San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING PROGRAM

STANDARD OPERATING PROCEDURES
FOR
Ecotech 3000 High Volume PM10 Sampler

First Edition

April 2015

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

APPROVAL OF STANDARD OPERATING PROCEDURES (SOP)

Title:	Ecotech 3000 High Volume PM10 Sampler
SOP:	First Edition – April 2015
Section:	Air Monitoring Program
Department:	Strategies and Incentives Department
Workgroup:	Strategies and Finance Workgroup
Prepared by:	Daniel Buschman, Air Quality Instrument Technician Nathan Trevino, Supervising Air Quality Instrument Technician
Approval:	This SOP has been reviewed and approved by:

Jon Klassen
Program Manager
Air Monitoring Program

4/27/15
Date

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1 BACKGROUND

1.1 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to document the procedures used by the San Joaquin Valley Air Pollution Control District (District) to operate the Ecotech 3000 High Volume PM10 Sampler (Ecotech HiVol 3000). The goal of this SOP is to provide a consistent reference to which site operators can refer for the operation, maintenance, and calibration of the Ecotech HiVol 3000 samplers in the District's air monitoring network. Maintaining consistency of these activities across the network will ensure the validity and comparability of the data collected from the samplers operating in the region. This SOP will be amended on an as needed basis as the procedures for the operation, maintenance, and calibration of these samplers change over time.

1.2 PRINCIPLE OF OPERATION

The Ecotech HiVol 3000 draws air into a specifically shaped inlet at 1.13 cubic meters per minute (CMM) (equivalent to 40 cubic feet per minute) where PM10 particulate matter collects on an 8" x 10" matted quartz fiber surface. The sampler's flow rate is altitude dependent. The concentration of PM10 particulate matter (in micrograms per cubic meter) is calculated by weighing the collected particulates and dividing by the measured volume of air sampled. The standard sampling frequency is every sixth day for a 24 hour period.

The inlet head is symmetric and therefore insensitive to wind direction, and has been determined to be relatively insensitive to wind speed. Using a brushless motor and volumetric flow controller, the air is drawn through the acceleration nozzles at 1.13 CMM. Particles larger than 10 microns cannot follow the air stream as they are deflected below the nozzles and fall onto the flat surface of the greased collection shim below the nozzles. The air sample is then drawn through vent tubes, and then through the filter, where the particulate matter less than 10 microns is collected. The height of the vent tube inlets above the

acceleration nozzle plate and the use of the greased shim prevent the re-entrainment of particles larger than 10 microns.

1.3 EQUIPMENT AND SUPPLIES

The following items listed are required for the operation and maintenance of the Ecotech HiVol 3000 sampler: silicone grease, shop towels, calibrated manometer, certified orifice plate, matted quartz fiber filters, and for remote connectivity capability, a PC with Windows OS and xVOL Communicator software and a serial cable.

1.4 SAFETY PRECAUTIONS

Only properly trained personnel should perform Ecotech HiVol 3000 sampler testing, installation, operation, maintenance and calibration procedures. The District's qualifications for personnel hired to work on the air monitoring network include experience in principles and techniques of electronics, experience in working with analytical instruments, and general understanding of physics and chemistry. Personnel interacting with the Ecotech HiVol 3000 sampler should be familiar with the key components required for the operation of the sampler, the menu options within the interface, and proper filter handling and processing. Personnel are expected to receive approximately 1-2 months of training under an experienced technician before operating the Ecotech HiVol 3000 sampler independently.

As with all monitoring equipment, precautions should be taken when working around electricity, power tools and above ground elevations. To avoid electrical shock, prior to cleaning or performing any maintenance on the Ecotech HiVol 3000 sampler, unplug the 115 volt AC power cord.

1.5 INTERFERENCES/LIMITATIONS

The matted quartz fiber filter is very delicate and can be easily torn or gouged. Handle carefully by the edges. Damaged filters will be invalidated.

Use factory specified replacement parts only. Each Ecotech HiVol 3000 sampler when properly configured is an EPA Designated Reference Method.

1.6 SITING

The Ecotech HiVol 3000 sampler should be sited in accordance with the U.S. EPA Title 40, Code of Federal Regulations Part 58 (40 CFR 58 Appendix E).

2 SAMPLING PROCEDURE

2.1 SAMPLING FREQUENCY

The high volume air samplers are run on a six day sampling schedule specified by the United States Environmental Protection Agency (U.S. EPA). The EPA sampling schedule for the current year can be found at http://www.epa.gov/ttn/amtic/calendar.html. For certain projects, the sampling frequency may be increased to daily or every three days. Figure 1 shows an example of the standard six day sampling schedule. The sampling duration is 24 hours, 0000 to 2400 hours PST. Special sampling (sulfates, etc.) may require varied time schedules.

2.2 INITIAL PROGRAMMING PROCEDURE

The Ecotech HiVol 3000 sampler can be programmed to automatically run every six days as per U.S. EPA guidelines, thus eliminating the need for programming the next run during filter collection. The procedure is as follows.

2.2.1. Select the date of the first run the sampler will be used for, and input this information as the start date (i.e. 1/30/2015). The sampler may be in a different date format (d/m/y), so be sure to note this when programming the date.

