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§ 53.41 Test conditions.

(a) Set-up and start-up of all test samplers shall be in strict accordance with the operating instructions specified in the manual referred to in § 53.4(b)(3).

(b) If the internal surface or surfaces of the candidate method's sampler inlet on which the particles removed by the inlet are collected is a dry surface (i.e., not normally coated with oil or grease), those surfaces shall be cleaned prior to conducting wind tunnel tests with solid particles.

(c) Once the test sampler or samplers have been set up and the performance tests started, manual adjustment shall be permitted only between test points for the sampling effectiveness and 50 percent cutpoint tests or between test days for the precision and flow rate stability tests. The manual adjustments and any periodic maintenance shall be limited to only those procedures prescribed in the manual referred to in § 53.4(b)(3). The submitted records shall show clearly when any manual adjustment or periodic maintenance was made and shall describe the operations performed.

(d) If a test sampler malfunctions during any of the sampling effectiveness and 50 percent cutpoint tests, that test run shall be repeated. If a test sampler malfunctions during any of the precision and flow rate stability tests, that day's test shall be repeated. A detailed explanation of all malfunctions and the remedial actions taken shall be submitted to EPA with the application.

§ 53.42 Generation of test atmospheres for wind tunnel tests.

(a) A vibrating orifice aerosol generator shall be used to produce monodispersed liquid particles of oleic acid tagged with uranine dye and monodispersed solid particles of ammonium fluoroscein with equivalent aerodynamic diameters as specified in table D–2. The geometric standard deviation for each particle size and type generated shall not exceed 1.1 (for primary particles) and the proportion of multiplets (doublets and triplets) in a test particle atmosphere shall not exceed 10 percent. The particle delivery system shall consist of a blower system and a wind tunnel having a test section of sufficiently large cross-sectional area such that the test sampler, or portion thereof, as installed in the test section for testing, blocks no more than 15 percent of that area. To be acceptable, the blower system must be capable of achieving uniform wind speeds at the speeds specified in table D–2.

TABLE D–2—PARTICLE SIZES AND WIND SPEEDS FOR SAMPLING EFFECTIVENESS TESTS

Particle size (μm) [a]	Wind speed (km/hr)		
	2	8	24
3±0.5	l	l	l
5±0.5	l	l	l
7±0.5	l	l	l
9±0.5	l	l	l
10±0.5	l	l	l
11±0.5	l	l	l
13±1.0	l	l	l
15±1.0	l	l	l
20±1.0	l	l	l
25±1.0	l	l/s	l/s

[a] Mass median aerodynamic diameter.
l = liquid particle.
s = solid particle.
Number of liquid particle test points (minimum of 3 replicates for each combination of particle size and wind speed): 90.
Number of solid particle test points (minimum of 3 replicates for each combination of particle size and wind speed): 6.
Total number of test points: 96.

(b) The size of the test particles delivered to the test section of the wind tunnel shall be established using the operating parameters of the vibrating orifice aerosol generator and shall be verified during the tests by microscopic examination of samples of the particles collected on glass slides or other suitable substrates. When sizing liquid particles on glass slides, the slides should be pretreated with an oleophobic surfactant and an appropriate flattening factor shall be used in the calculation of aerodynamic diameter. The particle size, as established by the operating parameters of the vibrating orifice aerosol generator, shall be within the tolerance specified in table D–2. The precision of the particle size verification technique shall be 0.5 μm or better, and particle size determined by the verification technique shall not differ by more than 0.5 μm or 10 percent, whichever is higher, from that established by the operating parameters of the vibrating orifice aerosol generator.

(c) The population of multiplets in a test particle atmosphere shall be determined during the tests and shall not exceed 10 percent. Solid particles shall be checked for dryness and evidence of breakage or agglomeration during the microscopic examination. If the solid particles in a test atmosphere are wet or show evidence of significant breakage or agglomeration (μ5 percent), the solid particle test atmosphere is unacceptable for purposes of these tests.

(d) The concentration of particles in the wind tunnel is not critical. However, the cross-sectional uniformity of the particle concentration in the sampling zone of the test section shall be established during the tests using isokinetic samplers. An array of not less than five evenly spaced isokinetic samplers shall be used to determine the particle concentration uniformity in the sampling zone. If the particle concentration measured by any single isokinetic sampler in the sampling zone differs by more than 10 percent from the mean concentration, the particle delivery system is unacceptable in terms of uniformity of particle concentration. The sampling zone shall be a rectangular area having a horizontal dimension not less than 1.2 times the width of the test sampler at its inlet opening and a vertical dimension not less than 25 centimeters. The sampling zone is an area in the test section of the wind tunnel that is horizontally and vertically symmetrical with respect to the test sampler inlet opening.

(e) The wind speed in the wind tunnel shall be determined during the tests using an appropriate technique capable of a precision of 5 percent or better (e.g., hot-wire anemometry). The mean wind speed in the test section of the wind tunnel during the tests shall be within 10 percent of the value specified in table D–2. The wind speed measured at any test point in the test section shall not differ by more than 10 percent from the mean wind speed in the test section. The turbulence intensity (longitudinal component and macroscale) in the test section shall be determined during the tests using an appropriate technique (e.g., hot-wire anemometry).

(f) The accuracy of all flow measurements used to calculate the test atmosphere concentrations and the test results shall be documented to be within ±2 percent, referenced to a primary standard. Any flow measurement corrections shall be clearly shown. All flow measurements shall be given in actual volumetric units.

(g) Schematic drawings of the particle delivery system (wind tunnel and blower system) and other information showing complete procedural details of the test atmosphere generation, verification, and delivery techniques shall be submitted to EPA. All pertinent calculations shall be clearly presented.

§ 53.43 Test procedures.

(a) *Sampling effectiveness*—(1) *Technical definition.* The ratio (expressed as a percentage) of the mass concentration of particles of a given size reaching the sampler filter or filters to the mass concentration of particles of the same size approaching the sampler.

(2) *Test procedure.* (i) Establish a wind speed specified in table D–2 and measure the wind speed and turbulence intensity (longitudinal component and macroscale) at a minimum of 12 test points in a cross-sectional area of the test section of the wind tunnel. The mean wind speed in the test section must be within ±10 percent of the value specified in table D–2 and the variation at any test point in the test section may not exceed 10 percent of the mean.

(ii) Generate particles of a size and type specified in table D–2 using a vibrating orifice aerosol generator. Check for the presence of satellites and adjust the generator as necessary. Calculate the aerodynamic particle size using the operating parameters of the vibrating orifice aerosol generator and record. The calculated aerodynamic diameter must be within the tolerance specified in table D–2.

(iii) Collect a sample of the particles on a glass slide or other suitable substrate at the particle injection point. If a glass slide is used, it should be pretreated with an appropriate oleophobic surfactant when collecting liquid particles. Use a microscopic technique to size a minimum of 25 primary particles in three viewing fields (do not include multiplets). Determine