Environmental Protection Agency

§ 1065.170 Batch sampling for gaseous and PM constituents.

Batch sampling involves collecting and storing emissions for later analysis. Examples of batch sampling include collecting and storing gaseous emissions in a bag or collecting and storing PM on a filter. You may use batch sampling to store emissions that have been diluted at least once in some way, such as with CVS, PPD, or BMD. You may use batch-sampling to store undiluted emissions.

(a) Sampling methods. If you extract from a constant-volume flow rate, sample at a constant-volume flow rate as follows:

(1) Validate proportional sampling after an emission test as described in §1065.545. Use good engineering judgment to select storage media that will not significantly change measured emission levels (either up or down). For example, do not use sample bags for...
storing emissions if the bags are permeable with respect to emissions or if they offgas emissions to the extent that it affects your ability to demonstrate compliance with the applicable gaseous emission standards. As another example, do not use PM filters that irreversibly absorb or adsorb gases to the extent that it affects your ability to demonstrate compliance with the applicable PM emission standard.

(2) You must follow the requirements in §1065.140(e)(2) related to PM dilution ratios. For each filter, if you expect the net PM mass on the filter to exceed 400 μg, assuming a 38 mm diameter filter stain area, you may take the following actions in sequence:

(i) For discrete-mode testing only, you may reduce sample time as needed to target a filter loading of 400 μg, but not below the minimum sample time specified in the standard-setting part.

(ii) Reduce filter face velocity as needed to target a filter loading of 400 μg, down to 50 cm/s or less.

(iii) Increase overall dilution ratio above the values specified in §1065.140(e)(2) to target a filter loading of 400 μg.

(b) Gaseous sample storage media. Store gas volumes in sufficiently clean containers that minimally off-gas or allow permeation of gases. Use good engineering judgment to determine acceptable thresholds of storage media cleanliness and permeation. To clean a container, you may repeatedly purge and evacuate a container and you may heat it. Use a flexible container (such as a bag) within a temperature-controlled environment, or use a temperature-controlled rigid container that is initially evacuated or has a volume that can be displaced, such as a piston and cylinder arrangement. Use containers meeting the specifications in the following table, noting that you may request to use other container materials under §1065.10:

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Engines</th>
<th>All other engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO, CO₂, O₂, CH₄, C₂H₆, C₃H₈, NO, NO₂</td>
<td>Tedlar™, Kynar™, Teflon™, or 300 series stainless steel¹</td>
<td>Tedlar™, Kynar™, Teflon™, or 300 series stainless steel²</td>
</tr>
<tr>
<td>THC, NMHC</td>
<td>Teflon™ or 300 series stainless steel⁴</td>
<td>Teflon™ or 300 series stainless steel³</td>
</tr>
</tbody>
</table>

¹ As long as you prevent aqueous condensation in storage container.
² Up to 40 °C.
³ Up to 202 °C.
⁴ At (191 ±11) °C.

(c) PM sample media. Apply the following methods for sampling particulate emissions:

(1) If you use filter-based sampling media to extract and store PM for measurement, your procedure must meet the following specifications:

(i) If you expect that a filter’s total surface concentration of PM will exceed 400 μg, assuming a 38 mm diameter filter stain area, for a given test interval, you may use filter media with a minimum initial collection efficiency of 98%; otherwise you must use a filter media with a minimum initial collection efficiency of 99.7%. Collection efficiency must be measured as described in ASTM D2986–95a (incorporated by reference in §1065.1010), though you may rely on the sample-media manufacturer’s measurements reflected in their product ratings to show that you meet this requirement.

(ii) The filter must be circular, with an overall diameter of 46.50 ±0.6 mm and an exposed diameter of at least 38 mm. See the cassette specifications in paragraph (c)(1)(vii) of this section.

