



STANDARD OPERATING PROCEDURES
FOR
Thermo Scientific Inc.
Partisol 2000i Air Sampler

AQSB SOP 403

First Edition

MONITORING AND LABORATORY DIVISION

February 2020

Disclaimer: Mention of any trade name or commercial product in this standard operating procedure does not constitute endorsement or recommendation of this product by the California Air Resources Board. Specific brand names and instrument descriptions listed in the standard operating procedure are for equipment used by the California Air Resources Board's Laboratory. Any functionally equivalent instrumentation is acceptable



Approval of Standard Operating Procedures

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HISTORY

Edition	Release Data	Changes
First	February 2020	New document.

LIST OF ACRONYMS

AMNS - Air Monitoring North Section
AMSS - Air Monitoring South Section
AQSB - Air Quality Surveillance Branch
CARB - California Air Resources Board
CFR - Code of Federal Regulations
FEM - Federal Equivalent Method
FRM - Federal Reference Method
LPM - Liters Per Minute
MFC - Mass Flow Controller
MFM - Mass Flow Meter
MLD - Monitoring and Laboratory Division
ODSS - Operation and Data Support Section
O.D. - Outside Diameter
LIMS - Laboratory Information Management System
NIST - National Institute of Standards and Technology
PQAO - Primary Quality Assurance Organization
PST - Pacific Standard Time
QA - Quality Assurance
QA/QC - Quality Control/Quality Assurance
QAS - Quality Assurance Section
QMB - Quality Management Branch
QMS - Quality Management Section
SLPM - Standard Liters Per Minute
SOP - Standard Operating Procedure
Thermo - Thermo Scientific Inc.
U.S.EPA - United States Environmental Protection Agency
PM2.5 - Particulate Matter 2.5 microns
PM10 - Particulate Matter 10 microns
VSCC - Very Sharp Cut Cyclone

1.0 GENERAL INFORMATION

1.1 Introduction:

The purpose of this Standard Operating Procedure (SOP) is to document the Thermo Scientific Partisol 2000i (Thermo 2000i) air sampler procedures utilized by the Air Quality Surveillance Branch of the California Air Resources Board (CARB). The goal of this SOP is twofold; to formalize the Thermo 2000i installation, configuration, and operation procedures in order to ensure comparability of all Thermo 2000i Federal Reference method (FRM) samplers within CARB's network, and to describe supplemental information and modifications to the Thermo Scientific Partisol 2000i Air Sampler Instruction Manual. The Thermo Scientific Partisol 2000i Instruction Manual contains a significant source of information pertinent to the operation, maintenance and understanding of this instrument, and therefore CARB highly recommends a thorough review of the manual.

1.2 Principle of Operation:

The Thermo 2000i sampler is designated as a FRM for collection of PM_{2.5}. The sampler meets the United States Environmental Protection Agency (U.S. EPA) requirements for PM_{2.5} sampling (40CFR part 50, Appendix L).

Ambient air is sampled through the top of the instrument at the PM₁₀ impactor and then through the PM_{2.5} very sharp cut cyclone (VSCC). The PM₁₀ and VSCC size selective inlets utilize angular velocity to remove particles larger than 2.5 microns. The sampler maintains a constant volumetric flow rate of 16.67 liters per minute (LPM) utilizing a mass flow controller and real-time ambient temperature/pressure compensation.

The sample is collected on a 47mm filter housed in Delrin 52 mm Teflon cassette. These cassettes are mounted in a single-filter tray for easy exchange and transportation to and from the sampling site.

Refer to Figure 1.0 for flow schematic.

1.3 Safety Precautions:

Installation, operation, maintenance, and calibration of the sampler should only be performed by properly trained personnel. To avoid electrical injury when replacing internal electric components be sure to unplug the sampler prior to repairs. Due to typical rooftop installations, the risks of working outdoors at elevation should also be considered. To prevent injury or damage to the equipment, the sampler should be securely mounted to the stand using the included hex head bolt hardware and washers. The stand should be properly

secured or anchored to the floor/platform.

1.4 Interferences/Limitations:

Special precaution must be taken when handling the PM_{2.5} filter cassettes. It is strongly recommended that the instrument operator wear powderless nitrile gloves when handling the filters to prevent contamination. The Teflon filter is extremely delicate. Any foreign object touching the surface may result in damage and/or contamination, which will cause filter invalidation.

1.5 Personnel Qualifications:

Staff installing, operating, calibrating or performing maintenance on the Thermo 2000i should be familiar with the operating manual and SOP. A basic understanding of the principles governing ambient air sampling is assumed.

EPA Quality Assurance Guidance Document 2.12 (U.S. Environmental Protection Agency, 2016) cover the specifics of field personnel qualifications, and provides the following general guidelines. All field operations personnel should be familiar with environmental field measurement techniques. Those who service the Thermo 2000i in the field must be very conscientious and attentive to detail in order to report complete and high-quality PM data.

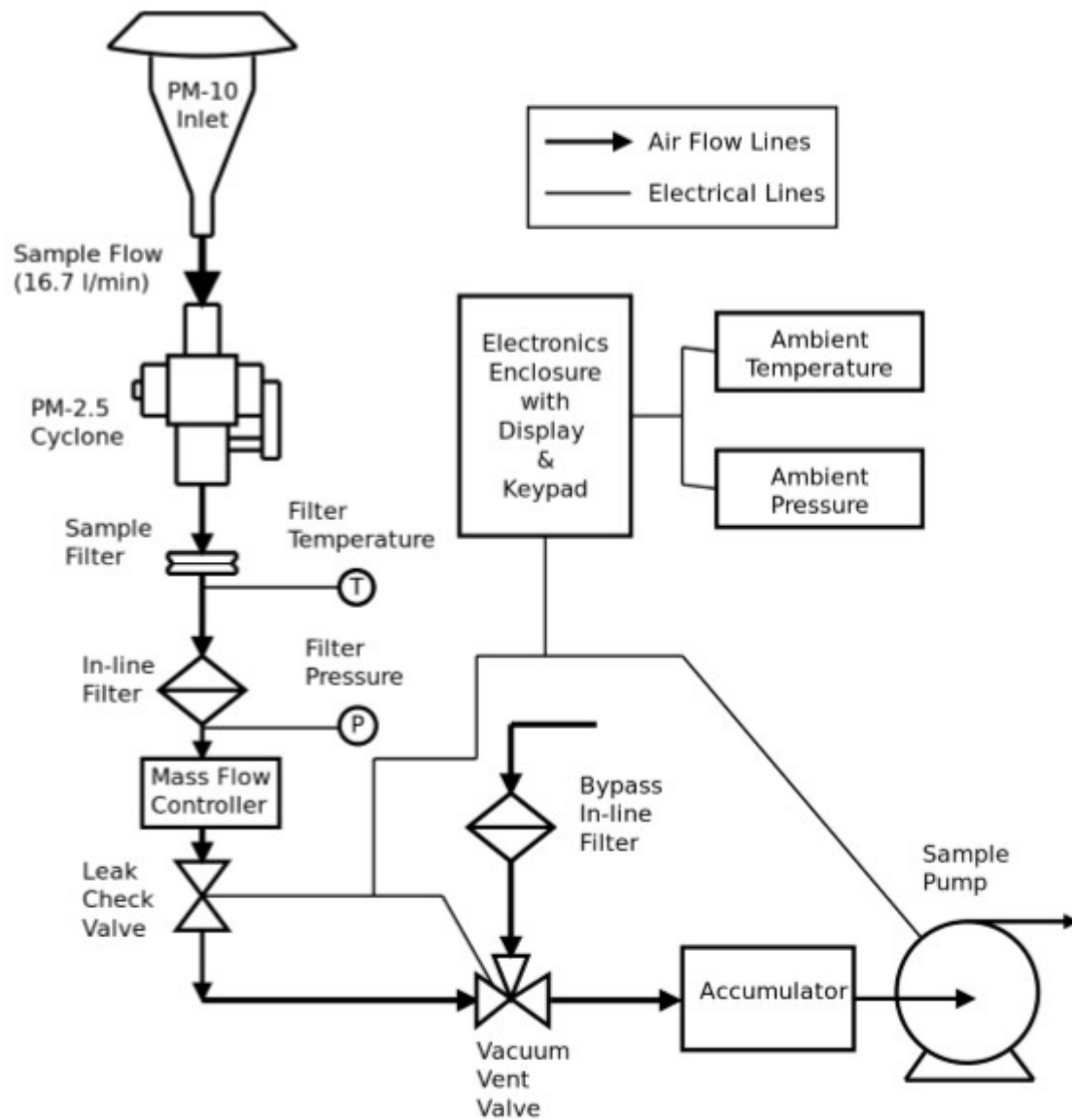


Figure 1.0 - Flow Schematic

2.0 INSTALLATION PROCEDURE

2.1 General Information:

To operate the Thermo 2000i as a Federal Reference Method (FRM), the sampler must be set up following the manufacturer's operating manual.

