Appendix A to Part 63--Test Methods [Amended]

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15. Appendix A to Part 63 is amended by adding method 319 in numerical sequence to read as follows:

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METHOD 319: DETERMINATION OF FILTRATION EFFICIENCY FOR PAINT OVERSPRAY ARRESTORS

1.0 Scope and Application.

1.1 This method applies to the determination of the initial, particle size dependent, filtration efficiency for paint arrestors over the particle diameter range from 0.3 to 10 μm. The method applies to single and multiple stage paint arrestors or paint arrestor media. The method is applicable to efficiency determinations from 0 to 99 percent. Two test aerosols are used -- one liquid-phase and one solid-phase. Oleic acid, a low volatility liquid (CAS Number 112-80-1), is used to simulate wet paint overspray. The solid-phase aerosol is potassium chloride salt (KCl, CAS Number 7447-40-7) and is used to simulate a dry overspray. The method is limited to determination of the initial, clean condition of the arrestor. Changes in efficiency (either increase or decrease) due to the accumulation of paint overspray on and within the arrestor are not evaluated.

1.2 Efficiency is defined as 1 - Penetration (e.g., 70 percent efficiency is equal to 0.30 penetration). Penetration is based on the ratio of the downstream particle concentration to the upstream concentration. It is often more useful, from a mathematical or statistical point of view, to discuss the upstream and downstream counts in terms of penetration rather than the derived efficiency value. Thus, this document uses both penetration and efficiency as appropriate.

2.0 Summary of Method.

2.1 This method applies to the determination of the fractional (i.e., particle size dependent) aerosol penetration of several types of paint arrestors. Fractional penetration is computed from aerosol concentrations measured upstream and downstream of an arrestor installed in a laboratory test rig. The aerosol concentrations upstream and downstream of the arrestors are measured with an aerosol analyzer that simultaneously counts and sizes the particles in the aerosol stream. The aerosol analyzer covers the particle diameter size range from 0.3 to 10 μm in a minimum of 12 contiguous sizing channels. Each sizing channel covers a narrow range of particle diameters. For example, Channel 1 may cover from 0.3 to 0.4 μm, Channel 2 from 0.4 to 0.5 μm, ... By taking the ratio of the downstream to upstream counts on a channel by channel basis, the penetration is computed for each of the sizing channels.

2.2 The upstream and downstream aerosol measurements are made while injecting the test aerosol into the air stream upstream of the arrestor (ambient aerosol is removed with HEPA filters on the inlet of the test rig). This test aerosol spans the particle size range from 0.3 to 10 μm and provides sufficient upstream concentration in each of the OPC sizing channels to allow accurate calculation of penetration, down to penetrations of approximately 0.01 (i.e., 1 percent penetration; 99 percent efficiency). Results are presented as a graph and a data table showing the aerodynamic particle diameter and the corresponding fractional efficiency.

3.0 Definitions.

Aerodynamic Diameter - diameter of a unit density sphere having the same aerodynamic properties as the particle in question.

Efficiency = 1 - Penetration.

Optical Particle Counter (OPC) - an instrument that counts particles by size using light scattering. An OPC gives particle diameters based on size, index of refraction, and shape.

Penetration - the fraction of the aerosol that penetrates the filter at a given particle diameter. Penetration equals the downstream concentration divided by the upstream concentration.