2.2.2. Set the start time to 00:00.

2.2.3. Set the end date to some point in the distant future (i.e. 1/30/2100).

2.2.4. Set the daily “On Time 1” to 00:00, and the daily “Off Time 1” to 24:00.

2.2.5. Set all days on the weekly schedule to “yes”.

2.2.6. Set the “Days/Cycle: selection to 6. The sampler will now run its first filter on 1/30/2015, as per the previous example, and run every six days for the entire life of the sampler.

2.3 PRE-RUN PROCEDURE

Perform the following procedures prior to any run the sampler is going to perform.

2.3.1. Air Sample Report – On the air sample report, record the reporting agency, station address, station name and instrument number. Figure 2 shows the air sample report. These reports are available from the Monitoring and Laboratory Division of the California Air Resources Board, telephone number (916) 445-0616.

2.3.2. Clean Filter Installation – The filter cassette has two components, an upper and a lower section. The lower section has a mesh screen which supports the sample filter. Center the pre-weighed filter with the numerically stamped side face down touching the screen. Replace the faceplate over the filter. Insert the loaded filter cassette into the locating stop on top of the sampler and close the inlet hood. The filter cassette is held in place and sealed by carefully lowering the inlet hood, and tightening the thumb screws located inside the sampler above the control panel. Filters are available from the Monitoring and Laboratory Division of the California Air Resources Board, telephone number (916) 445-0616.

2.3.2.1. Note: Check the filters for pinholes or damage prior to installation in the sampler. Filters are normally installed rough side up with identification number located on the bottom outer-most edge of the filter. Filters are fragile and to prevent damage and contamination they should only be handled by the edges while wearing powder free latex or nitrile gloves. During adverse weather conditions

filters should be pre-loaded into the cassette in a protected area prior to installation in sampler.

2.3.3. Clock – Ensure that the clock is set to the correct time and that the data has been downloaded and cleared from the previous run. If it has not, data will accumulate from run to run. See the Post-Run Procedure in the next section on how to perform this task.

2.3.4. Initial Flow Reading - Turn the motor on using manual mode on the unit. Run the sampler for 5 minutes and record the flow. Operating flow rate must be at 67.8 m^3/h ± 7% at existing temperature and pressure conditions for a sampler fitted with a SSI inlet hood.

2.4 POST-RUN PROCEDURE

Follow these procedures for proper filter collection and data retrieval after a run.

2.4.1. Data Collection – Download the data using a laptop computer with the Xvol Communicator software supplied with the sampler. Once the program is open select “terminal mode”. Connect to the sampler, via the RS 232 serial port connector on the machine, and a serial to usb adaptor to connect to the laptop. Go to the “status” page on the machine using the communicator. Once the information is displayed, copy the page, and paste it into a Word document. Highlight the pertinent information, i.e. runtime, total volume, corrected volume, temperature and pressure. This information will be used on the chain of custody form when the filter is sent to the lab. The information must now be cleared, as it will accumulate from run to run if not cleared after each run. To clear the information, at the sampler select Setup > Logger Setup > Clear Accumulated. This will remove the runtime, volume, temperature and pressure information for the previous run.

2.4.2. Final Flow Reading – Run the sampler for 5 minutes and record the final flow rate.

2.4.2.1. Note: The difference between the initial and final flow rates should not be significantly different. Variations greater than 2 m^3/hour may indicate a particle overload situation which has exceeded the compensating ability of the flow controller.

2.4.3. Exposed Filter Removal – Remove the exposed filter carefully from the filter cassette handling only the outer edges with powder free latex or nitrile gloves. Fold the filter in half widthwise so that the sample area touches each other. Place the sample in the glassine envelope that came with the filter. Dark streaks into the border may indicate an air leak which invalidates the sample. If there are insects on the filter remove them carefully. Note on the air sample report if the filter is torn or ruptured, if pieces of filter are left sticking to the gasket, if the start or finish times are not known, or if the flows are outside the acceptable range.

2.4.4. Post Cleaning – Before installing a new filter remove any surface dust from the upper and lower portions of the cassette and the funnel assembly with a damp lint-free cloth.

2.4.5. Air Sample Report – Record on the air sample report the sampling conditions code, start and finish dates and times, total run time, corrected and total volume, temperature, pressure, and the initial and final flow readings (Figure 2).

2.4.6. Sample Shipment – Scan the completed air sample report to store as a digital copy with the instrument download. Place the sample filter inside the glassine envelope and the air sample report into the provided return envelope. Mail to the Support laboratory designated on the return envelope.

2.5 FIELD BLANK PROCEDURE

To meet certain quality control requirements, each PM10 sampler used must collect a specific number of field blanks. A minimum of one field blank should be collected per quarter. Although field blanks can be sampled at any time in the quarter, field blanks should be collected early in the quarter to minimize

laboratory filter backlogs. Field blanks should be collected during a normal sample loading or retrieval day. The field blank collection procedure is described below.

2.5.1. Collect any exposed filters on the sampler using the procedure in Section 2.4 “Post-Run Procedure”.

2.5.2. Prepare a field blank sample suing the procedure outlined in steps 1-2 of Section 2.3 “Pre-Run Procedure” and take the field blank filter cartridge to the sampler.

