

chamber (or room) in which the particulate filters are conditioned and weighed shall be maintained at 295 K \pm 3 K (22 °C \pm 3 °C) during all filter conditioning and weighing.

(2) *Humidity.* The humidity of the chamber (or room) in which the particulate filters are conditioned and weighed shall be maintained at a dew point temperature of 282.5 K \pm 3 K (9.4 °C \pm 3 °C) and a relative humidity of 45% \pm 8%. Either the dew point temperature or the relative humidity or both may be averaged over the preceding 10 minute period on a moving average basis.

(3) The chamber (or room) environment shall be free of any ambient contaminants (such as dust) that would settle on the particulate filters during their stabilization. It is required that at least two unused reference filter pairs remain in the weighing room at all times in covered (to reduce dust contamination) but unsealed (to permit humidity exchange) petri dishes. These reference filter pairs shall be placed in the same general area as the sample filters. These reference filter pairs shall be weighed within 4 hours of, but preferably at the same time as, the sample filter pair weighings.

(4) If the average weight of the reference filter pairs changes between sample filter weighings by more than 40 micrograms, then all sample filters and background filters in the process of stabilization shall be discarded and the emissions tests repeated.

(5) If the room (or chamber) environmental conditions are not met, then the filters shall remain in the conditioning room for at least one hour after correct conditions are met prior to weighing.

(6) The reference filter pairs shall be changed at least once a month, but never between clean and used weighings of a given sample filter pairs. More than one set of reference filter pair may be used. The reference filters shall be the same size and material as the sample filters.

(b) *Weighing balance specifications.* The microgram balance used to determine the weights of all filters shall have a precision (standard deviation) of

20 micrograms and readability of 10 micrograms.

(Secs. 202, 203, 206, 207, 208, 301a, Clean Air Act, as amended; 42 U.S.C. 7521, 7522, 7525, 7541, 7542, 7601a)

[50 FR 10702, Mar. 15, 1985, as amended at 52 FR 47871, Dec. 16, 1987; 62 FR 47124, Sept. 5, 1997]

§ 86.1312-2007 Filter stabilization and microbalance workstation environmental conditions, microbalance specifications, and particulate matter filter handling and weighing procedures.

(a) *Ambient conditions for filter stabilization and weighing—(1) Temperature and humidity.* (i) The filter stabilization environment shall be maintained at 22 °C \pm 3 °C and a dewpoint of 9.5 °C \pm 1 °C. Dewpoint shall be measured with an instrument that exhibits an accuracy of at least \pm 0.25 °C NIST traceable as stated by the instrument manufacturer. Temperature shall be measured with an instrument that exhibits an accuracy of at least \pm 0.2 °C or better.

(ii) The immediate microbalance workstation environment shall be maintained at 22 °C \pm 1 °C and a dewpoint of 9.5 °C \pm 1 °C. If the microbalance workstation environment freely circulates with the filter stabilization environment, and this entire environment meets 22 °C \pm 1 °C and a dewpoint of 9.5 °C \pm 1 °C, then there is no requirement to measure temperature and dewpoint at the microbalance separate from the filter stabilization location. Otherwise, temperature at the microbalance workstation shall be measured with an instrument that exhibits an accuracy of at least \pm 0.2 °C or better, and dewpoint shall be measured with an instrument that exhibits an accuracy of at least \pm 0.25 °C NIST traceable as stated by the instrument manufacturer.

(2) *Cleanliness.* (i) The microbalance and filter stabilization environments shall be free of ambient contaminants (such as dust or other aerosols) that could settle on the particulate filters. It is recommended that these environments be built to conform with the Class 1000 specification (or cleaner) as determined by Federal Standard 209D or 209E for clean room classification

(Available from the Institute of Environmental Standards and Technology website at *www.iest.org* or phone (847) 255-1561). An alternative recommendation would be to equilibrate and/or weigh the filters within a separate, smaller, particle-free, temperature and humidity-controlled chamber (i.e., "glove box").

(ii) Reference filters shall be used to monitor for gross particle contamination. It is required that at least two unused reference filters remain in the filter stabilization environment at all times in partially covered glass petri dishes, as in paragraph (c) (1) of this section. These reference filters shall be placed in the filter stabilization environment. The reference filters shall be weighed within 2 hours of, but preferably at the same time as, the sample filters. The reference filters shall be changed at least once a month, but never while any sample filters are between their tare weight (pre-sampling) and gross weight (post-sampling) measurements. The reference filters shall be the same size and material as the sample filters.

(3) *Quality control of ambient conditions.* (1) If, before the start of a weighing session, the temperature or dewpoint of the filter stabilization environment are not within specifications, then filters must remain in the environment for at least 30 minutes after conditions are corrected. If the filter stabilization environment changes during a weighing session such that the specifications are no longer met, the weighing session shall be suspended until the environment has returned to within specifications for at least 30 minutes. Once the environment has returned to within specifications for at least 30 minutes, the reference filters shall be reweighed and the criteria in paragraph (a)(3)(ii) of this section shall apply. Note that temperature and dewpoint shall be sampled once per second, and an unweighted 5-minute moving average of this data shall be calculated once per second. This moving average shall be used to determine the environment temperature and dewpoint for the purpose of determining whether or not the environment is within specifications.