4.0 Interferences.

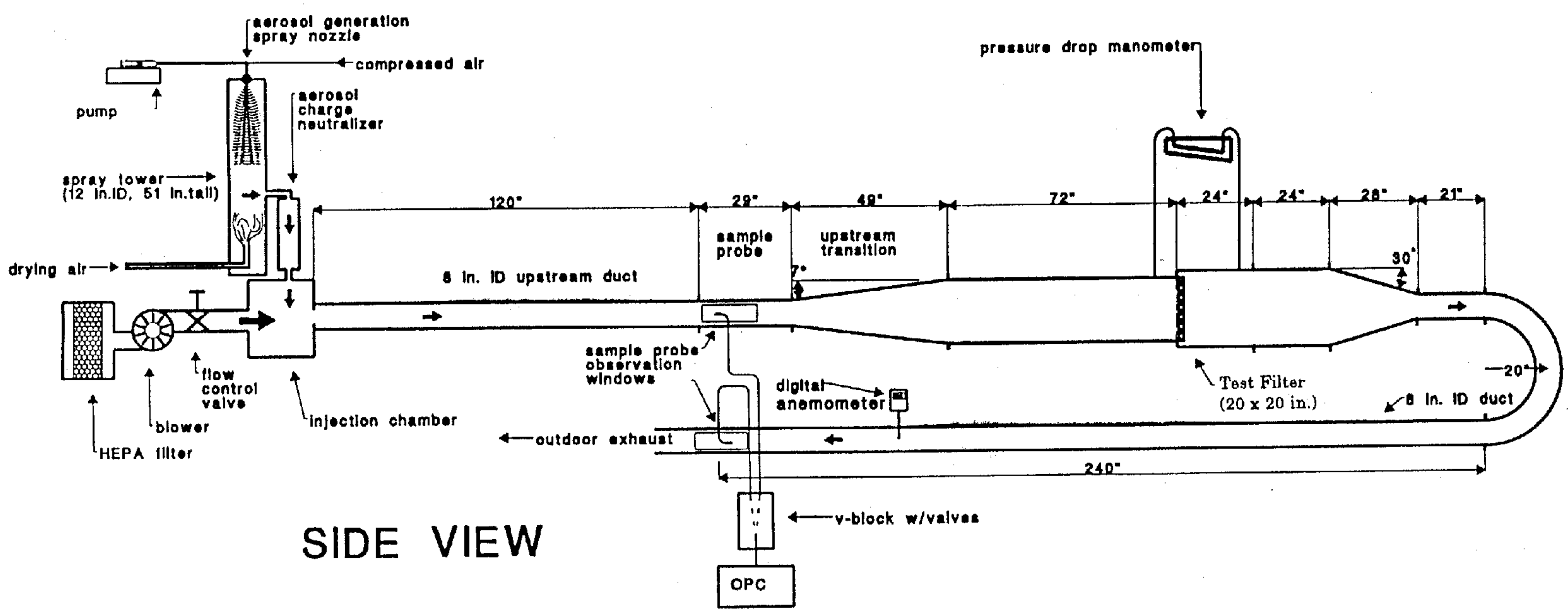
4.1 The influence of the known interferences (particle losses) are negated by correction of the data using blanks.

5.0 Safety.

5.1 There are no specific safety precautions for this method above those of good laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

6.0 Equipment and Supplies.

6.1 Test Facility. A schematic diagram of a test duct used in the development of the method is shown in Figure 319-1.



aerosol generation spray nozzle
compressed air
pump
aerosol charge neutralizer
spray tower (12 in.ID, 51 in.tall)
drying air
HEPA filter
blower
flow control valve
injection chamber
120"
29"
49"
72"
24"
24"
28"
21"
8 in. ID upstream duct
sample probe
upstream transition
7°
30°
pressure drop manometer
Test Filter (20 x 20 in.)
20"
8 in. ID duct
sample probe observation windows
digital anemometer
outdoor exhaust
240"
v-block w/valves
OPC

SIDE VIEW

6.1.1 The test section, paint spray section, and attached transitions are constructed of stainless and galvanized steel. The upstream and downstream ducting is 20 cm diameter PVC. The upstream transition provides a 7° angle of expansion to provide a uniform air flow distribution to the paint arrestors. Aerosol concentration is measured upstream and downstream of the test section to obtain the challenge and penetrating aerosol concentrations, respectively. Because the downstream ducting runs back under the test section, the challenge and penetrating aerosol taps are located physically near each other, thereby facilitating aerosol sampling and reducing sample-line length. The inlet nozzles of the upstream and downstream aerosol probes are designed to yield isokinetic sampling conditions.

6.1.2 The physical dimensions of the test duct can deviate from those of Figure 319-1 provided that the following key elements are maintained: the test duct must meet the criteria specified in Table 319-1; the inlet air is HEPA-filtered; the blower discharges into the test duct thereby creating a positive pressure in the duct relative to

Figure 319-1. Schematic illustration of the fractional efficiency test rig.