2.5.3. Place the field blank on the sampler and secure using the two swing bolt/nuts. Close the SSI hinged top but do not tighten the sample head into place. Leave the field blank filter in place for 5 minutes. DO NOT TURN ON THE SAMPLER. Open the Ecotech Hivol 3000 sampler and remove the field blank filter. Cover the field blank with filter cassette to prevent contamination. Load Ecotech Hivol 3000 sampler with the next scheduled sample and proceed to the interior of the station.

2.5.4. Remove the Ecotech Hivol 3000 sampler field blank filter from the filter cartridge holder using the procedure described in Section 2.4 “Post-Run Procedure”.

2.5.5. Complete the associated air sample report (Figure 2). The sample report will be completed in the same manner as a normal sample with the following exceptions.

2.5.5.1. The start date and time will be the moment the filter is placed on the sampler.

2.5.5.2. The finish date and time will be the moment the filter is removed from the sampler, at minimum 5 minutes later than the start date and time.

2.5.5.3. The start, finish and net elapsed time meter fields will be left blank.

2.5.5.4. The “LTP Vol” and the “Std Cor Vol” fields will be 0.00.

2.5.5.5. Leave the Ta and Pa fields blank.

2.5.5.6. Write FIELD BLANK in the field comments section of the sample report.

The field blank should be mailed back to the laboratory within 30 days of sampling.

2.6 QUALITY CONTROL CRITERIA FOR FILTER SAMPLES

Quality control invalidation criteria for filter samples collected on PM10 high volume samplers are listed below. All samples collected in the field will be checked using these criteria. If a sample is found to be invalid per these criteria, the sample and report form will be sent to the laboratory and a make-up run will be scheduled immediately.

2.6.1. Filter Contamination – Filter samples which are dropped or become contaminated by any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) will be invalidated.

2.6.2. Damaged or Torn Filters – Filter samples with tears or pinholes which occurred before, during or after sampling will be invalidated.

2.6.3. Sample Flow Rate – The sampler must maintain an operating flow rate of 67.8 m^3/h ± 7% for the entire 24 hour sampling period. The operating flow rate through samplers operating at elevations higher than 1,000 feet will vary with altitude. If the flow rate through the sampler varies outside the calculated acceptable range for each site more than one hour during the sampling period, the sample will be invalidated. This includes irregular flow rate excursions and the sampler warm-up stabilization period. See Table 2 for an altitude correction chart.

2.6.4. Ambient Temperature – The ambient temperature sensor must maintain a reading within ±2 ºC from a NIST traceable standard.

2.6.5. Barometric Pressure – The barometric pressure sensor must maintain a reading within ±10 mmHg from a NIST traceable standard.

2.6.6. Start/Stop Times – The sampler start and stop time must be 00:00 midnight ± 30 minutes. Filter samples collected by samplers starting before 23:30 hours and stopping after 00:30 hours will be invalidated.

2.6.7. Sample Run Duration – Sample run duration shall be at least 23 hours and no more than 25 hours (1440 ± 60 minutes). Filter samples collected on samplers which operated for less than 23 hours or more than 25 hours will be invalidated.

2.6.8. Power Failure – If a power failure during a sample run causes the start/stop time or the sample run duration requirements to be violated, the sample collected during the run will be invalidated.

2.6.9. Filter Leakage – If the filter sample shows evidence of air leaking due to a worn or improperly seated gasket, the sample will be invalidated.

2.6.10. Make-Up Runs – If the filter is found to be invalid, a make-up run can be scheduled, so long as the make-up run is performed prior to the next scheduled sampling day. If there is not sufficient time to run the makeup, and collect it prior to installing a filter for the next scheduled sampling date, no make-up shall be run. To schedule a make-up change the start date of the machine to the day you want the make-up to run. Be sure upon collection of the makeup to set the start date back to the next scheduled sampling day.