2.2 Physical Inspection and Set Up:

Each Thermo 2000i includes the following items:

- 1 Partisol enclosure
- 1 PM10 inlet
- 1 VSCC PM2.5 cut
- 1 Filter transport container with 2 cassettes
- 3 Vent rain hoods and associated hardware
- 1 Sample tube
- 1 Partisol stand
- 1 Ambient temperature sensor and cable
- 1 Flow audit adapter
- 1 Solid filter leak check/separator disk
- 1 9-to-9 pin null modem computer cable
- 1 Null modem adapter
- 1 Thermo Operating manual
- 1 Thermo Quick start guide
- 1 iPort software package
- 1 RPComm package

Upon receipt inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor and your agency's shipping department.

Set Up:

Vent Rain Hood Installation:

There are three vent rain hoods that must be attached to the sampler. Attach the gaskets to the rain hoods by peeling the paper backing off of the gaskets and apply the gaskets to the appropriate rain hood. Install the rain hoods with the included thumbscrews. The two small rain hoods are interchangeable and are to be installed on the back of the enclosure. The large rain hood is to be installed on the right side panel.



Figure 2.1 Vent Rain Hoods

Temperature Sensor Installation:

Remove the Phillips screws on the upper left side of the sampler enclosure. Use these screws to mount the temperature sensor. When mounting the temperature sensor, insert the washer and gasket between the sensor bracket and the enclosure, not under the head of the screw. Secure the three-pin connector into the connection marked "Ambient Temperature" on the back of the sampler.



Figure 2.2 Ambient Temperature Sensor

Very Sharp Cut Cyclone (VSCC) Installation:

Although the use of a Well Impactor Ninety-Six (WINS) size selective inlet is a designated PM2.5 Federal Reference Method, CARB air monitoring stations utilize the VSCC for PM2.5 FRM filter sampling (designated as a PM2.5 FEM).

To install the VSCC, open the filter exchange mechanism by pulling forward on its handle and allowing it to drop into its open position. Remove the filter cassette carrier with installed cassette. Lift the roller of the filter exchange mechanism through the slots in the left and right guides which will allow it drop down with enough space to install the VSCC.

Attach the VSCC adapter to the bottom of the cyclone. The VSCC with adapter can now be installed to the inside top of the enclosure by pushing the VSCC to the top until it hits a stop. Insert rollers of the filter mechanism back into the slots on the left and right guides.



Figure 2.3 VSCC

PM10 Inlet Installation:

Insert the 1¼" outside diameter (O.D.) sample tube into the instrument bulkhead. Ensure that the tube is pushed past both the lower and upper O-rings of the bulkhead until it stops. Tighten the dome connector to ensure a tight and leak-free grip. Place the PM10 inlet onto the tube ensuring it is firmly in place. The PM10 head goes on the top the inlet tube.

Stand Assembly:

Assemble the stand following the stand assembly diagram and instructions located in the Thermo Partisol 2000i Quick Start Guide. The sampler can now be mounted on the stand. To prevent injury from the sampler falling over, the sampler should be securely mounted to the stand using the included hex head bolt hardware and washers. The stand should also be properly secured or anchored to the floor/platform.



Figure 2.4 Thermo 2000i Sampler

Collection Filter Installation:

Place a white Delran cassette in the rectangular filter cassette carrier. The filter cassette carrier goes onto the filter platform. The slot and hole line up with the hardware on the filter exchange mechanism. Push the handle of the filter exchange mechanism backward to lock the filter cassette into its sampling position. Ensure it's lined up and the black V-seals are flat on the filter.

Press the power switch on the main panel to the "ON" position to activate the Sampler.



Figure 2.5 Thermo Filter carrier



Figure 2.6 Filter Exchange Mechanism

2.3 Instrument Siting:

The installation of the Thermo 2000i must follow the siting criteria requirements in 40 CFR Part 58, Appendix E. General siting criteria include: >10 meters from a tree drip line, 360 degree unobstructed view, 2 ± 0.2 meters above the roof line, and the probe inlet between 2 - 7 meters above ground.

2.4 Operational Verification:



Section 2.0 - 2.3 gave a brief overview of the initial sampler installation and setup. Refer to the Thermo 2000i operating manual and quick start guide for complete instructions. Also, consult with your manager for questions regarding installations and site compliance with all federal and CARB siting criteria.

Prior to sampler collection, a Verification/Calibration must be performed to ensure the sampler is operating as expected and the verification is properly documented. The calibration process is described in Section 9.0. After a verification calibration is performed and the instrument is determined to be within tolerances set by CARB and U.S. EPA, you may program the sampler to start on the next sampling day.

3.0 INSTRUMENT CONFIGURATION

3.1 Keypad:

Button Definitions and Main Screen (Figure 3)

1. CTRST soft key goes directly to Sample Setup Screen.
2. SSET soft key goes directly to Filter Setup.
3. RECS soft key goes directly to Sample Records.
4. STAT soft key goes directly to Status code screen to view errors.
5. Run/Stop Key  Single press goes to full screen statistics, second press changes between RUN/WAIT and STOP modes.
6. Menu Key  goes back one menu level.
7. The \leftarrow \uparrow \rightarrow \downarrow arrow keys are used for navigating the menus.
8. The \leftarrow or Enter key is used to confirm and save settings.

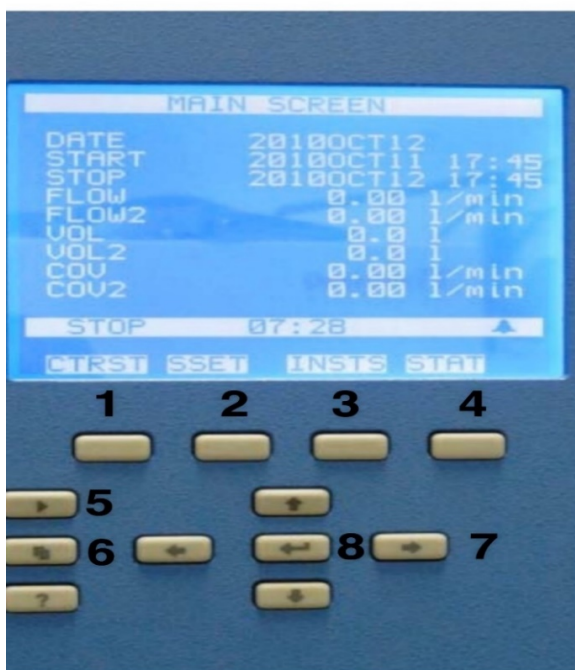




Figure 3.0 – Keypad/Main Screen

Main Screen

Most setup functions can be reached by pressing  from the main menu and using \leftarrow \uparrow \rightarrow \downarrow to select your desired option. Pressing  once from any menu screen returns you to the main screen.


3.2 Instrument Setup:

The settings below are recommended when following the U.S. EPA's sampling schedule.




1. Select Instrument Setup menu from the main menu.
2. Select "Default Sample Setup". The parameters should be as follows:

Method: BASIC or TIME
Flow: 16.67
Filter Type: A (default setting)

In BASIC mode, the sampler will automatically adjust the sampling schedule based on the initial sample run. In TIME mode, the sampler will automatically adjust the sampling schedule after the initial sample and the user will also have the ability to adjust individual sample runs. TIME mode is recommended when running make up samples or extra filters.

3. Select the  key to return to the Instrument setup menu. Choose "Default Sample Times". The parameters should be as follows:

Start Time: 00:00
Duration: 24 hr
Repeat: 72 for 1 in 3 day sampling
144 for 1 in 6 day sampling
(Dependent on the site sampling schedule).

4. Select the  key to return to the Instrument Setup menu. Scroll down and select "Site ID". Change the Site ID to match your designated site.
5. Select the  key to return to the Instrument Setup menu. Select "Date/Time". Adjust date and time to match the time standard.
6. Select the  key to return to the Instrument Setup menu. Select Time Zone. Ensure that the sampler is set to UTC (GMT).

Note: Do not set this configuration to PST. PST does not stand for Pacific Standard Time. Setting it to PST will prevent the sampler from starting and






stopping at 00:00. The UTC configuration allows the sampler to start and stop at 00:00.

Average Time Interval Setup

The Average Time parameter defines the time interval that is averaged by the sampler when storing data. The default and recommended setting is 30 minute averages.