(iii) We highly recommend that you use a pure PTFE filter material that does not have any flow-through support bonded to the back and has an overall thickness of 40 ±20 μm. An inert
polymer ring may be bonded to the periphery of the filter material for support and for sealing between the filter cassette parts. We consider Polymethylpentene (PMP) and PTFE inert materials for a support ring, but other inert materials may be used. See the cassette specifications in paragraph (c)(1)(vii) of this section. We allow the use of PTFE-coated glass fiber filter material, as long as this filter media selection does not affect your ability to demonstrate compliance with the applicable standards, which we base on a pure PTFE filter material. Note that we will use pure PTFE filter material for compliance testing, and we may require you to use pure PTFE filter material for any compliance testing we require, such as for selective enforcement audits.

(iv) You may request to use other filter materials or sizes under the provisions of §1065.10.

(v) To minimize turbulent deposition and to deposit PM evenly on a filter, use a filter holder with a 12.5° (from center) divergent cone angle to transition from the transfer-line inside diameter to the exposed diameter of the filter face. Use 300 series stainless steel for this transition.

(vi) Maintain a filter face velocity near 100 cm/s with less than 5% of the recorded flow values exceeding 100 cm/s, unless you expect the net PM mass on the filter to exceed 400 μg, assuming a 38 mm diameter filter stain area. Measure face velocity as the volumetric flow rate of the sample at the pressure upstream of the filter and temperature of the filter face as measured in §1065.140(e), divided by the filter's exposed area. You may use the exhaust stack or CVS tunnel pressure for the upstream pressure if the pressure drop through the PM sampler up to the filter is less than 2 kPa.

(vii) Use a clean cassette designed to the specifications of Figure 1 of §1065.170. In auto changer configurations, you may use cassettes of similar design. Cassettes must be made of one of the following materials: Delrin®Tm, 300 series stainless steel, polycarbonate, acrylonitrile-butadiene-styrene (ABS) resin, or conductive polypropylene. We recommend that you keep filter cassettes clean by periodically washing or wiping them with a compatible solvent applied using a lint-free cloth. Depending upon your cassette material, ethanol (C2H5OH) might be an acceptable solvent. Your cleaning frequency will depend on your engine’s PM and HC emissions.

(viii) If you keep the cassette in the filter holder after sampling, prevent flow through the filter until either the holder or cassette is removed from the PM sampler. If you remove the cassettes from filter holders after sampling, transfer the cassette to an individual container that is covered or sealed to prevent communication of semi-volatile matter from one filter to another. If you remove the filter holder, cap the inlet and outlet. Keep them covered or sealed until they return to the stabilization or weighing environments.

(ix) The filters should not be handled outside of the PM stabilization and weighing environments and should be loaded into cassettes, filter holders, or auto changer apparatus before removal from these environments.

(2) You may use other PM sample media that we approve under §1065.10, including non-filtering techniques. For example, you might deposit PM on an inert substrate that collects PM using electrostatic, thermophoresis, inertia, diffusion, or some other deposition mechanism, as approved.
§ 1065.190 PM-stabilization and weighing environments for gravimetric analysis.

(a) This section describes the two environments required to stabilize and weigh PM for gravimetric analysis: the PM stabilization environment, where filters are stored before weighing; and the weighing environment, where the balance is located. The two environments may share a common space. These volumes may be one or more rooms, or they may be much smaller, such as a glove box or an automated weighing system consisting of one or more countertop-sized environments.

(b) We recommend that you keep both the stabilization and the weighing environments free of ambient contaminants, such as dust, aerosols, or semivolatile material that could contaminate PM samples. We recommend that these environments conform with an "as-built" Class Six clean room specification according to ISO 14644-1 (incorporated by reference in §1065.1010); however, we also recommend that you deviate from ISO 14644-1 as necessary to minimize air motion that might affect weighing. We recommend maximum air-supply and air-return velocities of 0.05 m/s in the weighing environment.

(c) Verify the cleanliness of the PM-stabilization environment using reference filters, as described in §1065.390(d).

(d) Maintain the following ambient conditions within the two environments during all stabilization and weighing:

1. Ambient temperature and tolerances. Maintain the weighing environment at a tolerance of (22 ±1) °C. If the two environments share a common space, maintain both environments at a tolerance of (22 ±1) °C. If they are separate, maintain the stabilization environment at a tolerance of (22 ±3) °C.