FIGURE 1 EPA SAMPLING SCHEDULE

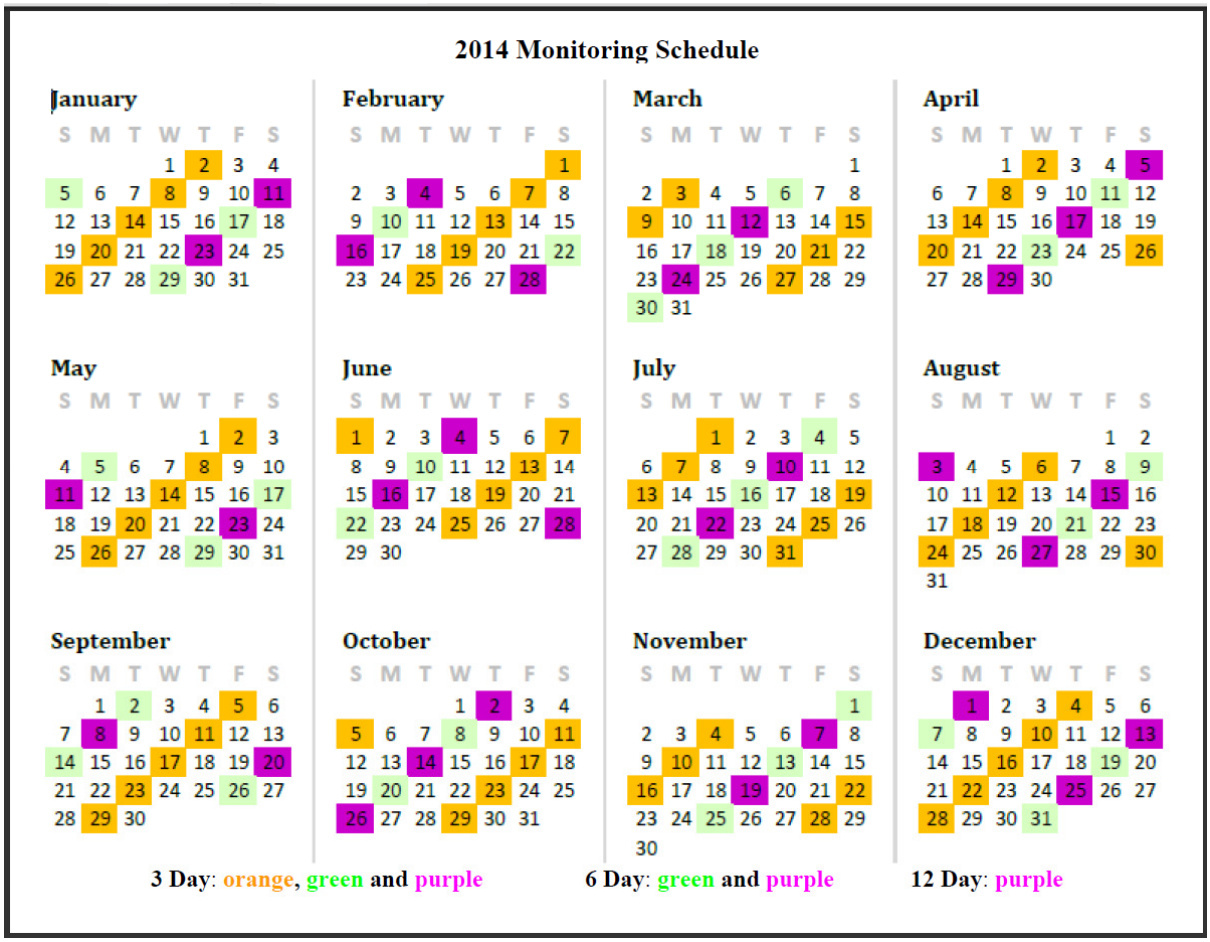


FIGURE 2 AIR SAMPLE REPORT

CALIFORNIA AIR RESOURCES BOARD
Ecotech Sampler PM10 24-Hour Sample Report/Sample Tracking

Sample Number (Filter Number)

Station Name: _____ COUNTY SITE AGENCY

Station Address: _____

Project Name (*If Applicable*): _____ INSTRUMENT NO.

Station Operator/Agency: _____ Phone No: _____

SAMPLING CONDITIONS

LOCAL CONDITION CODES (ENTER APPROPRIATE CODE IN THE BOX AT LEFT)

☑ - NO UNUSUAL CONDITIONS	J - CONSTRUCTION NEARBY	P - ROOFING OPERATIONS
A - HIGH WINDS	K - FARMING NEARBY	Q - PRESCRIBED BURN
E - FOREST FIRE	L - HIGHWAY CONSTRUCTION	X - RAIN Y - SNOW
F - STRUCTURAL FIRE	N - SANDING/SALTING STREETS	Z - OTHER (Explain in Field Comments)

SAMPLE COLLECTION DATA

DATE OF LAST CALIBRATION: YEAR MONTH DAY

	DATE YEAR	MONTH	DAY	TIME HOURS	MIN.	RUN TIME (MIN.)	FILTER PAPER WEIGHT (GRAMS)	
FINISH							.	Post
START							.	Pre
								Net

INDICATED VOLUMES **AMBIENT TEMP & PRESSURE**

LTP Vol . M^3 Std Cor. Vol . M^3 Ta . °C Pa mmHg

Type of Sample : [ ] Regular [ ] Collocate [ ] Make up

MUST BE COMPLETED BY SAMPLER OPERATOR:

- [ ] Inspection of sampler and filter indicates that sample collected is in compliance with quality control standards for sampling.
- [ ] Filter enclosed.
- [ ] Sample does not meet quality control standards for sampling and should be invalidated.

Make up sample scheduled for: _____

Reasons for invalidation:

- ___ Filter Contaminated or Damaged
- ___ Power Outage
- ___ Other (Explain in Field Comments)
- ___ High/Low Flowrate
- ___ Missing All or Partial Data Output
- ___ Erratic Flowrate
- ___ Timer Problem

Field Comments: _____

SAMPLE TRACKING

Action	Transfer Method (Check One) Carrier	Person	Name & Initials	Date/Time
Released by Field				
Received by Lab				
Inspected by Lab				

FOR LABORATORY USE ONLY

LIMS Sample ID: _____

Sample Conditions upon Received: [ ] *VALID* [ ] *INVALID*

Lab Comments: _____

	PRE-ANA.	POST-ANA.
Initials		
Date		

California Air Resources Board, Monitoring and Laboratory Division, P.O. Box 2815, Sacramento, CA 95812
03/12/15

3 ROUTINE SERVICE CHECKS

3.1 GENERAL INFORMATION

Perform the following service checks according the attached schedule (Table 1) and the procedures documented in this section. Checks may be performed more frequently, but should be performed at least at the prescribed intervals. Also attached is a copy of the Monthly Quality Control Maintenance Sheet (Figure 3) which should be completed for each run and forwarded to your supervisor on a monthly basis.