Checking and Resetting Status Codes

The Thermo 2000i is equipped with a red lamp on the exterior of the unit to alert the operator of any errors. The lamp will illuminate when the sampler encounters an issue. An alarm icon will also show on the instrument display. More information about each issue can be viewed in the instrument status code screen which can be accessed by pressing the STAT soft key button.

1. While in the status code screen, more information about certain status codes can be obtained by highlighting the individual status code and selecting it by pressing the  key. Record the status code if necessary for future reference. Contact the Operation and Data Support Section (ODSS) instrument shop or Thermo Scientific customer support for more detailed information about individual status codes.
2. To reset status codes, the sampler must be in STOP mode. To enter STOP mode, press the  key from the main screen and confirm by pressing the  key.
3. Enter the status code screen and highlight any status code. Press the  key. Confirm with the  key to clear the status code.


Stop Mode

If the sampler is in Run mode, placing it in Stop mode will result in the loss of the current sampling event and automatically invalidate the filter.

3.3 Sample Set-Up Procedures:

The following procedure is used to setup the sample run through the front screen.

1. Return to the main menu using the  key and select the Sample Setup Screen or press the SSET key.


2. Select "Sample". Select Start time. The next sampling event will automatically be set to midnight of the next day. Change the start date, if necessary.
3. Move the cursor to Filter ID and label the sample with the laboratory cassette ID using the ← ↑ → ↓ keys. The Filter ID will help you identify the correct filter when looking up the sample run records.
4. Verify the start and end dates and times for the scheduled run.
5. If the sampler is in STOP mode, press the  key to return to the main screen and again to place the sampler in WAIT mode. The sampler must be in WAIT mode to start sampling on the scheduled run date.



Make-Up Runs

Per U.S. EPA regulations (40 CFR Part 50, Appendix N), valid PM_{2.5} make-up samples must run prior to the next sampling day or exactly seven days after the missed or invalid sample. Valid make-up samples are necessary to maintain data completeness if regular samples are missed or voided. For a site to gain/maintain attainment status, three years of complete data for that site is required. A year meets data completeness requirements when the quarterly data capture rates for all four quarters are at least 75 percent. Having data completeness < 75% can result in non-attainment status. Samples that do not run on the scheduled run dates and do not meet the criteria of make-up samples, but are otherwise considered valid are called extra samples. Per the CFR, "extra samples are used in mean calculations and are included in the series of all daily values subject to selection as a 98th percentile value, but are not used to determine which value in the sorted list represents the 98th percentile." Therefore, extra samples are not used to meet completeness.

Please see Appendix H EPA Sampling Schedule 2020.

Procedure for TIME Sampling Mode

1. The sampler must be in STOP mode to change the sampling mode. If the sampler is in WAIT mode, press the  key and place the sampler in STOP mode.
2. Select Instrument Setup from the main menu. Choose Default Sample Setup. Record all parameters. These parameters should not require re-programming when returning to BASIC Sampling Mode, but the information should be recorded in case an error occurs.

3. Change the Method from BASIC to TIME.
4. TIME sampling mode allows the user to program custom sampling times for each filter. From the main menu select "Sample Setup" or Select SSET soft key to enter the Sample Setup screen. Select "Apply Default Times" to reset the run schedule to match your default settings. Program the Start time for each filter.
5. The unit will be in STOP mode. Select  key to enter WAIT mode.
6. After all make up samples in TIME sampling mode have been completed, return the sampler to BASIC mode or select "Apply Default Times" prior to the next scheduled sample to avoid losing scheduled samples. Verify that the sampling list matches your site's sampling schedule.
 - a. To change the sampling mode, the sampler must be in STOP mode. If the sampler is in WAIT mode, press the  key on the lower left corner of the keypad to place the sampler in STOP mode.
 - b. Select "Instrument Setup" from the main. Choose Default Sample Setup.
 - c. Change the Method from TIME to BASIC.
 - d. Enter the Sample Setup screen and verify that the new sample will run at the correct scheduled start time for your air monitoring site.

3.4 Firmware:

The firmware can be updated by the user in the field via serial port, Ethernet or USB memory device. Refer to the iPort manual for the firmware update procedure when using serial port or Ethernet. Running the latest firmware revision will ensure that the instrument will run without known glitches.

Updating Firmware via USB

1. Although the firmware update should not erase any stored data, it is highly recommended that the instrument operator records all pertinent data such as the flow and meteorological calibration values, sample ID numbers, sample run times, and any previous sample records.
2. Download the latest firmware revision from the Thermo Scientific online library ([Thermo Scientific Online Library](#)), registration may be required) or contact the Operation and Data Support Section staff for more information.

3. Copy the firmware file to the root directory of your USB flash drive and plug the USB drive into one of the two ports on the front panel of the Thermo 2000i.
4. The sampler must be in Service Mode to update the firmware. To toggle service mode, go to the Service Mode option in the main menu. Press the ⏏ key and confirm to enter Service Mode.
5. Scroll to USB from the Main Menu and press the ⏏ key.
6. Select the applicable USB port and press the ⏏ key.
7. Scroll to Firmware Update and confirm your selection.
8. Select the latest firmware revision from the on-screen list.
9. Follow the onscreen directions to complete the firmware update. The sampler will automatically reboot when the firmware update is complete. This step can take up to 10 minutes.
10. The sampler should maintain all information stored in the memory, but the site operator should verify that all information prior to the firmware update has not changed.

3.5 Viewing Calibration Values:

1. To view the flow calibration values, the instrument must be in Stop mode. Once the sampler is in Stop mode you can select Service Mode.
2. Select "Audit and Calibration" then "Calibration"
 - a. The flow calibration values will be listed under "Flow"
 - b. The calibration values will be listed under "Cal. Intercepts"

To reset the memory, select Restore User Defaults under Instrument Setup.

3.6 Resetting Instrument Memory:

WARNING: RESETTING THE MEMORY ERASES ALL CALIBRATION AND SAMPLER SETTINGS AND RESTORES ALL SETTINGS TO DEFAULT FACTORY VALUES. USE THIS OPTION ONLY WHEN NECESSARY. RECORD ALL CALIBRATION OFFSETS BEFORE RESETTING TO AVOID RE-CALIBRATING

THE SAMPLER AFTER RESET.

3.7 iPort Program:

The iPort program is designed to communicate with the iSeries product line. The sampler has electronic sensors and offers internal data storage. The iSeries has Ethernet connectivity and a RS-232 port. These options allow you to access and control the sampler by a remote device or computer. There are several ways to install and configure the iPort program. A review of the iPort Instruction Manual will outline different installations and configurations of the program.


4.0 DATA RETRIEVAL

4.1 General Information:


Field personnel will have the responsibility of ensuring the PM2.5 sampling information for each filter run is properly retrieved. The sampling information for the FRM samplers can be obtained either manually or electronically downloaded to a USB flash drive.

For each sample, field personnel will complete a PM2.5 Field Sample Report form MLD-140. Please see Appendix B for an example of a completed form.

4.2 Viewing Sample Summaries:

1. Select the  key until you are in the Main menu.
2. Select View Records and then Filter Records to bring up the stored filter records.
3. Use the ← ↑ → ↓ keys to scroll through the filter runs. The oldest record will appear at the top of the list. Pressing the ↑ arrow will bring you immediately to the bottom of the list and the most recent sample run. The → key is used to scroll through the data fields for a specific run.
4. Record the pertinent data to the MLD-140 field sample report form for the associated filter.

4.3 USB Data Download:

1. Insert a USB flash drive into an available USB port on the front of the instrument.
2. Press the  key and scroll down to the USB menu.
Note: It may take up to a minute before the USB flash drive is recognized and

for the USB menu to appear.

3. Select the port used in Step 1 and press the ⏏ key to select your desired file destination.
4. Scroll down to instrument sample data and select Export Data Logs. The types of exportable data logs include:
 - Filter Data Log: 24 hour run data and filter and ambient meteorological values recorded for the last 64 runs
 - User Data: Instrument status and conditions recorded at 30 minute intervals
 - Interval Data: Instrument status and conditions recorded at 5 minute intervals
5. Select Filter Data Log and follow the on-screen instructions to download the necessary data logs for the laboratory chain of custody form.
6. The USB flash drive can be removed when the download is complete.
7. The data is located in the root directory of the USB drive and can be viewed on a computer using Microsoft Excel.

Note: Best practice is to download the data every time samples are loaded or removed. This action keeps an electronic record of the date and time.