(ii) If the average change in weight of the reference filters is more than 10 micrograms (after correcting for buoyancy as described in paragraph (c)(3) of this section), then all filters in the process of stabilization shall be discarded and all data collected with respect to the discarded filters shall be considered void. Note that more than 2 reference filters may be used to achieve a more robust average of the change in weight of the reference filters.

(b) *Microbalance specifications.* The microbalance used to determine the weights of all filters shall have a precision (standard deviation) of at least ± 0.25 micrograms or better for repeated weighing of a calibration weight, a precision of at least ± 2.5 micrograms or better for repeated weighing of a clean filter, and a readability equal to or less than 0.1 micrograms. It is recommended that the microbalance be installed on a vibration isolation platform to isolate the microbalance's load cell from external vibration. It is also recommended that the microbalance should be shielded from convective airflow by means of an electrically grounded static dissipative draft shield. Microbalance manufacturer specifications for all preventive maintenance, periodic certification, calibration, and re-zeroing shall be followed. All certification and calibration procedures shall be NIST traceable, or traceable to an equivalent national standard.

(c) *Particulate matter filter handling and weighing.* Care should be taken to prevent contamination of the sample filters and to prevent a buildup of static charge on the filters that could interfere with filter weighing. Static neutralizers, such as Po-210 sources, shall be used to neutralize charge on a filter prior to each weighing. A static neutralizer should be replaced at the interval recommended by its manufacturer, or when it is no longer able to reduce static charge on a filter to less than ± 2 VDC as measured with an electrostatic monitor at the microbalance workstation. The person weighing filters shall be grounded with respect to the microbalance to prevent imparting a static charge on the filters. This can be accomplished safely by using a

grounding strap such as the wrist straps that are commonly used in the microelectronics industry, or by connecting a similar grounding strap to the tweezers. To prevent electrical shock, a 1-megohm resistor should be installed in series between the person weighing filters and ground.

(1) Within the filter stabilization environment, a pair of clean and electrically conductive tweezers shall be used to place a filter in the lower half of a filter cassette and the cassette shall be placed in a partially open glass petri dish. The petri dish lid should extend over the filter to prevent gross contamination, but it should be left slightly open on one edge to permit stabilization with the environment for at least 30 minutes.

(2) After at least 30 minutes of stabilization, each filter shall be weighed using the specified microbalance. The process of weighing a filter may be repeated and a statistical mean weight of a single filter may be calculated. Sound engineering judgment shall dictate the use of statistics to discard outliers and the weighting of averages. For a clean filter its single weight or statistical mean weight shall be considered the uncorrected tare weight of the filter.

(3) All filter weights shall be corrected for filter buoyancy in air. For the uncorrected tare weight of a filter, this calculated value is the corrected tare weight of the filter, and it must be recorded (see § 86.1344(e)(18)). Barometric pressure of the microbalance environment shall be measured with an instrument that exhibits $\pm 0.01\%$ full-scale accuracy and 0.01% per-year full scale stability, and the full-scale value used for such a specification shall not exceed 200 kPa.

(i) Buoyancy correction calculation. (A) Calculate vapor pressure of liquid water using the dewpoint temperature in the Magnus formula:

$$P_w = 0.6113 \times 10^{\wedge} ((7.5 \times T_{dp}) / (237.3 + T_{dp}))$$

Where:

P_w =vapor pressure of liquid water, kPa.

T_{dp} =dewpoint temperature, °C.

(B) Calculate air density using the ideal gas relationship and molecular weights of standard air and water:

$$A = (3.484 \times P - 1.317 \times P_w) / (T + 273.15)$$

Where:

A =air density, kg/m³.

P =barometric pressure, kPa.

P_w =vapor pressure of liquid water, kPa.

T =temperature, °C.

(C) Buoyancy correction:

$$M = R \times (1 - (A / \rho_w)) / (1 - (A / \rho_s))$$

Where:

M =corrected mass in units of the balance display.

R =uncorrected filter weight in units of the balance display.

A =calculated air density, kg/m³.

ρ_w =density of calibration weight used to calibrate the balance, kg/m³.

ρ_s =density of filter material used to sample PM emissions, kg/m³.

(ii) For determining ρ_s note that PTFE (Teflon™) and borosilicate glass both have densities in the range of 2,200 to 2,400 kg/m³. Therefore, for PTFE-coated borosilicate glass fiber filters, an acceptable ρ_s is 2,300 kg/m³. Note also that polymethylpentene has a density of 850 kg/m³. Because Teflon PTFE membrane filters have an integral polymethylpentene support ring that accounts for 95% of the filter mass, an acceptable ρ_s for these filters is 920 kg/m³. Other ρ_s values for other filters may be obtained similarly. Information about “ ρ_s ” should be available from the calibration weight manufacturer.