TABLE 319-1. QC CONTROL LIMITS

	Frequency and description	Control Limits
OPC zero count	Each Test. OPC samples HEPA-filtered air.	<50 counts per minute
OPC sizing accuracy check	Daily. Sample aerosolized PSL spheres.	Peak of distribution should be in correct OPC channel
Minimum counts per channel for challenge aerosol	Each Test.	Minimum total of 500 particle counts per channel
Maximum particle concentration	Each Test. Needed to ensure OPC is not overloaded	<20/cc based on cumulative count >0.3 µm diameter.
Standard Deviation of Penetration	Computed for each test based on the CV of the upstream and downstream counts.	<0.10 for 0.3 - 5 µm diameter <0.30 for >5 µm diameter
0% Penetration	Monthly.	<0.01
100% Penetration - Kcl	Triplicate tests performed immediately before, during, or after triplicate arrestor tests.	0.3-1 >0.95 1-3 >0.75 3-10 >0.50
100% Penetration - Oleic Acid	Triplicate tests performed immediately before, during, or after triplicate arrestor tests.	0.3-1 >0.95 1-3 >0.75 3-10 >0.50

the surrounding room; the challenge air has a temperature between 60 and 80°F and a relative humidity of less than 70 percent; the angle of the upstream transition (if used) to the paint arrestor must not exceed 7°; the angle of the downstream transition (if used) from the paint arrestor must not exceed 30°; the test duct must provide a means for mixing the challenge aerosol with the upstream flow (in lieu of any mixing device, a duct length of 30 duct diameters fulfills this requirement); the test duct must provide a means for mixing any penetrating aerosol with the downstream flow (in lieu of any mixing device, a duct length of 30 duct diameters fulfills this requirement); the test section must provide a secure and leak-free mounting for single and multiple stage arrestors; the test duct must utilize a 180° bend in the downstream duct; the test duct must be in straight centerline alignment from the point of aerosol injection to the upstream end of the 180° bend; the test duct must be in straight centerline alignment from the downstream end of the 180° bend to the downstream aerosol sample probe; and the upstream and downstream aerosol sampling probes must be located directly opposite each other (within a tolerance of 12-inches).

6.2 Aerosol Generator. The aerosol generator is used to produce a stable aerosol covering the particle size range from 0.3 to 10 µm diameter. The generator used in the development of this method consists of an air atomizing nozzle positioned at the top of a 0.30-m (12-in.) diameter, 1.3-m (51-in) tall, acrylic, transparent, spray tower. This tower allows larger sized particles, that would otherwise foul the test duct and sample lines, to fall out of the aerosol. It also adds drying air to ensure that the KCl droplets dry to solid salt particles. After generation, the aerosol passes through an aerosol neutralizer (Kr85 radioactive source) to neutralize any electrostatic charge on the aerosol (electrostatic charge is an unavoidable consequence of most aerosol generation methods). To improve the mixing of the aerosol with the air stream, the aerosol is injected counter to the airflow. Generators of other designs may be used, but they must produce a stable aerosol concentration over the 0.3 to 10 µm diameter size range; provide a means of ensuring the complete drying of the KCl aerosol; and utilize a charge neutralizer to neutralize any electrostatic charge on the aerosol. The resultant challenge aerosol must meet the minimum count per channel and maximum concentration criteria of Table 319-1.

6.3 Frame Dimensions. To secure the arrestor or arrestor media in the test duct, a mounting frame is necessary. The frame is used to seal the arrestor into the rig to prevent aerosol laden air bypassing the arrestor. Since arrestor media are often sold unmounted, the frame must provide back support for the media in addition to sealing into the rig. The test frame for the 20" x 20" test rig has internal dimensions of 18 1/4" square and a removable wire rod back support. The wire support is used for media with insufficient internal support.

6.4 Optical Particle Counter. The upstream and downstream aerosol concentrations are measured with a high resolution optical particle counter (OPC). To ensure comparability of test results, the OPC utilize an optical design based white-light wide-angle forward light scattering encompassing the angles from 15° to 150° with respect to the incident light and provide a minimum of 12 contiguous particle sizing channels from 0.3 to 10 µm diameter (based on response to PSL) where, for each channel, the ratio of the diameter corresponding to the upper channel bound to the lower channel bound must not exceed 1.5.