5.0 DATA SUBMITTAL (Field to Laboratory)

5.1 General Information:

Information for each sampled filter must be recorded on it's respective MLD-140 Field Sample Report form and will accompany the sampled filter(s) once they are shipped back to the laboratory.

5.2 Sample Process and Documentation:

The sample process begins once the filter is pre-conditioned and inspected by laboratory personnel. After pre-conditioning is complete, filters will be pre-weighed, placed in filter rings, and prepared for shipping. Each filter will be associated with a barcode number that will be attached to a MLD-140 field sample report form. Laboratory personnel will annotate the pre-weight of the filter, date, and initials on the report sheet. The sample report sheet and filter will then be shipped to the field.

Within 30 days of the pre-weight, the filter must be used for sampling. When the filter is loaded on the sampler, field personnel must document the date, time, and name of person loading the sampler. After sampling, field personnel must document date, time and name of personnel removing the sample from the sampler. If the filter is not being shipped to the laboratory right away, the filter will be placed in a freezer for storage until shipping. Field personnel will document date, time, and filter temperature when the filter is placed in the refrigerator. When the filter is shipped to the laboratory, the date, time, and the personnel shipping the filter will be documented on the sample report.

Once the filter arrives at the laboratory, the date, time, filter temperature, and person receiving the filter will be noted on the sample report. Laboratory personnel will then enter the filter information into the Laboratory Information Management System (LIMS). LIMS will generate a LIMS sample identification number that will be documented on the sample report. The filter will then be prepared for post-conditioning or placed in a refrigerator for storage until post-conditioning can occur. The date, time, filter temperature, and name of analyst will be documented once post-conditioning begins.

5.3 Completing the MLD-140 Field Sample Report:

On the field sample report, field personnel will record the following information: start date and time, elapsed time, volume, flow CV, and minimum, maximum, and average values for the ambient temperature, filter temperature, and ambient pressure. Field personnel may also note any unusual local conditions they may have observed during the sample run by circling the appropriate condition code.

“No Unusual Conditions” may be used if no unusual conditions were observed during the sample run.

The field personnel will also need to complete and verify the top part of MLD-140. Site Name, AQS Site Number, Field Technician, Agency, Cassette I.D. Number, Scheduled Sampling Date and Sampler Property Number. Please see Appendix B for an example of a completed form.

6.0 SAMPLE FILTER HANDLING PROCEDURES

6.1 General Information:

Federal regulations stipulate specific time frames and environmental conditions for FRM PM_{2.5} sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated by the receiving laboratory. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample filters, filter cassettes, or anything else which may come in contact with the sample filters.

6.2 Pre-Sampling Filter Handling Procedures:

Sample filters must be used within 30 days of the pre-weighing procedure. If 30 days have elapsed before the cassette is to be used, do not use the filter and return it to the laboratory for a replacement. The filter expiration date is located on the MLD-140. The sample filter temperature must be within 5° C of the ambient temperature while installed in the sampler.

6.3 Post Sampling Filter Handling Procedures:

Sampled filters must be removed from the sampler within 177 hours after the end of sampling and placed in cold storage immediately (40 CFR Part 50, Appendix L Section 10.10).

Sampled filters must be kept at a temperature of 4°C or less during storage and shipping which allows the laboratory up to 30 days from the end of sampling for analysis. If at any time during storage or shipping the temperature exceeds but is kept at no greater than 25°C, the laboratory has up to 10 days to analyze.

Sampled filters and the MLD-140 field sample report form will be shipped in an insulated shipping container containing sufficient Blue Ice or other chilled media to assure that sample filters arrive at the laboratory at a temperature no greater than 25°C, preferably 4°C or less. Other cold storage methods may also be employed if they comply with these temperature requirements.

Shipping containers will contain an irreversible temperature indicator or other suitable means to determine whether temperature requirements of the sample filters have been exceeded during transit. This requirement also applies when sampled filters are being transported by staff from remote or satellite sites to central or main locations.

Samples received at the laboratory at temperatures of 4°C or less will be noted

on the field sample report form and also entered into LIMS. LIMS will automatically flag the sample so that gravimetric analysis is prioritized to meet the 10 day analysis deadline.

Sampled filters should be shipped to the laboratory weekly on Monday, Tuesday or Wednesday to avoid Saturday, Sunday, or holiday arrivals when staff may not be present to receive the samples.

More information about the laboratory documentation and handling procedures can be found in the Standard Operating Procedure for the Determination of PM_{2.5} Mass in Ambient Air by Gravimetric Analysis (SOP MLD 55, [CARB NLB PM_{2.5} SOP](#)) in section 7.3.10.

6.4 Field and Trip Blank Handling Procedures:

Upon receipt and identification of filter blanks, treat these filters the same as filters to be sampled with the exception that no air will be drawn through the filter. A field blank is loaded into the sampler and removed after 5 minutes. The filter is placed in the freezer and treated like a standard filter.

Trip blanks are to accompany all standard filters and field blanks, but are not loaded into the instrument. For Trip Blanks, fill out the MLD-140 field sample report form with exception of run data. For Field Blanks, in addition to the above, fill in the sample start date/time, total elapsed time, volume, sample load time, and sample removal time. The elapsed time and volume should be zero. Field and Trip Blank frequency is 10% of the site sampling schedule.

Please see Appendix C for an example of a completed Field Blank form.
Please see Appendix D for an example of a completed Trip Blank form.

7.0 CALIBRATION OVERVIEW

7.1 Calibration Introduction:

The purpose of this section is to outline the Thermo 2000i verification and calibration procedures used by the AQSB of CARB. The procedures listed are in reference to the Thermo 2000i Instruction Manual and are not intended to replace the Instruction Manual. Verification and calibrations are essential to ensure quality and defensibility of data.

7.2 Calibration Overview:

The calibration of the Thermo 2000i samplers must be performed on a six month basis. Calibrations are also required upon installation of a replacement or new sampler, controller, and after major maintenance. There are several parameters

that must be calibrated: flow, temperature and pressure calibration, and time adjusted.

The primary purpose of the verification/calibration is to verify that the volumetric flow of the PM2.5 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Monthly quality control checks should be performed to ensure that the sampler stays within the intended operating criteria. Refer to 40 CFR Part 50, Appendix L for further information. Chapter 8 of the Thermo 2000i instruction manual outlines the full calibration procedure.

The calibration procedure should be completed in the following order:

1. Verification (AS-IS Calibration) – Single Point
If AS-IS calibration checks are within criteria, no adjustment final verification is required. If any parameter does not meet the criteria, an adjustment and final verification is required.
2. Verification (Final Calibration) – Single Point
If any parameter does not meet the criteria, an adjustment and final verification is required.

Calibrations require using a NIST traceable standard.
NIST-traceable standards must be certified at least once a year.

7.3 Calibration Apparatus for Instrument/Sampler:

- National Institute of Standards and Technology (NIST) traceable flow transfer standard with a range that includes 16.7 LPM
- NIST-traceable temperature standard
- NIST-traceable pressure standard
- AQSB Calibration Sheet 404B
- Calibration filter with transport box
- Leak check filter for external and internal checks.
- Leak check adaptor

A transfer standard is defined as an instrument, device or apparatus which, together with associated operational procedures, is capable of accurately reproducing standard values (e.g. flows) or producing accurate assays of these standard values which are quantitatively related to an authoritative primary standard. The most common transfer standards for calibrating the Thermo 2000i are the BGI Delta Cal or the Alicat FP-25, which are NIST-traceable mass flow transfer standards, temperature standards, and pressure standards all in one

device. All calibration transfer standard equipment must possess up-to-date certification.

8.0 VERIFICATION (AS-IS AND QUALITY CONTROL FLOW RATE CHECK)

8.1 Verification Overview

A verification, also known as the AS-IS calibration, is required to verify the sampler was operating within criteria. This also verifies the data collected from the last check to present date are valid. A passing AS-IS verification ensure the integrity of the previous collected samples.

8.2 General Information

The following verification procedures can be performed in the Audit mode which allows the user to resume the sampling event immediately after the verification is complete.

Its best practice to preform verification checks on non-sampling days.

Flow rate and Leak check verifications require a white Delrin filter cassette or Thermo's leak check filter set (audit cassette). The set includes a green audit cassette and a solid red audit cassette. The green audit cassette is only utilized when troubleshooting flow and external leaks checks. If the external leak fails, the solid red audit cassette is utilized for the internal leak process to troubleshoot the leak location.

Note: Using an internal leak check filter while performing an external leak, may cause damage to the sampler.