3.2 EACH RUN

Follow these procedures to maintain a properly functioning sampler after each run.

3.2.1. Initial Flow Meter Reading – Run the sampler for at least 5 minutes and record the flow meter reading as measured in Section 1.3.4. If the value is outside of the average initial flow meter range, take a second reading. If the second reading falls out of bounds, check the line voltage and change the filter. Perform a calibration if neither of the above checks identifies the trouble. For samplers used on a more frequent schedule than every six days, check the initial flow meter reading each run, but record it on the Monthly Quality Control Maintenance Sheet no more than every three days.

3.2.1.1. Note: The average initial flow meter reading is determined by averaging the first four initial flow meter readings after the high volume sampler is calibrated. Establish the upper and lower tolerance limits by multiplying the average reading by 1.07 and 0.93 respectively. Record these limits on the Monthly Quality Control Maintenance Sheet.

3.2.2. Faceplate Gasket – At the end of each run, inspect the faceplate gasket to see if it has lost resilience and become deformed or flattened. The

resulting air leakage will show as an irregular edge of particulate deposit on the filter. When the condition is noticed, replace the gasket.

3.2.3. Run Time – Record post-run filter run time that is retrieved from the download on the Monthly Quality Control Maintenance Sheet.

3.3 SHIM PLATE

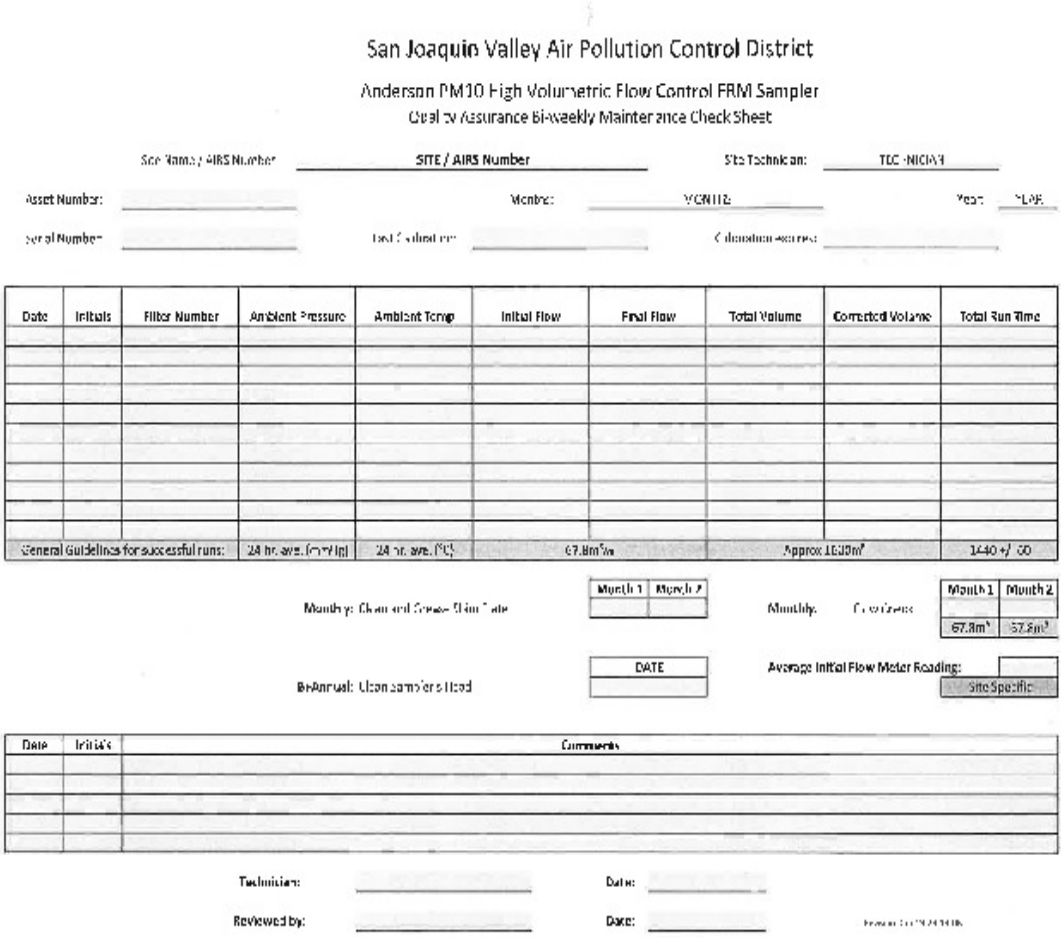
After every six runs, or once a month, whichever occurs first, the shim plate inside the SSI inlet head shall be cleaned, and have grease reapplied to the impact zones of the plate.