6.5 Aerosol Sampling System. The upstream and downstream sample lines must be made of rigid electrically-grounded metallic tubing having a smooth inside surface, and they must be rigidly secured to prevent movement during testing. The upstream and downstream sample lines are to be nominally identical in geometry. The use of a short length (50 mm maximum) of straight flexible electrically-dissipative tubing to make the final connection to the OPC is acceptable. The inlet nozzles of the upstream and downstream probes must be sharp-edged and of appropriate entrance diameter to maintain isokinetic sampling within 10 percent of the air velocity. The system must be designed to allow repeated sequential upstream - downstream sampling. Sufficient time must be allowed between each upstream to downstream and downstream to upstream switch to minimize cross contamination in the resultant OPC measurement (verified per 11.3).

6.6 Airflow Monitor. The volumetric airflow through the system may be measured with a calibrated orifice flow nozzle or by use of a velocity probe. If a velocity probe is used, traverse measurements (Figure 319-2) across the duct (12-point equal area traverse for round ducts, 9-point equal area traverse for square ducts) must be performed to allow accurate determination of volumetric flow (i.e. average velocity x cross sectional area of duct). The flow orifice and velocity probe must have an accuracy of 5 percent or better. The resolution of the velocity probe must be 5 percent of reading or better.

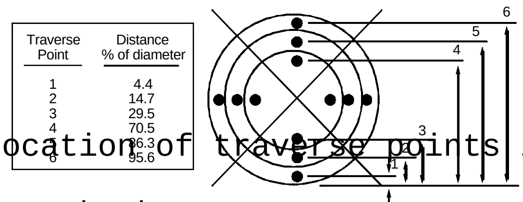


Figure 319-2. Location of traverse points in circular duct.

7.0 Reagents and Standards.

7.1 The liquid test aerosol is reagent grade, 98 percent pure, oleic acid (Table 319-2). The solid test aerosol is KCl aerosolized from a solution of 20 percent KCl in water. In addition to the test aerosol, a calibration aerosol of monodisperse polystyrene latex (PSL) spheres are used to verify the calibration of the OPC.

TABLE 319-2. PROPERTIES OF THE TEST AND CALIBRATION AEROSOLS

	Refractive index	Density, g/cm^3	Shape
Oleic Acid (liquid-phase challenge aerosol)	1.46 non absorbing	0.89	Spherical
KCl (solid-phase challenge aerosol)	1.49	1.98	Cubic or agglomerated cubes
PSL (calibration aerosol)	1.59 nonabsorbing	1.05	Spherical

8.0 Sample Collection, Preservation, and Storage.

8.1 In this test, all sampling occurs in real-time, thus no samples are collected that require preservation or storage during the test. The paint arrestors are shipped and stored to avoid structural damage or soiling. Each arrestor may be shipped in its original box from the manufacturer or similar cardboard box. Arrestors are stored at the test site in a location that keeps them clean and dry. Each arrestor is clearly labelled for tracking purposes.

9.0 Quality Control.

9.1 Table 319-1 lists the QC control limits.

9.2 The standard deviation (F) of the penetration (P) for a given test at each of the 15 OPC sizing channels is computed from the coefficient of variation (CV, the standard deviation divided by the mean) of the upstream and downstream measurements as:

$$F_P = P \sqrt{(CV^2_{upstream} + CV^2_{downstream})} \qquad \text{(Eq. 319-1)}$$

For a properly operating system, the standard deviation of the penetration is < 0.10 at particle diameters from 0.3 to 5 μm and less than 0.30 at diameters > 5 μm.

9.3 Data Quality Indicators. Data Quality Objectives (DQO).

9.3.1 Fractional Penetration. From the triplicate tests of each paint arrestor model, the standard deviation for the penetration measurements at each particle size (i.e., for each sizing channel of the OPC) is computed as:

$$s = \left[\sum (P_i - \overline{P})^2 / (n-1)\right]^{1/2} \qquad \text{(Eq. 319-2)}$$

where P_i represents an individual penetration measurement, and $\overline{P}$ the average of the 3 (n = 3) individual measurements.

