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(2) Collect either a nominal 24-hour or 48-hour atmospheric PM sample simultaneously with each of the three test samplers.

(3) Following sample collection, retrieve the collected sample from each sampler. For sequential samplers, retrieve the additional stored (blank, unsampled) filters after at least 5 days (120 hours) storage in the sampler if the active samples are 24-hour samples, or after at least 10 days (240 hours) if the active samples are 48-hour samples.

(4) Determine the measured PM mass concentration for each sample in accordance with the applicable procedures prescribed for the candidate method in appendix L or appendix O, as applicable, of part 50 of this chapter, and in accordance with the associated manual referred to in §53.4(b)(3) and supplemental guidance in reference 2 in appendix A of this subpart. For sequential samplers, also similarly determine the storage deposition as the net weight gain of each blank, unsampled filter after the 5-day (or 10-day) period of storage in the sampler.

(5) Repeat this procedure to obtain a total of 10 sets of any combination of (nominal) 24-hour or 48-hour PM measurements over 10 test periods. For sequential samplers, repeat the 5-day (or 10-day) storage test of additional blank filters once for a total of two sets of blank filters.

(g) *Calculations.* (1) Record the PM concentration for each test sampler for each test period as $C_{i,j}$, where i is the sampler number (i = 1,2,3) and j is the test period (j = 1,2, * * * 10).

(2)(i) For each test period, calculate and record the average of the three measured PM concentrations as $C_{ave,j}$ where j is the test period using equation 26 of this section:

Equation 26

$$C_{ave,j} = \frac{1}{3} \times \sum_{i=1}^{3} C_{i,j}$$

(ii) If $C_{ave,j}$ <3 μg/m³ for any test period, data from that test period are unacceptable, and an additional sample collection set must be obtained to replace the unacceptable data.

(3)(i) Calculate and record the precision for each of the 10 test periods, as the standard deviation, using equation 27 of this section:

Equation 27

$$P_j = \sqrt{\frac{\sum_{i=1}^{3} C_{i,j}^2 - \frac{1}{3}\left(\sum_{i=1}^{3} C_{i,j}\right)^2}{2}}$$

(ii) For each of the 10 test periods, also calculate and record the precision as the relative standard deviation, in percent, using equation 28 of this section:

Equation 28

$$RP_j = 100\% \times \frac{P_j}{C_{ave,j}}$$

(h) *Test results.* (1) The candidate method passes the precision test if *either* P_j or RP_j is less than or equal to the corresponding specification in table E–1 of this subpart for all 10 test periods.

(2) The candidate sequential sampler passes the blank filter storage deposition test if the average net storage deposition weight gain of each set of blank filters (total of the net weight gain of each blank filter divided by the number of filters in the set) from each test sampler (six sets in all) is less than 50 μg.

[71 FR 61292, Oct. 17, 2006,as amended at 72 FR 32208, June 12, 2007]

§ 53.59 Aerosol transport test for Class I equivalent method samplers.

(a) *Overview.* This test is intended to verify adequate aerosol transport through any modified or air flow splitting components that may be used in a Class I candidate equivalent method sampler such as may be necessary to achieve sequential sampling capability. This test is applicable to all Class I candidate samplers in which the aerosol flow path (the flow path through which sample air passes upstream of sample collection filter) differs significantly from that specified for reference method samplers as specified in 40 CFR

part 50, appendix L or appendix O, as applicable. The test requirements and performance specifications for this test are summarized in table E–1 of this subpart.

(b) *Technical definitions.* (1) Aerosol transport is the percentage of a laboratory challenge aerosol which penetrates to the active sample filter of the candidate equivalent method sampler.

(2) The active sample filter is the exclusive filter through which sample air is flowing during performance of this test.

(3) A no-flow filter is a sample filter through which no sample air is intended to flow during performance of this test.

(4) A channel is any of two or more flow paths that the aerosol may take, only one of which may be active at a time.

