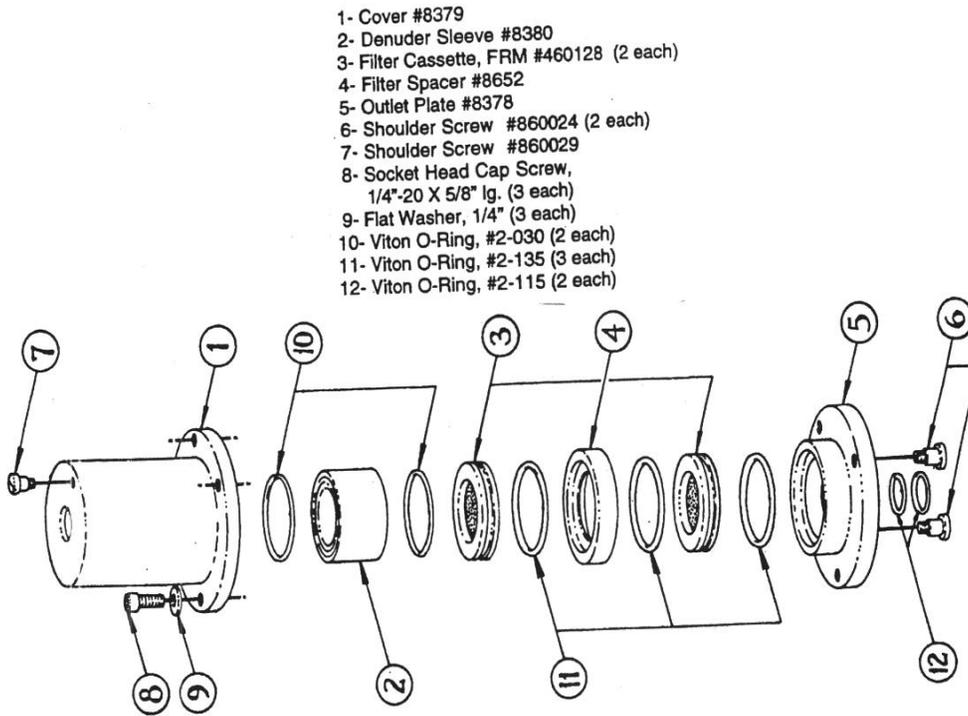
2.45.1.3.1 Canister Assembly and SCC Installation

In order to check the operation of the SuperSASS, blank filters must be loaded into the canisters that will be used for the system check. Remove the two yellow caps from both ends of the canister. The canisters are secured with three socket head cap screws, 1/4" -20 x 5/9" lg. Unscrew all three using a long Allen wrench. Once the screws have been removed, lift the upper portion of the canister to expose the two filter cassettes and the denuder sleeve. Place 47mm Teflon filters into each cassette and place back onto the canister bottom. Referring to Figure 2.45.1.3.1, replace the contents of the canister in the appropriate order, with filter surfaces facing away from the screws. After all contents have been replaced, lower the upper portion of the canister back onto the bottom portion, and secure with the three screws.

The fixed shoulder screw at the top of the sample canister will hold the SCC in place. Do not loosen or remove this screw. Referring to Figure 2.45.1.3.1, insert the SCC into the sample canister and twist so that the bracket slides under the shoulder screw. A light coating of silicone grease can be applied to the two O-rings on the SCC for easier installation. The sample canister is now complete and ready to be used in the systems check.



- 1- Grit Pot #8664
- 2- Body #8662
- 3- Outlet Head #8666
- 4- Bracket #8665
- 5- Viton O-Ring, #2-016
- 6- Viton O-Ring, #2-020
- 7- Viton O-Ring, #2-015 (2 each)
- 8- Flat Washer, #4 (3 each)
- 9- Socket Head Cap Screw, #4-40 X 1" lg.
- 10- Socket Head Cap Screw, #4-40 X 1 1/4" lg. (2 each)



- 1- Cover #8379
- 2- Denuder Sleeve #8380
- 3- Filter Cassette, FRM #460128 (2 each)
- 4- Filter Spacer #8652
- 5- Outlet Plate #8378
- 6- Shoulder Screw #860024 (2 each)
- 7- Shoulder Screw #860029
- 8- Socket Head Cap Screw, 1/4"-20 X 5/8" lg. (3 each)
- 9- Flat Washer, 1/4" (3 each)
- 10- Viton O-Ring, #2-030 (2 each)
- 11- Viton O-Ring, #2-135 (3 each)
- 12- Viton O-Ring, #2-115 (2 each)

Figure 2.45.1.3.1 Sharp Cut Cyclone (SCC) and Canister Assembly

2.45.1.3.2 Operational Checkout of System

Before the system check can begin, sample canisters must be loaded into each sampling channel to be used. . Each canister has a pair of mounting shoulder bolt posts and a vacuum connection with O-rings. Insert the posts into the inlet assembly and twist to the right until locked into position. Each canister has an alignment mark that should be pointing out and away from the tripod mast. The mark should approximately align with the channel number above the canister. A light coating of silicone grease can be used on the canister O-rings for easier installation.