TABLE 1 ECOTECH HIVOL 3000 SERVICE SCHEDULE

	Each Run	Monthly
CHECK AND RECORD INITIAL FLOW METER READING & TRUE AIR FLOW RATE	X	
INSPECT FACEPLATE GASKET	X	
CHECK OPERATION OF FLOW RECORDER	X	
CLEAN SHIM PLATE AND GREASE		X
CALIBRATION*/FLOW CHECK		X

* or each time the initial flow meter reading falls outside average initial flow meter reading tolerance limits, or specified maintenance is performed.

FIGURE 3 MONTHLY QUALITY CONTROL MAINTENANCE SHEET



San Joaquin Valley Air Pollution Control District

Anderson PM10 High Volumetric Flow Control FRM Sampler
Quality Assurance Bi-Weekly Maintenance Check Sheet

Site Name / AIRS Number: SITE / AIRS Number Site Technician: TEC - NICHVI

Asset Number: Month: Year: YEAR

Serial Number: Last Calibration: Calibration Due:

Date	Initials	Filter Number	Ambient Pressure	Ambient Temp	Initial Flow	Final Flow	Total Volume	Corrected Volume	Total Run Time
General Guidelines for successful runs:			24 hr. ave. (mm Hg)	24 hr. ave. (°C)	67.8m³/hr		Approx 1600m³		1440 +/- 60

Monthly: Clean and Grease Slide Rails

Month 1	Month 2

Monthly:

Month 1	Month 2
67.8m³	67.8m³

Bi-Annual: Clean sampler shroud

DATE

Average Initial Flow Meter Reading:

Site Specific

Date	Initials	Comments

Technician: Date:

Reviewed by: Date:

TABLE 2 ALTITUDE CORRECTION CHART

Elevation (Feet Above Sea Level)	Altitude Correction Factor	Flow Rate Set Point (m^3/h)
0-999	1.00	76.5
1000	.965	73.7
1250	.956	73.1
1500	.947	72.4
1750	.938	71.7
2000	.930	71.2
2250	.921	70.5
2500	.913	69.8
2750	.904	69.2
3000	.896	68.5
3250	.888	68.0
3500	.879	67.3
3750	.871	66.6
4000	.863	65.9
4250	.855	65.4
4500	.847	64.7
4750	.840	64.2
5000	.832	63.5
5250	.824	63.0
5500	.817	62.5
5750	.805	61.8
6000	.802	61.3
6250	.794	60.7
6500	.787	60.1
6750	.750	59.6
7000	.772	59.0
7250	.765	58.4
7500	.758	57.9
7750	.751	57.4
8000	.744	56.9
8250	.737	56.4
8500	.731	55.9

4 CALIBRATIONS

4.1 FLOW CALIBRATIONS

The Ecotech HiVol 3000 sampler is calibrated using the Top Loading Orifice Plate (Part number: P-ECO-HVS3000-21) along with the Calibration Chart supplied with the plate to obtain the manometer pressure at three flow rates used for calibration (60, 70, 80 m^3/h). The chart is shown in Figure 6. This unit is specifically designed for the Ecotech HiVol 3000 samplers and each orifice plate has been calibrated against a certified reference standard. A manometer (water filled U-tube or digital) is connected to the orifice plate and gives a pressure drop across the orifice which is related to volumetric flow rate. The orifice transfer standard is referenced to 25℃ and 760mmHg. Pressure drops and indicated flow meter readings are recorded and corrected for elevation, as necessary. Using the pressure drops, the standard (true) flow rates are calculated using the certification equation for the transfer standard. Finally, a working sampler calibration curve of standard flow rate vs. indicated flow rate is plotted. The field calibration procedure assumes that elevation is below 1,000 feet and is equivalent to standard conditions. Also that the effect of temperature on the indicated flow rate is negligible, and therefore is not used in the determination of the standard flow rate. Flow calibrations must be performed every six months. Figure 4 shows an example of a calibration sheet. Note: The flow rate transfer standard (orifice plate) must itself be calibrated against a NIST traceable flow standard at least every 10 years, or sooner if damage or wear occurs. The manometer must be calibrated against a NIST traceable flow standard annually.

4.2 FLOW CALIBRATION PROCEDURE

Other than routine daily checks, sampler repairs or adjustments (motor replacement, etc.) should not be made prior to the “as is” calibrations. The sampler should be calibrated after each six months of operation, if the sampler is

moved to a different site, or if the initial flow meter reading falls outside of specified tolerance limits (shown on the Monthly Maintenance sheet).

4.2.1. Raise the inlet hood. Remove the filter from the filter cassette then install the orifice plate on top of the cassette. The assembly is fastened with two thumb screws, one on either side of the filter cassette. Firmly finger tighten the two thumb screws to ensure a good seal (without bending the plate). Connect a manometer to the port on the side of the orifice plate with a length of flexible tubing. A schematic diagram of a typical sampler flow calibration is shown in Figure 5.

4.2.2. Make sure there are no leaks between the sampler and orifice plate. This will be completed through personnel conducting an auditory test or by touching the outer surface of the orifice plate seal to identify any potential flow occurring around the seal. Check that the flexible tube is connected securely. Any leaks identified during this test need to be corrected before performing any calibrations or sampling with the Ecotech HiVol 3000 sampler.

4.2.3. Ensure the blower motor is running for a minimum of 5 minutes to allow for the motor to stabilize before proceeding.