(5) An added component is any physical part of the sampler which is different in some way from that specified for a reference method sampler in 40 CFR part 50, appendix L or appendix O, as applicable, such as a device or means to allow or cause the aerosol to be routed to one of several channels.

(c) *Required facilities and test equipment.* (1) Aerosol generation system, as specified in § 53.62(c)(2).

(2) Aerosol delivery system, as specified in § 53.64(c)(2).

(3) Particle size verification equipment, as specified in § 53.62(c)(3).

(4) Fluorometer, as specified in § 53.62(c)(7).

(5) Candidate test sampler, with the inlet and impactor or impactors removed, and with all internal surfaces of added components electroless nickel coated as specified in § 53.64(d)(2).

(6) Filters that are appropriate for use with fluorometric methods (e.g., glass fiber).

(d) *Calibration of test measurement instruments.* Submit documentation showing evidence of appropriately recent calibration, certification of calibration accuracy, and NIST-traceability (if required) of all measurement instruments used in the tests. The accuracy of flow rate meters shall be verified at the highest and lowest pressures and temperatures used in the tests and shall be checked at zero and at least one flow rate within ±3 percent of 16.7 L/min within 7 days prior to use for this test. Where an instrument's measurements are to be recorded with an analog recording device, the accuracy of the entire instrument-recorder system shall be calibrated or verified.

(e) *Test setup.* (1) The candidate test sampler shall have its inlet and impactor or impactors removed. The lower end of the down tube shall be reconnected to the filter holder, using an extension of the downtube, if necessary. If the candidate sampler has a separate impactor for each channel, then for this test, the filter holder assemblies must be connected to the physical location on the sampler where the impactors would normally connect.

(2) The test particle delivery system shall be connected to the sampler downtube so that the test aerosol is introduced at the top of the downtube.

(f) *Test procedure.* (1) All surfaces of the added or modified component or components which come in contact with the aerosol flow shall be thoroughly washed with 0.01 N NaOH and then dried.

(2) Generate aerosol. (i) Generate aerosol composed of oleic acid with a uranine fluorometric tag of 3 ±0.25 μm aerodynamic diameter using a vibrating orifice aerosol generator according to conventions specified in § 53.61(g).

(ii) Check for the presence of satellites and adjust the generator to minimize their production.

(iii) Calculate the aerodynamic particle size using the operating parameters of the vibrating orifice aerosol generator. The calculated aerodynamic diameter must be 3 ±0.25 μm aerodynamic diameter.

(3) Verify the particle size according to procedures specified in § 53.62(d)(4)(i).

(4) Collect particles on filters for a time period such that the relative error of the resulting measured fluorometric concentration for the active filter is less than 5 percent.

(5) Determine the quantity of material collected on the active filter using a calibrated fluorometer. Record the mass of fluorometric material for the active filter as $M_{active\ (i)}$ where i = the active channel number.

(6) Determine the quantity of material collected on each no-flow filter using a calibrated fluorometer. Record

the mass of fluorometric material on each no-flow filter as $M_{no\text{-}flow}$.

(7) Using 0.01 N NaOH, wash the surfaces of the added component or components which contact the aerosol flow. Determine the quantity of material collected using a calibrated fluorometer. Record the mass of fluorometric material collected in the wash as M_{wash}.

(8) Calculate the aerosol transport as:

EQUATION 29

$$T_{(i)} = \frac{M_{active}}{M_{active+}M_{wash+}\sum M_{no\text{-}flow}} \times 100\%$$

where:

i = the active channel number.

(9) Repeat paragraphs (f)(1) through (8) of this section for each channel, making each channel in turn the exclusive active channel.

(g) *Test results.* The candidate Class I sampler passes the aerosol transport test if $T_{(i)}$ is at least 97 percent for each channel.