A quality control check should be completed on a monthly basis by the operator. During a quality control check, all parameters must meet the acceptable criteria: flow $\pm 4.1\%$ of true or between 16.02 and 17.38 LPM, temperature $\pm 2^{\circ}\text{C}$ from true, and ambient pressure ± 10 mmHg from true, a leak check value of < 25 mm Hg and clock time is within 2 minutes of true. If any parameter does not meet the specified criteria, a calibration must be performed. In additional, samples collected after the previous flow check must be evaluated to determine validity.

8.3 Verification Procedures

Ambient Temperature and Barometric Pressure Sensor Verification

1. Install the NIST transfer standard on the downtube. Allow time for the transfer standard to equilibrate to ambient conditions.
2. From the main menu, select Audit and Calibration then select Audit Mode.

3. Place an audit cassette into the filter holder and close filter assembly.
4. Select Audit from the menu. The Audit screen will display the ambient temperature and pressure readings. Verify the readings with your standard and record all values into the Verification/AS-IS calibration sheet or monthly check sheet.

The ambient pressure reading should be within 10 mm Hg of the transfer standard. The ambient temperature reading should be within 2° C of the temperature standard. If the temperature and pressure readings are out of tolerance, the ambient temperature sensor and/or barometer must be re-calibrated. Calibration procedures are listed in Section 6.

Filter Temperature Sensor Verification

1. Install the NIST transfer standard on the downtube with the external thermometer plugged in. Allow time for the transfer standard to equilibrate to ambient conditions.
2. From the main menu, select Audit and Calibration then select Audit Mode.
3. Open the filter assembly and remove the audit cassette. The sampler's filter temperature sensor is located under the filter cassette holder.
4. Verify the sampler's filter temperature by measuring the temperature at the location of the filter temperature sensor. Record the value on your Verification/AS-IS calibration sheet or Monthly Check Sheet.


The filter temperature reading should be within 2° C of the temperature standard. If the temperature readings are out of tolerance, the filter temperature sensor must be re-calibrated. Calibration procedures are listed in Section 6.

Flow Rate Verification

Replace the leak check adaptor with the measuring head of you NIST transfer standard. Allow time for the transfer standard to equilibrate to ambient conditions.

1. In the Audit and Calibration menu, scroll down to the Flow field. Press the → key to start the pump. Allow the pump to warm up for 15 minutes.
2. Once the flow and temperature readings on your standard have stabilized, compare the volumetric flow on the transfer standard to the sampler's flow reading. Record the value on your Verification/AS-IS calibration sheet or

Monthly Check Sheet.

3. A passing flow verification will be between 16.02 and 17.38 LPM. If the flow readings are out of tolerance a flow calibration is required. Calibration procedures are listed in Section 9.
4. Stop the pump after verifying the flow rate by pressing the ← key.
5. Select Audit Mode from the Audit and Calibration Menu. Exit Audit Mode. This will place the sampler back in WAIT mode. Do not use the  button to return to wait mode as it will only place the sampler in STOP mode.

External Leak Check Verification

1. Remove the PM10 inlet and replace it with the leak check adaptor. Ensure that the adaptor is in the closed position.
2. Place an audit cassette into the filter holder and close the filter assembly.
3. From the Audit and Calibration menu select Leak Check. Select External and follow the on screen instructions complete the leak check. A passing leak check value is < 25 mmHg. If the leak check fails, troubleshoot the error and perform an additional leak check. Refer to Section 9.0 for more information. Record the value on your Verification/AS-IS calibration sheet or Monthly Check Sheet.
4. Slowly open the leak check adaptor to release the vacuum.
5. Before proceeding to the Flow Rate Verification the instrument must pass the Leak Check Verification. Any issues causing leaks must be addressed with the appropriate repairs.

Clock Verification & Adjustment

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler.

1. Observe the sampler time from the Main Screen. Record this value on the calibration or monthly check data sheet.
2. At the same time, record the value of your time keeping device.
3. Identify your time keeping device on the data sheet (i.e. cell phone). Most

modern cell phones maintain accurate time.

4. If the sampler time is off by more than 2 minutes, an adjustment to the clock must be made. Navigate to the Main Menu > Instrument Setup > Date/Time to make the necessary adjustments to the clock. Record that clock adjustment was performed on QC sheet.

The sampler will need to be in STOP mode to correct the clock.

See Appendix E for an example of AQSB Form 404 Monthly Check sheet.

9.0 CALIBRATION (FINAL)

9.1 Calibration Overview:

A FINAL calibration is performed after adjusting the Thermo 2000i flow, temperature, or pressure. The FINAL calibration will verify that the adjustments performed are within acceptable criteria and will validate samples collected moving forward.

9.2 Calibration Information:

Flow calibrations and leak checks must be performed with a white Delrin cassette. Calibrations should be performed by someone independent of the day-to-day site operations. Calibrations should also be completed using a NIST-traceable standard and one that is not used for the monthly quality control checks.


The adjustments made on the Thermo 2000i sampler should be performed in the following order:

1. Filter and Ambient Temperature
2. Pressure
3. Leak Check
4. Flow Check
5. Verification of Calibrations (Final Calibration)

Before adjustments are made on an in-use sampler, flow, pressure, and temperature verifications should be performed. This step is also known as an AS-IS Verification. The initial verification/AS-IS calibration will allow the site operator to certify that all prior samples were sampled under valid conditions. A passing verification requires that the following parameters be within the control limits: flow $\pm 4.1\%$ of true (16.02 - 17.38 LPM), temperature $\pm 2^\circ\text{C}$ from true, and ambient pressure ± 10 mmHg from true. Verification procedures are listed in section 5.0 of this SOP.

Parameters that are out of the acceptable criteria must be adjusted and a final verification must be performed. A passing flow verification will be between 16.02 and 17.38 LPM, but an adjustment and final calibration must be performed if the flow is not within 2% of expected flow (16.34 - 17.00 LPM). If temperature or pressure requires adjustment, the flow must be verified and adjusted if needed.

All calibration information and data must be recorded on the AQSB Calibration sheet 404B.

A calibration can only be completed while the instrument is stopped and in Service Mode. To stop the instrument, press the  key twice and confirm to

place it in Stop mode. To place it in Service Mode, navigate to and select "Service Mode" from the main menu. Press the Enter key to enable service mode.

9.3 Calibration Procedures:

Ambient Temperature Sensor Calibration

If the calibration is performed at ambient conditions, the reference temperature measurement can be taken with the probe installed in the Thermo 2000i radiation sensor. Install the NIST transfer standard on the downtube. Allow time for the transfer standard to equilibrate to ambient conditions.

1. Navigate to the main menu and select the Calibration menu, scroll to Ambient Temp and press the enter key.
2. The instrument will display the current reading and will allow you to input the reading from your temperature standard. Input the ambient temperature reading from your standard into the reference field. Press the Enter key to save any changes. The sampler automatically adjust the corresponding offset based on this input.
3. Verify the Thermo 2000i sampler value matches the standard. Document the values on the calibration sheet. Record previous and new offset.


Filter Temperature Sensor Calibration

Install the NIST transfer standard on the downtube with the external thermometer plugged in. Allow time for the transfer standard to equilibrate to ambient conditions.

1. Navigate to the main menu and select the Calibration menu, scroll to Filter Temp and press the enter key.
2. Open the filter assembly and remove the audit cassette. The samplers filter temperature sensor is located under the filter cassette holder.
3. The instrument will display the current reading and will allow you to input the reading from your external temperature standard. Input the filter temperature reading from your standard into the reference field. Press the Enter key to save any changes. The sampler automatically adjusts the corresponding offset based on this input.
4. Verify the Thermo 2000i sampler value matches the standard. Document the values on the calibration sheet. Record previous and new offset.


Barometric Pressure Calibration

Install the NIST transfer standard on the downtube. Allow time for the transfer standard to equilibrate to ambient conditions.

1. Navigate to the main menu and select the Calibration menu, scroll to Ambient Pres and press the enter key.
2. The instrument will display the current reading and will allow you to input the reading from your transfer standard. Input the ambient pressure reading from your standard into the reference field. Press the Enter key to save any changes. The sampler automatically adjusts the corresponding offset based on this input.
3. Verify the Thermo 2000i sampler value matches the standard. Document the values on the calibration sheet. Record previous and new offset.
4. Select the  key to return to the Calibration menu.

External Leak Checks

Before adjusting the flow of the sampler it is important to ensure that the sampling train does not have a leak.

1. Remove the PM10 inlet from the instrument and place the leak check adaptor on the downtube. Close the valve on the leak check adaptor.
2. Load an audit filter into the filter carrier and filter exchange mechanism and close.
3. Return to the Audit and Calibration menu by pressing the  key.

Choose External leak check and follow the onscreen instructions to start the test. Once the countdown ends, record your results on the calibration sheet. An external leak check value of less than 25mm Hg is considered passing.