4.2.4. Record the operating flow rate with a certified precision manometer, if these readings are more than ±3.4 m^3/h from the standard, calibrate as follows.

4.2.5. From the Main Screen, go to the Main Menu > Calibration Menu > Start Cal, then press Enter. The motor will automatically start up. Allow at least 5 minutes for the sampler to warm up.

4.2.6. Use the arrow keys to go to the second line: MOTOR ADJUST. Press Select and the cursor will appear under ADJUST. Use the up and down arrows to adjust the motor speed until the manometer indicates the pressure that corresponds to the flow rate indicated, by using the Calibration Chart that came with the orifice plate. Allow the manometer a few seconds to stabilize between each adjustment.

4.2.7. Press Enter once the manometer is at the correct value. Now wait a few moments while the flow signal stabilizes.

4.2.8. Allow at least 30 seconds, then use the arrow keys to go to the bottom line "Point x Done". Press Select and Enter. The second point will be displayed.

4.2.9. Repeat the previous three steps for the next two flow rates, using the new manometer readings. Each time, allow time for the signal to stabilize. Note: If the Exit key is pressed during calibration, the Manual mode is enabled which prompts the user that the calibration was not completed successfully.

4.2.10. Verify the calibration performed by operating the sampler in Manual mode at the operating flow rate. Use the equation given in the operator's manual to calculate flow rates other than those given on the chart. This is best done in the Manual mode, than the Calibration mode. Ensure that the final flow rate reading is within ±1.4 m^3/h from the standard.

4.2.11. Repeat these steps until the operating flow rate displayed by the sampler is within the criteria noted in 4.2.10. If the flow rate calibration process continues to fail to meet this requirement, further investigation of the sampler is required.

4.2.12. Turn the sampler off and remove the orifice plate. The flow rate calibration procedure is complete.

4.3 AMBIENT TEMPERATURE CALIBRATION

Ambient temperature calibrations must be performed every six months. The ambient temperature standard must itself be calibrated against a NIST traceable standard annually or sooner if damage or wear occurs. To access the ambient temperature calibration screen the hidden menu must be accessed. To do this hit the button located under the second "c" in Ecotech on the front panel of the machine.

4.3.1. Ensure the blower motor is running.

4.3.2. Record the temperature displayed by the machine.

4.3.3. Record the actual temperature with a certified precision thermometer, if these readings are more than ±1 ºC from the standard, calibrate as follows.

4.3.4. x = $\frac{actual\ temperature}{hivol\ temperature}$.

4.3.5. Assign “temp coeff 2” the value of [(temp coeff 2) ÷ x^2].

4.3.6. Assign “temp coeff 1” the value of [(temp coeff 1) ÷ x].

4.3.7. Do not change “temp coeff 0”.

4.3.8. Ensure that the final temperature reading is within ±1 ºC from the standard.

4.3.9. Repeat these steps until the temperature displayed by the sampler is within the criteria noted in 4.3.8. If the temperature calibration process continues to fail to meet this requirement, further investigation of the sampler is required.

4.4 BAROMETRIC PRESSURE CALIBRATION

Barometric pressure calibrations must be performed every six months. The barometric pressure standard must itself be calibrated against a NIST traceable standard annually or sooner if damage or wear occurs. To access the barometric pressure calibration screen the hidden menu must be accessed. To do this hit the button located under the second “c” in Ecotech on the front panel of the machine.

4.4.1. Ensure the blower motor is off.

4.4.2. Record the barometric pressure displayed by the machine.

4.4.3. Record the actual barometric pressure using a certified pressure gauge or barometer. If these measurements are more than ±5 mmHg from the standard, continue with the calibration as follows.

4.4.4. Calculate the difference between the two values and adjust the barometric pressure coefficient 0 by this value. If the sampler is reading high, decrease the value of the coefficient 0 and vice versa.

4.4.5. Do not adjust coefficient 1.

4.4.6. Ensure that the final barometric pressure reading is within ±5 mmHg from the standard.

4.4.7. Repeat these steps until the barometric pressure displayed by the sampler is within the criteria noted in 4.4.6. If the barometric pressure calibration process continues to fail to meet this requirement, further investigation of the sampler is required.

5 TROUBLE SHOOTING

Any activities that require further evaluation and investigation which are outside of the scope of this SOP can refer to the Ecotech HiVol 3000 sampler User Manual.

6 REFERENCES

❖ Ecotech 3000 High Volume PM10 Sampler User Manual
http://ecotech.com/wp-content/uploads/2015/02/HiVol-3000-Manual.pdf

❖ District Class Specifications for Air Quality Instrument Technician I/II Position
http://agency.governmentjobs.com/valleyair/default.cfm?action=viewclassspec&classSpecID=819820&agency=2071&viewOnly=yes

❖ 40 CFR Part 58 Appendix E (January 15, 2013)

❖ EPA QA Handbook Volume II (December 2008)

❖ ARB Air Monitoring Quality Assurance Manual Volume V Appendix D (August 2012)

FIGURE 4 CALIBRATION FORM

SAN JOAQUIN VALLEY
UNIFIED AIR POLLUTION CONTROL DISTRICT
VOLUMETRIC FLOW CONTROL
PM10 SAMPLER CALIBRATION DATA SHEET

Date _____ Calibration: AS-IS _____ FINAL _____

Site Name: _____ Site Elevation (ft.): _____
AIRS Code: _____

Calibration Standards		Sampler Being Calibrated
Orifice Standard:	Make:	Make and Mode:
	Model:	VFC Serial Number:
	Property #:	Property Number:
	Date Cert.	Last Cal. Date:
Ambient BP/TMP Standard:	Make:	
	Mode:	
	Serial #:	
	Property #:	Time Verification (DST)
	Date Cert.	Standard: Dialed to Cellular Phone: Time:
Pressure Drop Standard:	Make:	Sampler: Time:
	Model:	Correction to sampler's time and date:
	Property #:	Final Sampler's time after correction: Time:
	Date Cert.	