[62 FR 38799, July 18, 1997, as amended at 71 FR 61293, Oct. 17, 2006]

TABLE E–1 TO SUBPART E OF PART 53—SUMMARY OF TEST REQUIREMENTS FOR REFERENCE AND CLASS I EQUIVALENT METHODS FOR $PM_{2.5}$ AND $PM_{10-2.5}$

Subpart E procedure	Performance test	Performance specification	Test conditions	Part 50, appendix L reference
§ 53.52 Sample leak check test.	Sampler leak check facility.	External leakage: 80 mL/min, max. Internal leakage: 80 mL/min, max.	Controlled leak flow rate of 80 mL/min.	Sec. 7.4.6.
§ 53.53 Base flow rate test.	Sample flow rate ..... 1. Mean ..... 2. Regulation ..... 3. Meas accuracy ..... 4. CV accuracy ..... 5. Cut-off	1. 16.67 ±5%, L/min ..... 2. 2%, max ..... 3. 2%, max ..... 4. 0.3% max ..... 5. Flow rate cut-off if flow rate deviates more than 10% from design flow rate for >60 ±30 seconds.	(a) 6-hour normal operational test plus flow rate cut-off test. (b) Normal conditions ..... (c) Additional 55 mm Hg pressure drop to simulate loaded filter. (d) Variable flow restriction used for cut-off test.	Sec. 7.4.1. Sec. 7.4.2. Sec. 7.4.3. Sec. 7.4.4. Sec. 7.4.5.
§ 53.54 Power interruption test.	Sample flow rate ..... 1. Mean ..... 2. Regulation ..... 3. Meas. accuracy ..... 4. CV accuracy ..... 5. Occurrence time of power interruptions. 6. Elapsed sample time 7. Sample volume	1. 16.67 ±5%, L/min ..... 2. 2%, max ..... 3. 2%, max ..... 4. 0.3% max ..... 5. ±2 min if >60 seconds. 6. ±20 seconds ..... 7. ±2%, max	(a) 6-hour normal operational test. (b) Nominal conditions ..... (c) Additional 55 mm Hg pressure drop to simulate loaded filter. (d) 6 power interruptions of various durations.	Sec. 7.4.1. Sec. 7.4.2. Sec. 7.4.3. Sec. 7.4.5. Sec. 7.4.12. Sec. 7.4.13. Sec. 7.4.15.4. Sec. 7.4.15.5.
§ 53.55 Temperature and line voltage test.	Sample flow rate ..... 1. Mean ..... 2. Regulation ..... 3. Meas. accuracy ..... 4. CV accuracy ..... 5. Temperature meas. accuracy. 6. Proper operation.	1. 16.67 ±5%, L/min ..... 2. 2%, max ..... 3. 2%, max ..... 4. 0.3% max ..... 5. 2 °C	(a) 6-hour normal operational test. (b) Normal conditions ..... (c) Additional 55 mm Hg pressure drop to simulate loaded filter. (d) Ambient temperature at −20 and + 40 °C. (e) Line voltage: 105 Vac to 125 Vac.	Sec. 7.4.1. Sec. 7.4.2. Sec. 7.4.3. Sec. 7.4.5. Sec. 7.4.8. Sec. 7.4.15.1.
§ 53.56 Barometric pressure effect test.	Sample flow rate ..... 1. Mean ..... 2. Regulation ..... 3. Meas. accuracy ..... 4. CV accuracy ..... 5. Pressure meas. accuracy. 6. Proper operation.	1. 16.67 ±5%, L/p;min ..... 2. 2%, max ..... 3. 2%, max ..... 4. 0.3% max ..... 5. 10 mm Hg	(a) 6-hour normal operational test. (b) Normal conditions ..... (c) Additional 55 mm Hg pressure drop to simulate loaded filter. (d) Barometric pressure at 600 and 800 mm Hg.	Sec. 7.4.1. Sec. 7.4.2. Sec. 7.4.3. Sec. 7.4.5. Sec. 7.4.9.