If a leak check fails, ensure the audit filter is in place and the leak check adapter is closed. Repeat the leak check. If the external leak check fails a second time, isolate the leak and repair. Refer to Section 9.0 Troubleshooting for additional information.

4. After a successful leak check, open the valve on the leak check adapter slowly.

Flow Rate Calibration (Multi-Point)

Record current slope and offset in the calibration spreadsheet.

Install the NIST transfer standard on the downtube. Allow time for the transfer standard to equilibrate to ambient conditions.

1. Load an audit filter into the filter carrier and filter exchange mechanism and close.
2. Return to the Main menu by pressing the  key. Scroll to Audit and Calibration, press the  key to display Audit and Calibration menu. Scroll to Calibration and press  to display calibration menu. Scroll to Flow and press  to display the Calibration for Flow menu.
3. The display will show the 3 calibration points. Scroll to Set point 1 and press enter to display Set point. The system will start the flow calibration at 15.0 LPM. Let the flow stabilize and change the "Actual" field to match the flow standard and select the enter key. The Thermo 2000i will automatically

proceed to the next point. Repeat for the 16.67 LPM and the 18.34 LPM points.

4. Once all points have been completed, the sampler will adjust the offset and Span values automatically. Ensure that the slope and intercept have updated. Record previous and new slope and offset.
5. A flow verification is required after the calibration to ensure the flow was adjusted and within 2% of the set point (between 16.34 and 17.00 LPM). Document the values on the calibration sheet.
6. Exit Service mode and return the sampler to Audit mode.
7. In Audit mode, select Audit and arrow down to flow option and press → key to start flow.
8. Verify the Flow is set to 16.7 LPM.
9. Exit Audit mode and return the sampler to Wait mode.
10. Remove the flow transfer standard and reinstall the PM10 inlet.

Please see Appendix F for an example of AQSB Calibration Form 404.

10.0 OPERATIONAL AND ROUTINE SERVICE CHECKS

10.1 General Information:

Completion of the routine maintenance items listed below is essential to the normal operation of the Thermo 2000i sampler. Additional information regarding preventative maintenance can be found in chapter 10 of the Instruction Manual. Field staff must adhere to the check frequencies listed below. Check frequencies may be needed sooner based on instrument usage, age, and environmental conditions.

10.2 Post Run Checks:

After each run, review the summary data for compliance with Measurement Quality Objectives for FRM PM2.5.

Complete and return the sample report form with the appropriate filter(s)
Notate any abnormal sampling conditions or local air conditions.

10.3 Weekly Checks:

Inspect the water trap on the PM10 inlet and empty if necessary.

Ship sampled filters within appropriate conditions as outlined in section 6.3.

10.4 Monthly Checks:

Perform leak and flow verification checks. The leak rate must not exceed 25 mm Hg.

Compare and record the sampler's display flow rate. The sampler's display flow rate should be within $\pm 4.1\%$ of the flow measurement standard. If the flow rate is approaching $\pm 2\%$ from expected notify the calibrator to schedule a calibration.

Compare and record the sampler's indicated flow rate to the design flow rate of 16.67 LPM. This should not exceed $\pm 5.1\%$

Perform temperature sensor verification. The sensor should be within $\pm 2^\circ\text{C}$ of the transfer standard.

Perform pressure sensor verification. The pressure sensor should be within ± 10 mm Hg of the transfer standard.

Perform a clock and date verification check. The clock should be within ± 2

minutes of the time standard and the date should be correct. Clock adjustment only needs to be recorded on the QC sheet (calibration sheet not required if only adjusting the clock time).

Record results for all verification procedures.

Disassemble, clean, and inspect the PM10 inlet. Lubricate the O-rings if necessary. Replace the O-rings if the rubber is cracked or if they are damaged.

Disassemble, clean, and inspect VSCC inlet.

Check V-seals at the top and bottom of the PM2.5 VSCC. Lightly lubricate with Dow vacuum grease if necessary. Replace the V-seals if the rubber is cracked or if they are damaged.

Clean interior compartment and the sample downtube.

If monthly flow, temperature, or pressure checks are outside the criteria, request a calibration.

10.5 Semiannual Checks:

Clean the foam air intake filters under the rain hoods and replace as necessary.

Check the particle trap filter and replace as necessary.

Perform temperature, pressure, flow, and clock calibrations.

10.6 As Required Checks:

Replace the particle trap filter.

Rebuild/Replace pump.

Check clock battery, replace as necessary (CR2032).

Replace sintered filters for pump and pressure vent valve (Parts #32-002693 and 32-005139).

The exterior of the sampler, filter compartment, and downtube should be wiped down with a clean cloth and a simple degreaser (such as 409).

Check V-seals and grease or replace when necessary.

11.0 TROUBLESHOOTING

11.1 General Information:

Using the proper filter cassettes is critical in this sampler. The standard CARB filter cassette is the white Delrin cassette. Please note that the blue polycarbonate cassettes are no longer recommended by CARB for use in valid PM2.5 samples.

The sampler system menus provides troubleshooting information. In the main menu you can chose System Status > Status Codes to view alarms. The sampler's red light will also flash to let the operator know the system has detected an error.

11.2 Common Issues:

Leak Check Failure

A failed leak check is the most common error on the Thermo 2000i. Ensure that the leak check cassette is properly seated. If that fails, ensure that the leak check cassette is not worn or damaged. Request a new leak check cassette from the laboratory if necessary.

Using Thermo's solid green filter cassette for flow and leak checks helps identify if the leak is coming from the filter cassette. If the cassette is not the issue, perform the internal leak procedure to determine where the leak is (above or below the cassette).

Clean and lubricate or replace the V-seals if necessary. If this fails to correct the leak, the sampler may need additional repair. More information about V-seal maintenance can be found in section 10-17 of the instrument manual.

12.0 QUALITY CONTROL AND ASSURANCE

12.1 General Information:

To ensure that the ambient air monitoring data collected throughout California can be considered quality data and complies with procedures and regulations set forth by the U.S. EPA, CARB has a robust quality assurance program which includes several types of performance audit activities. SOPs ensure that quality control and assurance activities are conducted consistently and in accordance with program requirements. When instruments are found to be operating outside CARB's Performance Criteria, a corrective action notification (CAN) or Air Quality Data Action (AQDA) request may be issued.

12.2 Quality Control (Field Sample Validation Criteria):

Quality control invalidation criteria for PM_{2.5} filter samples collected on FRM samplers are listed below. All samples collected in the field are to be checked using these criteria. If a sample does not meet these criteria, the sample is invalid.

NOTE: IF A SAMPLE IS INVALIDATED, THE FILTER AND THE COMPLETED REPORT FORM SHOULD BE RETURNED TO THE LABORATORY (WRITE INVALID ON THE FORM WITH EXPLANATION OF WHY). IF REQUIRED, A MAKE-UP SAMPLE SHOULD BE COLLECTED IN ACCORDANCE WITH SECTION 3.3 OF THIS SOP.

1. Filter Contamination – Filters which are dropped or become contaminated by any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) are invalid.
2. Damaged or Torn Filters – Filters with tears or pinholes which occurred before, during or after sampling are invalid.

NOTE: Care should be used when removing a filter from the sampler. If you tear, rip or otherwise damage a filter when removing it, the filter is considered invalid and a make-up run should be conducted.

3. Average Flow Rate – The average flow rate for a 24-hour period must be within 5 percent of 16.67 LPM at actual conditions. If this limit is exceeded, the sample is invalid.
4. Flow Rate Verification - In the event that a FRV fails QC acceptance criteria ($\pm 4.1\%$ from true), data collected back to the last valid FRV check are considered invalid. No data should be collected until the flow deviation is resolved.

5. Missing Flow Rate Verification – Should a FRV not be completed within a 30 day period, but data are considered valid, data should be flagged with the AQS Qualifier code, (1- Deviation from Critical Criteria). The data flag range should cover the period beginning the first day after last FRV check until the next valid FRV check is accomplished.
6. Variability in Flow Rate - The coefficient of variation (CV, sample standard deviation divided by the mean) of the flow rate, measured over a 24-hour period, must not be greater than 2 percent. If the CV exceeds 2%, the sample is invalid and a make-up sample must be taken.
7. Start/Stop Times – The sampler must operate for at least 23, but not more than 25, hours (1,380 to 1,500 minutes). Samples taken for less than 23 hours are invalid for the daily average, but can be used to determine exceedances of the PM_{2.5} standard. Therefore, samples collected for run times less than 23 hours should be returned to the laboratory for processing.
8. Sample Removal - Within 177 hours (7 days, 9 hours) of the end of the sample collection period, the filter, while still contained in the filter cassette, must be carefully removed from the sampler. Samples removed from the sampler after 177 hours from end of sample collection are invalid.
7. Power Failure – If a power failure during a sample run causes the start/stop time requirement to be violated, the sample should still be returned to the laboratory for processing.
8. Report Form – The filter is considered invalid if a completed 24-Hour PM_{2.5} Air Sample Report is not included with the sample.