9.3.2. Bias of the fractional penetration values is determined from triplicate no-filter and HEPA filter tests. These tests determine the measurement bias at 100 percent penetration and 0 percent penetration, respectively.

9.3.3 PSL-Equivalent Light Scattering Diameter. The precision and bias of the OPC sizing determination are based on sampling three known diameter sizes of PSL and noting whether the particle counts peak in the correct channel of the OPC. This is a pass/fail measurement with no calculations involved.

9.3.4 Flow Velocity. The precision of the measurement is 5 percent of the set point as read with the thermal anemometer. The maximum acceptable bias is 20 percent based on a comparison of the thermal anemometer to pitot tube readings.

10.0 Calibration and Standardization.

10.1 Optical Particle Counter. The OPC must have an up-to-date factory calibration (i.e., calibrated within prior 6-months). Check the OPC zero at the beginning and end of each test by sampling HEPA-filtered air. Verify the sizing accuracy at the beginning of the measurement program with three sizes of PSL spheres and then on a daily basis (for days when tests are performed) with 1-size PSL spheres.

10.2 Flow Velocity. Airflow orifice plates and velocity probes must have an accuracy of 5 percent or better. Manometers used in conjunction with the orifice plate must be inspected prior to use for proper level, zero, and mechanical integrity. Tubing connections to the manometer must be free from kinks and have secure connections.

10.3 Pressure Drop. Measure pressure drop across the paint arrestor with an inclined manometer readable to within 0.01 in. H_2O. Prior to use, the level and zero of the manometer, and all tubing connections, must be inspected and adjusted as needed.

11.0 Procedure

11.1 Filtration Efficiency. For both the oleic acid and KCl challenges, this procedure is performed in triplicate using a new arrestor for each test.

11.1.1 General Information and Test Duct Preparation

11.1.1.1 Use the "Test Run Sheet" form (Figure 319-3) to record the test information.

RUN SHEET

Part 1. General Information

Date and Time: __________________________ Test Operator: ______________ Test #: ___________
Paint Arrestor: Brand/Model____________________________ Arrestor Assigned ID # _______________
Condition of arrestor (i.e., is there any damage? Must be new condition to proceed): ____________________
Manometer zero and level confirmed? ________

Part 2. Clean Efficiency Test Date and Time: __________________________

Optical Particle Counter: 20 min. warm up _________
Zero count (< 50 counts/min) _________
Daily PSL check _________ PSL Diam: __________ µm
File name for OPC data: ____________________

Test Conditions: Air Flow: _____________
Temp & RH: Temp _______F RH _______
Atm. Pressure: _________ inch Hg (from mercury barometer)

Aerosol Generator:
record all operating parameters

Test Aerosol: (Oleic acid or KCl) ______________

Arrestor: Pressure drop: at start ___________ inch H_2O at end ___________ inch H_2O

Condition of arrestor at end of test (note any phys. deterioration) ____

Figure 319-3. Test run sheet.

11.1.1.2 Record the date, time, test operator, Test #, paint arrestor brand/model and its assigned ID number. For tests with no arrestor, record none.

11.1.1.3 Ensure that the arrestor is undamaged and is in "new" condition.

11.1.1.4 Mount the arrestor in the appropriate frame. Inspect for any airflow leak paths.

11.1.1.5 Install frame-mounted arrestor in the test duct. Remove the downstream window and examine the installed arrestor to verify that it is sealed in the duct. For tests with no arrestor, install the empty frame.

11.1.1.6 Visually confirm the manometer zero and level. Adjust as needed.

11.1.2 Clean Efficiency Test

11.1.2.1 Record the date and time upon beginning this section.

11.1.2.2 Optical Particle Counter

11.1.2.2.1 General: Operate the OPC per the manufacturer's instructions allowing a minimum of 20 minutes warm up before making any measurements.

11.1.2.2.2 Overload: The OPC will yield inaccurate data if the aerosol concentration it is attempting to measure exceeds its operating limit. To ensure reliable measurements, the maximum aerosol concentration will not exceed 10 percent of the manufacturer's claimed concentration limit. If this value is exceeded, reduce the aerosol concentration until the acceptable conditions are met.