(iii) This paragraph (c)(3)(iii) shows an example of the buoyancy correction. This example assumes the following inputs: Barometric pressure (P)=101.325 kPa, temperature (T)=22.0 °C, dewpoint temperature (T_{dp})=9.5 °C, balance display (R)=100.0000 mg, calibration weight density (ρ_w)=8,000 kg/m³, and filter material density (ρ_s)=2,300 kg/m³. Then:

(A) The water vapor pressure (P_w) is calculated as:

$$P_w = 0.6113 \times 10^{\wedge} ((7.5 \times 9.5) / (237.3 + 9.5)) = 1.186 \text{ kPa.}$$

(B) The air density (A) is calculated as:

$$A = (3.484 \times 101.325 - 1.317 \times 1.186) / (22.0 + 273.15) = 1.191 \text{ kg/m}^3.$$

(C) The corrected mass (M) is calculated as:

$$M = 100.0000 \times (1 - (1.191 / 8000)) / (1 - (1.191 / 2300)) = 100.0369 \text{ mg.}$$

(4) The uncorrected weight, corrected weight, barometric pressure, temperature and humidity, of the filter shall be recorded. Afterward the filter shall be returned to the lower half of the filter cassette, and the upper half of the cassette shall be set in place. The cassette-with filter-shall then be stored in a covered glass petri dish or a sealed (i.e., ends plugged) filter holder assembly, either of which shall remain in the filter stabilization environment until needed for testing. It is recommended that the filter be transported between the filter stabilization environment and the location of the emissions test within a sealed filter holder assembly.

(5) After the emissions test, the filter cassette shall be removed from the filter holder assembly. If this removal is performed in the filter stabilization environment, the upper half of the cassette shall be removed using a properly designed separator tool, the lower half of the cassette-with filter-shall be placed in a partially covered petri dish, and allowed to stabilize for at least 30 minutes. Otherwise, the cassette and filter shall be placed in a closed petri dish until it can be returned to the filter stabilization environment. Once the closed petri dish is returned to the filter stabilization environment, the petri dish shall be opened, the upper half of the cassette shall be removed using a properly designed separator tool, the lower half of the cassette-with filter-shall be placed in a partially covered petri dish, and allowed to stabilize for at least one hour.

(6) After at least 30 minutes, but no more than 60 hours of stabilization, each filter may be weighed using the specified microbalance. The process of weighing a filter may be repeated and a statistical mean may be calculated. Sound engineering judgment shall dictate the use of statistics to discard outliers and the weighting of averages. For a used filter, its single weight or statistical mean weight shall be identified as the uncorrected gross weight of the filter. The uncorrected gross weight shall be corrected for filter buoyancy using the procedure in (c)(3) of this section. The uncorrected gross filter weight, corrected gross filter weight, barometric pressure, temperature, and dewpoint shall be recorded.

(7) The net particulate matter weight (Pf) of each filter shall be equal to the corrected gross filter weight minus the corrected tare filter weight.

(8) Should the particulate matter on the filters contact the petri dish, tweezers, microbalance or any other surface, the data with respect to that filter is void.

[66 FR 5177, Jan. 18, 2001]

§ 86.1313-94 Fuel specifications.

(a) *Gasoline fuel.* (1) Gasoline having the specifications listed in table N94-1 will be used by the Administrator in exhaust emission testing. Gasoline having these specifications or substantially equivalent specifications approved by the Administrator, shall be used by the manufacturer in exhaust emission testing, except that the octane specification does not apply.

TABLE N94-1

Item	ASTM	Value
Octane, research, min	D2699	93
Sensitivity, min		7.5
Lead (organic), g/U.S. gal. (g/liter)	D3237	¹ (0.050) ¹ (0.013)
Distillation range:		
IBP, °F (°C)	D86	75-95 (23.9-35)
10 pct. point, °F (°C)	D86	120-135 (48.9-57.2)
50 pct. point, °F (°C)	D86	200-230 (93.3-110)
90 pct. point, °F (°C)	D86	300-325 (148.9-162.8)
EP, max. °F (°C)	D86	415 (212.8)
Sulphur, Max., wt. pct	D1266	0.10
Phosphorus, max., g/U.S. gal. (g/liter)	D3231	0.005 (0.0013)
RVP, psi (kPa)	D323	8.0-9.2 (60.0-63.4)
Hydrocarbon composition:		
Olefins, max. pct	D1319	10
Aromatics, max. pct	D1319	35
Saturates	D1319	(²)

¹ Maximum.
² Remainder.

(2)(i) Unleaded gasoline representative of commercial gasoline which will be generally available through retail outlets shall be used in service accumulation.