12.3 Data Completeness:

Data completeness requirements are met for the year when quarterly data capture rates for all four calendar quarters are at least 75 percent. Three years of valid annual means are required to produce a valid annual PM_{2.5} NAAQS design value.

12.4 Flow Rate Verifications:

A one-point flow rate verification (FRV) must be performed at least once every month (each verification minimally separated by 14 days) on each PM_{2.5} monitor used in CARB's ambient air monitoring network. The FRV is made by checking

the operational flow rate of the monitor. If the FRV is made in conjunction with a flow rate adjustment, the verification must be made prior to the flow rate adjustment. Flow rate verifications must be made using certified flow rate transfer standards. FRVs are reported to AQS. The percent differences between the audit and measured flow rates are used to assess the bias of the monitoring data (using flow rates in lieu of concentrations).

If, during a FRV, the reading of the sampler's flow rate indicator or measurement device differs by ± 4.1 percent or more from the flow rate measured by the flow rate standard, a new multipoint calibration shall be performed and the flow rate verification must then be repeated.

12.5 Semi-Annual Flow Audits:

A semi-annual flow rate audit for FRM monitors used in CARB's ambient air monitoring network must be conducted twice a year. The two audits should ideally be spaced between 5 and 7 months apart. The EPA strongly encourages more frequent auditing. The audit should (preferably) be conducted by an operator/auditor other than the routine site operator. The audit is made by measuring the monitor's normal operating flow rate(s) using a certified flow rate transfer. The flow rate standard used for auditing must not be the same flow rate standard used for verifications or to calibrate the monitor. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Report the audit flow rate of the transfer standard and the corresponding flow rate measured by the monitor to AQS. The percent differences between these flow rates are used to evaluate monitor performance.

13.0 REFERENCES

Thermo Scientific Partisol 2000i Air Sampler Instructional Manual (PN110735-00)

Thermo Scientific Partisol iPort Instruction Manual (PN102606-00)

Thermo Scientific Partisol 2000i Air Sampler Quick Start Guide (PN111160-00)

United States Code of Federal Regulations, (2006) Title 40 Part 50 Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere.

United States Code of Federal Regulations, (2013) Title 40 Part 50 Appendix N, Interpretation of the National Ambient Air Quality Standards for PM_{2.5}.

United States Code of Federal Regulations, (2013) Title 40 Part 58 Appendix E, Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Appendix A MLD-140 Field Sample Report

CARB 24 Hour – FIELD SAMPLE REPORT Delrin Cassette (FRM) PM 2.5 Samplers

Bar Code:
LIMS Sample ID:

Site Name: Sacramento DP – PM10 C
 AIRS Site Number: _____
 Field Technician: _____
 Agency: _____

Cassette I. D. Number: R
 Scheduled Sampling Date: _____
 Sampler Property #: _____
 Filter Expiration Date: _____

SAMPLE SUMMARY

Start Date / Time: /
 Stop Date / Time: /
 Total Elapsed Time: _____ Hr:min
 Volume: _____ M³
 Flow CV: _____ %

	MIN	AVG	MAX
Ambient Temp(°C):			
Filter Temp (°C):			
Pressure (mmHg):			

Local Condition Codes: (Circle One)	
NO UNUSUAL CONDITIONS	
High Winds	Forest Fire
Farming Nearby	Construction Nearby
Sanding/Salting Streets	Highway Construction
Roofing Operations	Prescribe Burn

Sampler Flag Codes: (Circle One, as necessary)
F. Flowrate 5-min average, out of spec
T. Filter Temp differential, 30 minutes interval out of spec
E. Elapsed sample time, out of spec

Operator Comments	

CHAIN OF CUSTODY

ACTION	DATE	TIME	FILTER TEMP °C	NAME
Sample Load				
Sample Removal				
Sample Placed in Freezer				
Sample Shipped to Lab				
Sample Received at Lab				
Start Post-conditioning				

FOR LABORATORY USE ONLY

	MASS	DUP MASS	DATE	ANALYST
PRE-WEIGHT				
POST-WEIGHT				

Lab Comments:	

Appendix B
MLD-140 Field Sample Report Completed

CARB 24 Hour - FIELD SAMPLE REPORT
PM2.5 FRM



S200102206

Site Name: Roseville-N Sunrise Avenue Collocated

AQS Site Number: 06-061-0006

Cassette ID Number: R 1923

Field Technician: Vandermast

Scheduled Sampling Date: 1-4-2020

Agency: CARB

Sampler Property #: 20112266

SAMPLE SUMMARY

Start Date/Time: 1-4-2020 / 00:00

Filter Expiration Date: FEB 02

Stop Date/Time: 1-5-2020 / 00:00

Total Elapsed Time: 24:00 hr:min

Volume: 24.0 m³

Flow CV: 0.08 %

	Min	Avg	Max
Ambient Temp(°C)	8.0	10.1	12.4
Filter Temp(°C)	7.9	9.8	11.9
Pressure(mmHg)	758.0	761.2	764.8

Local Condition Codes: (Circle One)

NO UNUSUAL CONDITIONS

High Winds Forest Fire
Farming Nearby Construction Nearby
Sanding/Salting Streets Highway Construction
Roofing Operations Prescribe Burn

Sampler Flag Codes: (Circle One, as necessary)

F. Flowrate 5-min average out of spec
T. Filter Temp differential, 30 min. interval out of spec
E. Elapsed sample time out of spec

Operator
Comments

CHAIN OF CUSTODY

ACTION	DATE	TIME	FILTER TEMP °C	NAME
Sample Load	1-3-2020	8:35		gme
Sample Removal	1-6-2020	10:18		gme
Sample Placed in Freezer	1-6-2020	10:25		gme
Sample Shipped to Lab	1-6-2020	13:10		gme
Sample Received at Lab	1-6-2020	14:30		Lab
Start Post-conditioning	1-6-2020	15:18		Lab

FOR LABORATORY USE ONLY

	MASS	DUP MASS	DATE	NAME
PRE-WEIGHT	156.4470		01/03/20	MgN
POST-WEIGHT				

Lab
Comments

Appendix C
MLD-140 Field Sample Report Field Blank Example

CARB 24 Hour - FIELD SAMPLE REPORT
PM2.5 FRM



S200102206

Site Name: Roseville-N Sunrise Avenue Collocated
AQS Site Number: 06-061-0006
Field Technician: Vandermaast
Agency: CARB
Cassette ID Number: R 1900
Scheduled Sampling Date: FB
Sampler Property #: 20112266

SAMPLE SUMMARY

Start Date/Time: 1-6-2020 / 10:30
Stop Date/Time: 1-6-2020 / 10:35
Total Elapsed Time: 5 hr:min
Volume: 5 m³
Flow CV: 5 %

Filter Expiration Date: FEB 02

	Min	Avg	Max
Ambient Temp(°C)	/	/	/
Filter Temp(°C)	/	/	/
Pressure(mmHg)	/	/	/

Local Condition Codes: (Circle One)

NO UNUSUAL CONDITIONS

High Winds Forest Fire
Farming Nearby Construction Nearby
Sanding/Salting Streets Highway Construction
Roofing Operations Prescribe Burn

Sampler Flag Codes: (Circle One, as necessary)

F. Flowrate 5-min average out of spec
T. Filter Temp differential, 30 min. interval out of spec
E. Elapsed sample time out of spec

Operator Comments Field Blank.

CHAIN OF CUSTODY

ACTION	DATE	TIME	FILTER TEMP °C	NAME
Sample Load	1-6-2020	10:30		gml
Sample Removal	1-6-2020	10:35		gml
Sample Placed in Freezer	1-6-2020	10:42		gml
Sample Shipped to Lab	1-6-2020	13:10	<50	gml
Sample Received at Lab	1-6-2020	14:36	<50	lab
Start Post-conditioning	1-6-2020	15:18	40-250	lab

FOR LABORATORY USE ONLY

	MASS	DUP MASS	DATE	NAME
PRE-WEIGHT	156.4470		01/03/20	MAN
POST-WEIGHT				

Lab Comments Field Blank.