11.1.2.2.3 Zero Count: Connect a HEPA capsule to the inlet of the OPC and obtain printouts for three samples (each a minimum of 1-minute each). Record maximum cumulative zero count. If the count rate exceeds 50 counts per minute, the OPC requires servicing before continuing.

11.1.2.2.4 PSL Check of OPC Calibration: Confirm the calibration of the OPC by sampling a known size PSL aerosol. Aerosolize the PSL using an appropriate nebulizer. Record whether the peak count is observed in the proper channel. If the peak is not seen in the appropriate channel, have the OPC recalibrated.

11.1.2.3 Test Conditions:

11.1.2.3.1 Airflow: The test airflow corresponds to a nominal face velocity of 120 FPM through the arrestor. For arrestors having nominal 20" x 20" face dimensions, this measurement corresponds to an airflow of 333 cfm. For arrestors have nominal face dimensions of 24" x 24", this measurement corresponds to an airflow of 480 cfm.

11.1.2.3.2 Temperature and Relative Humidity: The temperature and relative humidity of the challenge air stream will be measured to within an accuracy of +/- 2°F and +/- 5 percent RH. To protect the probe from fouling, it may be removed during periods of aerosol generation.

11.1.2.3.3 Barometric Pressure: Use a mercury barometer. Record the atmospheric pressure.

11.1.2.4 Upstream and Downstream Background Counts

11.1.2.4.1 With the arrestor installed in the test duct and the airflow set at the proper value, turn on the data acquisition computer and bring up the data acquisition program.

11.1.2.4.2 Set the OPC settings for the appropriate test sample duration with output for both printer and computer data collection.

11.1.2.4.3 Obtain 1 set of upstream-downstream background measurements.

11.1.2.4.4 After obtaining the upstream-downstream measurements, stop data acquisition.

11.1.2.5 Efficiency Measurements:

11.1.2.5.1 Record the arrestor pressure drop.

11.1.2.5.2 Turn on the Aerosol Generator. Begin aerosol generation and record the operating parameters.

11.1.2.5.3 Monitor the particle counts. Allow a minimum of 10 minutes for the generator to stabilize.

11.1.2.5.4 Confirm that the total particle count does not exceed the predetermined upper limit. Adjust generator as needed.

11.1.2.5.5 Confirm that a minimum of 50 particle counts are measured in the upstream sample in each of the OPC channels per sample. Adjust generator or sample time as needed.

11.1.2.5.6 If you are unable to obtain a stable concentration within the concentration limit and with the 50 count minimum per channel, adjust the aerosol generator.

11.1.2.5.7 When the counts are stable, perform repeated upstream-downstream sequential sampling until of 10 upstream-downstream measurements are obtained. (Note, begin data acquisition with upstream sampling.)

11.1.2.5.8 After collection of the 10 upstream-downstream samples, stop data acquisition and allow 2 more minutes for final purging of generator.

11.1.2.5.9 Obtain 1 additional set of upstream-downstream background samples.

11.1.2.5.10 After obtaining the upstream-downstream background samples, stop data acquisition.

11.1.2.5.11 Record the arrestor pressure drop.

11.1.2.5.12 Turn off blower.

11.1.2.5.13 Remove the paint arrestor assembly from the test duct. Note any signs of physical deterioration.

11.1.2.5.14 Remove the arrestor from the frame and place the arrestor in an appropriate storage bag.

11.2 Control Test: 100 Percent Penetration Test. Three 100 percent penetration tests must be performed as part of each test series. These tests are performed with no arrestor installed in the test housing. This test is relatively stringent test of the adequacy of the overall duct, sampling, measurement, and aerosol generation system. The test is performed as a normal penetration test except the paint arrestor is not used. A perfect system would yield a measured penetration of 1 at all particle sizes. Deviations from 1 can occur due to particle losses in the duct, differences in the degree of aerosol uniformity (i.e., mixing) at the upstream and downstream probes, and differences in particle transport efficiency in the upstream and downstream sampling lines.