Multi-Point Flow/Temp/BP Calibration

	HiVol	Standard	Coeff 2	Coeff 1
Ambient Temperature:				
Final Ambient Temp:				

	HiVol	Standard	Coeff 1
Ambient Pressure:			
Final Ambient Pressure:			

	Initial Indicated Flow	kPa	Final Indicated Flow	kPa
60m³/h				
70m³/h				
80m³/h				

Calibrated by: _____ Reviewed by: _____

Version 1 2014-08

FIGURE 5 CALIBRATION SCHEMATIC

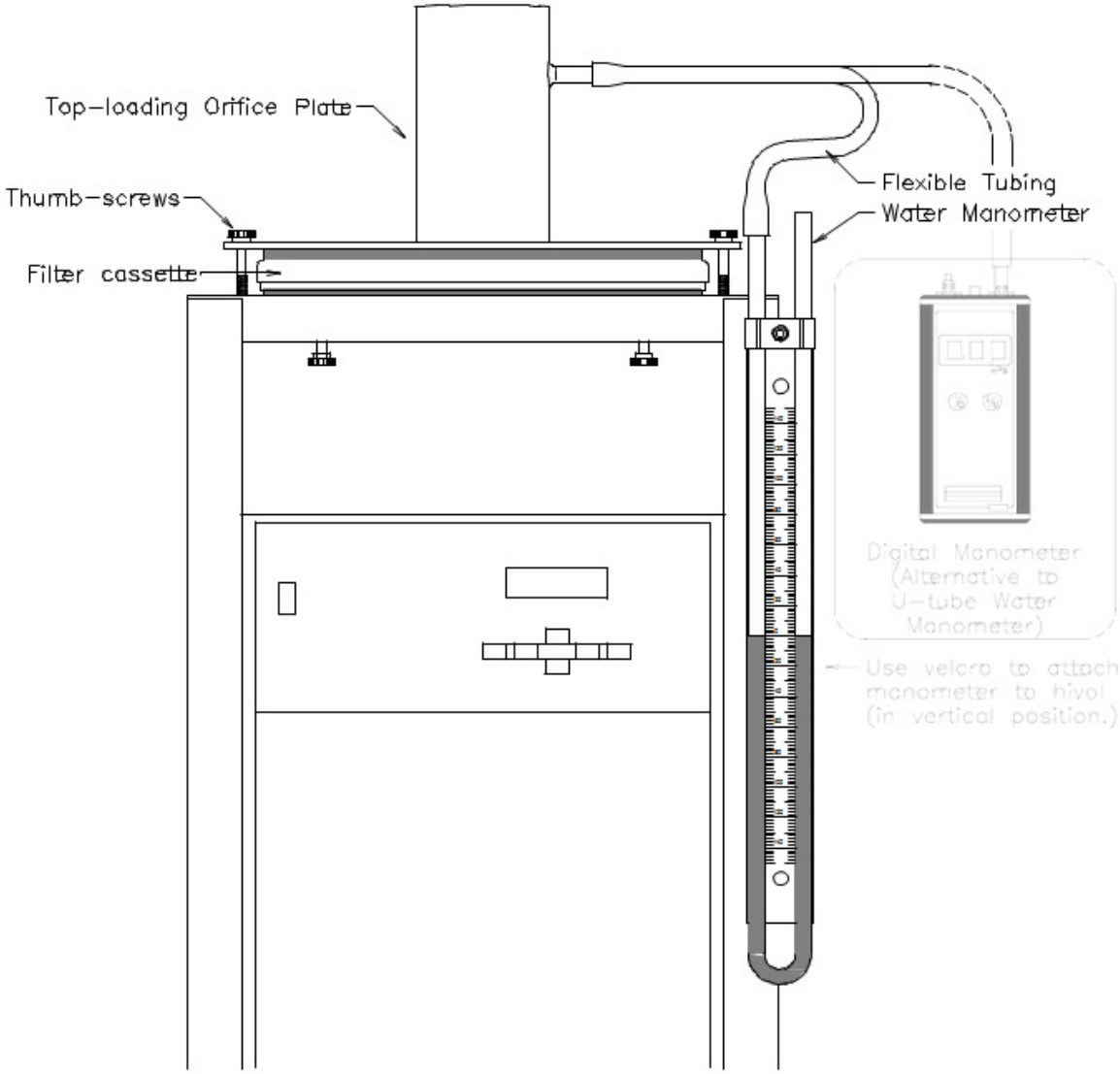


FIGURE 6 CALIBRATION CHART