Appendix D
MLD-140 Field Sample Report Trip Blank Example

CARB 24 Hour - FIELD SAMPLE REPORT
PM2.5 FRM



S200102206

Site Name: Roseville-N Sunrise Avenue Collocated

AQS Site Number: 06-061-0006

Cassette ID Number: R 1983

Field Technician: Vandermast

Scheduled Sampling Date: TB

Agency: CARB

Sampler Property #: 201122166

SAMPLE SUMMARY

Start Date/Time: /

Stop Date/Time: /

Total Elapsed Time: / hr:min

Volume: / m³

Flow CV: / %

Filter Expiration Date: FEB 02

	Min	Avg	Max
Ambient Temp(°C)	<u>/</u>	<u>/</u>	<u>/</u>
Filter Temp(°C)	<u>/</u>	<u>/</u>	<u>/</u>
Pressure(mmHg)	<u>/</u>	<u>/</u>	<u>/</u>

Local Condition Codes: (Circle One)

NO UNUSUAL CONDITIONS

High Winds Forest Fire
Farming Nearby Construction Nearby
Sanding/Salting Streets Highway Construction
Roofing Operations Prescribe Burn

Sampler Flag Codes: (Circle One, as necessary)

F. Flowrate 5-min average out of spec
T. Filter Temp differential, 30 min. interval out of spec
E. Elapsed sample time out of spec

Operator
Comments

TRIP Blank

CHAIN OF CUSTODY

ACTION	DATE	TIME	FILTER TEMP °C	NAME
Sample Load	<u>/</u>	<u>/</u>		<u>/</u>
Sample Removal	<u>/</u>	<u>/</u>		<u>/</u>
Sample Placed in Freezer	<u>1-6-2020</u>	<u>10:42</u>		<u>JML</u>
Sample Shipped to Lab	<u>1-6-2020</u>	<u>13:10</u>	<u><5°</u>	<u>JML</u>
Sample Received at Lab	<u>1-6-2020</u>	<u>14:30</u>	<u><5°</u>	<u>Lab</u>
Start Post-conditioning	<u>1-6-2020</u>	<u>15:18</u>	<u>4°-25°</u>	<u>Lab</u>

FOR LABORATORY USE ONLY

	MASS	DUP MASS	DATE	NAME
PRE-WEIGHT	<u>150.4470</u>		<u>01/03/20</u>	<u>MGN</u>
POST-WEIGHT				

Lab
Comments

TRIP Blank

Appendix E AQSB Monthly QC Maintenance Check Sheet 404

CALIFORNIA AIR RESOURCES BOARD MONTHLY QUALITY CONTROL MAINTENANCE CHECK SHEET Thermo Scientific 2000i/2025i - FRM PM2.5 AIR SAMPLER

Location: _____ Month/Year: _____
Station Number: _____ Technician: _____
Property Number: _____ Agency: _____

Operator Instructions:

- Each Run:** Remove sampled filter(s), download, record, and review sample data, install new sample filter(s), program the sampler for next run.
- Weekly:** Inspect PM10 inlet water collection jar and drain if necessary;
- Monthly:** Disassemble, clean, and inspect O-rings of the inlet, clean interior cabinet and down tube, clean or replace air intake filters, inspect V-seals, clean very sharp cut cyclone.
Date performed: _____
Perform flow, temperature, pressure, leak check and clock verification.
Date performed: _____
- Semiannually:** Perform flow, temperature, pressure calibrations and leak check. Last cal date: _____

Results

ACTION	Sampler	Standard	Difference	Control Limits*
Leak Check				<25 mm Hg*
Sampler Display Flow Rate				± 4.1% or 16.02 - 17.38 LPM
Design Flow Rate	16.67			± 5.1% or 15.82 - 17.52 LPM
Ambient Temp.				± 2°C
Ambient Pressure				±10 mm Hg
Clock Time (PST)				± 2 Min

* If control limits are exceeded, investigate to determine cause and repeat check immediately. If second check also exceeds limits, request a re-calibration.

Standards

Standard	Make/Model	Serial I.D. Number	Date Certified	Slope	Intercept
Flow Rate					
Temperature					
Pressure					

Operator Comments:

Date	Comments or Maintenance Performed:

Reviewed by: _____

Date: _____

Appendix F AQSB Calibration Form 404 "AS IS"

Thermo Scientific Inc. Partisol 2000i Calibration Report (BGI DeltaCal/Alicat)

ID Information:		Instrument:		Calibration:	
Station Name	Roseville	Make	Thermo	"As Is"	X
ARB Site Number	31-822	Model	2000i	"Multi-Point/Final"	
Station Address	151 N. Sunrise Blvd	Property #	20112266 (P)	Calibration Date	1/23/2019
Agency	CARB	Serial #	NA	Report Date	1/23/2019
Operator:	Vandermast			Previous Cal. Date	7/21/2018

Flow Standard:	
Make & Model	DeltaCal
Serial #	20071237
Certification Date	8/20/2018
Certification Exp.	8/20/2019

Time Standard:	
Make & Model	Iphone7+
Certification #	NA
Certification Date	NA

Time:	Sampler:	Standard:
Date	1/23/2019	1/23/2019
Hours:Minutes	11:15	11:15
Time = +/- 2 minutes		

Temperature:	Sampler	Standard	Difference From True	% Deviation	Previous Offset	New Offset
Ambient	13.5	15.9	2.40	15.09%	-10.8	-10.8
Filter	14.2	14.2	0.00	0.00%	-10.4	-10.4

Temperature = +/- 2.0 Celsius

Pressure: (mm Hg)	Sampler	Standard	Difference From True	% Deviation	Previous Offset	New Offset
Ambient	760	762	2.00	0.26%	1.2	1.2

Pressure = +/- 10 mm Hg

Leak Test: (LPM)	Pressure Drop (mm Hg)
External	16
< 25 mm Hg	

Flow Verification Tests (LPM)	Sampler Display	Flow Transfer Standard	Percent From True	Previous Span	Previous Offset	New Span	New Offset
Flow	16.7	16.89	1.32%	1	-0.74	1	-0.74

Flow = +/- 4.1% From True

Comments	At Calibration Required. See Final.		
Calibrated By:	D. Goto	Checked By:	

Appendix G AQSB Calibration Form 404 Final

Thermo Scientific Inc. Partisol 2000i Calibration Report (BGI DeltaCal/Alicat)

ID Information:

Station Name	Roseville	Make	Thermo
ARB Site Number	31-822	Model	2000i
Station Address	151 N. Sunrise Blvd	Property #	20112266 (P)
Agency	CARB	Serial #	NA
Operator:	Vandermast		

Calibration:

"As Is"	
"Multi-Point/Final"	X
Calibration Date	1/23/2019
Report Date	1/23/2019
Previous Cal. Date	7/21/2018

Flow Standard:

Make & Model	Deltacal
Serial #	20071237
Certification Date	8/20/2018
Certification Exp.	8/20/2019

Time Standard:

Make & Model	Iphone7+
Certification #	NA
Certification Date	NA

Time:
Sampler:
Standard:

Date	1/23/2019	1/23/2019
Hours:Minutes	11:35	11:35

Time = +/- 2 minutes

Temperature: (deg.)	Sampler	Standard	Difference From True	% Deviation	Previous Offset	New Offset
Ambient	13.5	13.6	0.10	0.74%	-10.8	-9
Filter	14.2	14.2	0.00	0.00%	-10.4	-10.4

Temperature = +/- 2.0 Celsius

Pressure: (mm Hg)
Sampler
Standard
Difference From True
% Deviation
Previous Offset
New Offset

Ambient	760	762	2.00	0.26%	1.2	1.2
---------	-----	-----	------	-------	-----	-----

Pressure = +/- 10 mm Hg

Multi-Point Flow Calibration:

Set Point	Sampler	Standard
15.0 LPM	15.01	15.3
16.67 LPM	16.67	16.83
18.34 LPM	18.34	18.4

Leak Test: (LPM)
Pressure Drop (mm Hg)

External	16
----------	----

< 25 mm Hg

Flow Verification Tests (LPM)
Sampler Display
Flow Transfer Standard
Percent From True
Previous Span
Previous Offset
New Span
New Offset

Flow	16.7	16.72	0.30%	1	-0.74	1	-0.74
------	------	-------	-------	---	-------	---	-------

Flow = +/- 2% From True

Comments	Adjusted AT.					
Calibrated By:	D. Goto			Checked By:		

Appendix H EPA Sampling Schedule 2020

EPA Sampling Schedule 2020	
Important Dates	Notes 3-Day schedule is shown in orange, green, and purple 6-Day schedule is shown in green and purple 12-Day schedule is shown in purple _____ _____ _____ _____