Once the SuperSASS has been powered, the pump fan in the pump box should be detected operating and the LCD display of the Control unit should illuminate. There is no on/off switch. The Control unit's main screen menu will be displayed as below in Figure 2.45.1.3.2. The LCD display can be adjusted according to brightness by pressing the * key on the Control Unit keypad. Continued pressure on the key will lighten or darken the LCD display.



Figure 2.45.1.3.2 Main Screen Display

As part of the preliminary setup and checkout of the SuperSASS, the following process can be used to verify the operation of the unit. To insure that the system has been correctly assembled, there are no leaks, and that there has been no damage to the unit use the following procedure.

2.45.1.3.2.1 Temperature, Pressure and Flow Test

From the main menu, select the "Calibrate" function at the bottom of the screen. From the next screen menu, select the "System Test" by pressing the FI key. The System Test menu will be displayed on the LCD as shown in Figure 2.45.1.3.3.

System Test		MM/DD/YY HH:MM:SS	
Ambient P	745 mmHg	Ambient T	24.4 C
Flow 1	.0 LPM	Filter 1	24.2 C
Flow 2	.0 LPM	Filter 2	24.3 C
Flow 3	.0 LPM	Filter 3	24.2 C
Flow 4	.0 LPM	Filter 4	24.2 C
Pump: ON			
Cans		Pump	Exit

Figure 2.45.1.3.3 System Test Screen

This screen displays the current ambient temperature, the current temperature of the filters in the sample head, and the current absolute barometric pressure in mmHg. The filter temperatures and the individual channel flow values are displayed in two groups of four. Temperature and pressure will be displayed simultaneously for channels 1 through 4. Pressing the "Cans" in the bottom left hand corner of the screen will change the display to read the temperatures and flow values of channels 5 through 8. These screens will toggle back and forth by pressing the "Cans" button. The values for flow should read 0.0 LPM for all channels. If the values displayed for temperature or barometric pressure are obviously incorrect, check to verify that all connections have been made and the connectors from the pump box are installed.

Press the "Pump" button. This will bring up a caution screen that reads "Press 'Continue' to STOP the sample event and control the pump". Pressing the "Continue" button will activate the pump and you should immediately hear the pump start inside of the pump box. (The pump will activate automatically if the temperature inside the pump box reaches below 35° F, so that there is no possibility of the pump not starting correctly in cold weather). Once the pump has started, allow a minimum of five minutes for the flow readings to stabilize. The values for all canisters should be between 6.6 and 6.8 LPM of flow. Channels with no canisters installed will have flow values of 0.0 LPM. Record the flows on the AQ109 and in the instrument logbook. If flow values are outside the range of 6.7 ± 0.67 or 0.0 ± 0.1 LPM, check the trouble shooting and maintenance information contained in section 6.0 of this QA plan.

2.45.1.3.2.2 Leak Check of System

Allow pump to run for a minimum of 5 minutes or until flow readings vary by 0.1 LPM or less. Press the Leak button to put the unit in leak test mode. This turns OFF the motor control to the flow control valves. While pump is operating and flow values are being displayed on the screen of the control unit, use a yellow plastic cap and block off the inlet tube of the SCC of canister # 1. The flow value for canister #1 should drop to 0.0 or 0.1 LPM, indicating that there are no leaks in the components of the first canister. Record the results on the AQ109 form and in the instrument logbook at the ECB. Continue this procedure for each of the eight channels, using the "Cans" button to toggle the screen of the control unit between the first four channels and the last four channels. Any channel reading higher than 0.1 LPM indicates that there is a leak in that portion of the system. Refer to the troubleshooting and maintenance information in Section 2.45.1.6 Troubleshooting and Maintenance of this QA plan.

2.45.1.4 System Verification and Calibration

Follow the procedures for doing a system verification and calibration in 2.45.2.4 (The Particulate Matter 2.5 Speciation QA Plan Section 2 Operator Responsibilities). If needed for troubleshooting, the procedure for doing a 2-point pressure calibration is provided in ATTACHMENT 3 Two-Point Pressure Calibration. Record the

results of the system verification and calibration on the AQ109 form and in the instrument maintenance logbook.

2.45.1.5 Programming of System

Follow the set-up procedures in Section 2.45.2.5 (The Particulate Matter 2.5 Speciation QA Plan Section 2 Operator Responsibilities).

The software will be loaded onto the laptop PC's of the operators. There are two disks containing the SassCommAQ software. To install, insert Disk #1 into the disk drive. Click on the Windows <Start> button and then <Run>. Type in A:\Setup, then press <Enter>. Follow the instructions on the screen. If Disk #1 is not available, the software can also be downloaded from the Met One website.