11.3 Control Test: 0 Percent Penetration. One 0 percent penetration test must be performed as part of each test series. The test is performed by using a HEPA filter rather than a paint arrestor. This test assesses the adequacy of the instrument response time and sample line lag.

12.0 Data Analysis and Calculations

12.1 Analysis. The analytical procedures for the fractional penetration and flow velocity measurements are described in Section 11. Note that the primary measurement, that of the upstream and downstream aerosol concentrations, are performed with the OPC which acquires the sample and analyzes it in real time. Because all the test data is collected in real time, there are no analytical procedures performed subsequent to the actual test, only data analysis.

12.2 Calculations

12.2.1 Penetration

Nomenclature

U = Upstream particle count
D = Downstream particle count
U_b = Upstream background count
D_b = Downstream background count
P_{100} = 100 percent penetration value determined in triplicate no filter tests
P = Penetration corrected for P_{100}
F = Sample standard deviation
CV = Coefficient of variation = F/mean
E = Efficiency.

Overbar denotes arithmetic mean of quantity

Analysis of each test involves the following quantities:

- P_{100} value for each sizing channel from the no filter tests,
  - 2 upstream background values,
  - 2 downstream background values,
  - 10 upstream values with aerosol generator on, and
  - 10 downstream values with aerosol generator on.

$$P = \{\frac{(\overline{D}-\overline{D}_b)}{(\overline{U}-\overline{U}_b)}\} / P_{100} \qquad \text{(Eq. 319-3)}$$

Using the values associated with each sizing channel, the penetration associated with each particle sizing channel is calculated as:

Most often, the background levels are small compared to the values when the aerosol generator is on.

12.3 The relationship between the physical diameter ($D_{Physical}$) as measured by the OPC to the aerodynamic diameter

$$E = 1 - P \qquad \text{(Eq. 319-4)}$$

(D_{Aero}) is given by:

$$D_{Aero} = D_{Physical} \sqrt{\frac{D_{Particle}}{D_o} \; \frac{CCF_{Physical}}{CCF_{Aero}}} \qquad \text{(Eq. 319-5)}$$

where:

D_o = unit density of 1 g/cm^3.

$D_{Particle}$ = the density of the particle, 0.89 g/cm^3 for oleic acid.

$CCF_{Physical}$ = the Cunningham Correction Factor at $D_{Physical}$.

CCF_{Aero} = the Cunningham Correction Factor at D_{Aero}.

12.4 Presentation of Results. The test results must be presented in both graphical and tabular form.

12.4.1 The X-axis of the graph will be a logarithmic scale of aerodynamic diameter from 0.1 to 100 µm. The Y-axis will be Penetration on a linear scale from 0 to 1. Plots for each individual run and a plot of the average of triplicate solid-phase and of the average triplicate liquid-phase tests must be prepared. All plots are to based on point-to-point plotting (i.e., no curve fitting is to be used). The data are to be plotted based on the geometric mean diameter of each of the OPC's sizing channels.

12.4.2 Tabulated data from each test must be provided. The data must include the upper and lower diameter bound and geometric mean diameter of each of the OPC sizing channels, the background particle counts for each channel for each sample, the upstream particle counts for each channel for each sample, the downstream particle counts for each channel for each sample, the 100 percent penetration values computed for each channel, and the 0 percent penetration values computed for each channel.

13.0 Pollution Prevention

13.1 The quantities of materials to be aerosolized should be prepared in accord with the amount needed for the current tests so as to prevent wasteful excess.

14.0 Waste Management

14.1 Paint arrestors may be returned to originator, if requested, or disposed of with regular laboratory waste.

15.0 References

1. Hanley, J.T., D.D. Smith and L. Cox. "Fractional Penetration of Paint Overspray Arrestors, Draft Final Report," EPA Cooperative Agreement CR-817083-01-0, January 1994.
2. Hanley, J.T., D.D. Smith, and D.S. Ensor. "Define a Fractional Efficiency Test Method that is Compatible with Particulate Removal Air Cleaners Used in General Ventilation," Final Report, 671-RP, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc, December 1993.
3. "Project Work and Quality Assurance Plan: Fractional Penetration of Paint Overspray Arrestors, Category II," EPA Cooperative Agreement No. CR-817083, July 1994.