2.45.1.6 Troubleshooting and Maintenance

Very little maintenance is required for the operation of the SuperSASS Sampler System. Most maintenance involves inspection and cleaning of components for damage or wear, as well as the regularly performed checks and calibrations by the operators. All routine maintenance, troubleshooting activities, and on-site repairs should be recorded in the site log, on the AQ109 form, and in the instrument logbook at ECB.

In the event a sampler fails to operate properly after repeated attempts, the ECB should collect the sampler from the site for further troubleshooting. Additional troubleshooting and off-site repairs will be recorded on the AQ109 form and in the instrument logbook at ECB. Operators will inform the ECB of such occasions.

2.45.1.6.1 ECB Annual Checks and Services

2.45.1.6.1.1 System Cleaning

Each time the system canisters are replaced, or as deemed necessary, the regional operator should clean the solar radiation shield of the sampler head with a wet cloth. Buildup on the shield can reduce the effectiveness of the reflective surface and cause the temperature to rise inside the shield. At least once a year, the ECB will check the solar radiation shield to verify that the regional operator is keeping it clean and will clean it, if necessary. Document all findings and activities on the 109 form, in the site logbook and in the instrument maintenance logbook at the ECB.

Likewise, the regional operator should inspect and clean the pump housing at least every quarter by removing the four screws on the corners and lifting the cover up and out of the way. At least once a year, the ECB will inspect and check the pump housing to verify

that the regional operator is keeping it clean and will clean it, if necessary. To clean, using a brush, or a compressed air source, clean the insides of the enclosure, particularly the screen located below the pump assembly. When completed, reattach the pump box cover and re-secure the four screws. Document all findings and activities on the 109 form, in the site logbook and in the instrument maintenance logbook at the ECB.

The regional operator should also inspect the control box and cables for damage or dirt/dust accumulation. At least once a year, the ECB will inspect and check the control box and cables to verify that the regional operator is keeping it clean and will clean it, if necessary. The control panel should only be cleaned with a damp cloth, and no liquids should be allowed to enter the electronic package. Document all findings and activities on the 109 form, in the site logbook and in the instrument maintenance logbook at the ECB.

2.45.1.6.1.2 System Inspection

The various components of the system should be inspected for wear, damage, and changes in previous operation. Most inspections rely on visual checks during normal operation of the system.

Each time a canister is removed, check the O-rings of the canisters and those on the SCC. Each time the cyclones are removed, unscrew the grit cap and dump out any dirt that may have collected as part of a routine maintenance program.

2.45.1.6.2 Contractor Maintenance Activities

The MgO denuder will need replacement approximately every three months of operation, or as required by the US-EPA. The third party contract laboratory performing the chemical analysis of the filters replaces the denuders. The third party vendor is replacing filters and denuders in each canister.

2.45.1.6.3 ECB Maintenance Activities

The O-rings in the SASS monitor and the pump diaphragms should be replaced every two years per the manufacturer's recommendations.

ATTACHMENT 1**Shipping List**

- Box 1: (CONTROL UNIT) Size 20"L x 20"W x 12"H Wt = 20 Lbs
Contains: Control unit (PN 8863) & mounting hardware
Ambient Temperature Sensor (PN 064-1)
Temperature Shield (PN 5980) and mounting hardware
Five (4) Sharp Cut Cyclones (PN 8670)
One (1) MgO Denuder (PN 8382)
RS-232 Cable (PN 3159)
- Tools: Kit (PN 8629) Poly bagged together
One (1) ¼ x 20 Allen Wrench
One (1) Allen Wrench Kit
One (1) O-rind lubricant
Three (3) Hex Head Screws
One (1) Wrench
One (1) Cassette Laboratory Assembly Block
Two (2) Black Tie Wraps
- Manuals:
One (1) SuperSASS Operators Manual
One (1) SASSComm Operators Manual and Software
- Box 2: (TRIPOD) Size 8" x 8" x 52" Wt = 15 Lbs
Contains: One (1) Tripod (PN 8864)
- Box 3: (PUMP BOX) Size 20"L x 20"W x 24"H Wt = 45 Lbs
Contains: One (1) Pump Box and Flow Management System
(PN 8862-2)
- Box 4: (TRANSPORT CASE) Size 18"L x 16"W x 12"H Wt = 18 Lbs
Contains: One (1) Canister Transport Case (PN 8460)
Four (4) Sample Canisters (PN 8370) with cap
Plugs for inlet and outlet of cassettes
- Box 5: (SAMPLING HEAD) Size 25"L x 25"W x 20"H Wt = 15 Lbs
Contains: One (1) Sampling Head and Canister Mounting
Platform (PN 8861-2)

ATTACHMENT 2

Troubleshooting Guide

Out of specification ($\pm 10\%$ of transfer standard)	<ol style="list-style-type: none"> 1. Completely remove flow rate measurement adapter; reconnect and perform flow rate check again. 2. Perform Leak test 3. Check flow rate at three points to determine if flow rate problem with slope. 4. Recalibrate flow rate
Leak outside acceptable tolerance	<ol style="list-style-type: none"> 1. Completely remove flow rate measurement adapter; reconnect and perform leak test again. 2. Inspect all seals and O-rings; replace as necessary and perform leak test again. 3. Check sampler with different leak test device.
Consistently low flows during sample runs	<ol style="list-style-type: none"> 1. Check programming of sampler flow rate. 2. Check flow with a flow rate verification filter and determine if actual flow is low.
Out of specification ($\pm 2^\circ\text{C}$ of standard)	<ol style="list-style-type: none"> 1. Recalibrate sensor; replace sensor.
Out of specification ($\pm 10\text{ mmHg}$ of standard)	<ol style="list-style-type: none"> 1. Make certain pressure sensors are exposed to ambient air and are not in direct sunlight. 2. Obtain pressure data from a third source to verify the pressure standard is correct. 3. Connect new pressure sensor.
Out of specification ($\pm 5\text{ min}$)	<ol style="list-style-type: none"> 1. Check programming; verify power outages 2. Reset
Sample did not run	<ol style="list-style-type: none"> 1. Check programming 2. Try programming sample run to start while operator is at site; ensure the transport filter is in the unit.
Power Interruptions	<ol style="list-style-type: none"> 1. Check line voltage

Liquid-crystal display pen on, but sample not working.	1. Check to see that plugs are in place and there are no loose connections.
Data did not transfer to laptop computer	1. Document key information on sample data sheet. Make sure problem is resolved before data may be overwritten.

ATTACHMENT 3 Two-Point Pressure Calibration

From the Utility Menu press F4 for the Pressure Calibration Menu. Comparing the SuperSASS pressure measurement with a reference barometer can make a preliminary check. If the SuperSASS does not compare to within ± 10 mmHg, calibration is necessary.

Pressure Calibration				
SASS	Pt	Save	Reference	
760	1	600	600 mmHg	Save (F1)
	2	800	800 mmHg	Save (F4)
Calibrate			Default	Exit

Display Screen for Pressure Calibration Menu

A pressure calibration requires a NIST traceable reference pressure device, a syringe, some tubing and a tee. Refer to Figure 4.1 for the pressure test setup. Refer to Figure 4.2 for location of the pressure test port. The cover of the pump box must be removed to reach the pressure test port.



Figure 4.1 Pressure Test Setup

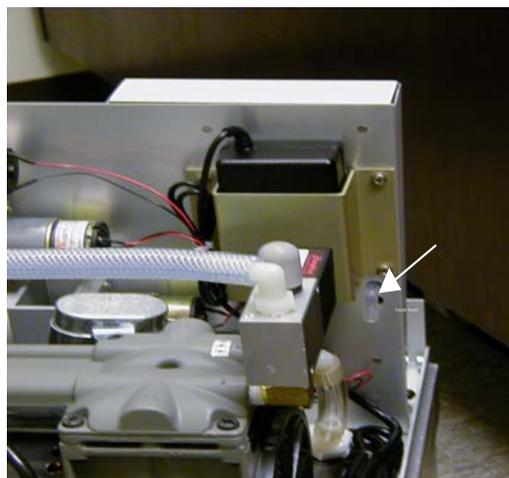


Figure 4.2 Pressure Test Port
inside of pump box

Connect the syringe to the tubing shortest in length and the long tubing to the pressure test port of the SuperSASS. The syringe is used to change the pressure inside the tubing from below ambient to above ambient. Verify that the syringe is able to adjust the pressure to 600 and 800 mmHg. Adjust the length of tubing to provide the necessary adjustment.

Follow the procedure outlined below to calibrate for pressure.

- Set the simulated pressure value to 600 mmHg as measured from the reference pressure sensor. When the measurement is stable, enter the value measured from the reference by moving the cursor to the top reference window position and entering the value. When completed press F1 to save value.
- Now set the simulated pressure value to 800 mmHg as measured from the reference sensor. When the measurement is stable, enter the value measured from the reference by moving the cursor to the second reference window position and entering the value. When completed press F4 to save value.
- Now press the “Calibrate” key and the new values will be saved in the memory of the control unit.
- Re-check the pressure to the reference pressure device and verify that the values are within the ± 10 mmHg tolerance. If test fails after two times, a new pressure sensor may be required. If a new sensor is installed set the replacement sensor using the “Default” menu selection. This will return to the original measurement factors.

Remove the test setup and log results in the on site maintenance log.