

**§ 1065.590 PM sample preconditioning and tare weighing.**

Before an emission test, take the following steps to prepare PM samples and equipment for PM measurements:

(a) Make sure the balance and PM-stabilization environments meet the periodic verifications in § 1065.390.

(b) Visually inspect unused sample media (such as filters) for defects.

(c) To handle PM samples, use electrically grounded tweezers or a grounding strap, as described in § 1065.190.

(d) Place unused sample media in one or more containers that are open to the PM-stabilization environment. If you are using filters, you may place them in the bottom half of a filter cassette.

(e) Stabilize sample media in the PM-stabilization environment. Consider an unused sample medium stabilized as long as it has been in the PM-stabilization environment for a minimum of 30 min, during which the PM-stabilization environment has been within the specifications of § 1065.190.

(f) Weigh the sample media automatically or manually, as follows:

(1) For automatic weighing, follow the automation system manufacturer's instructions to prepare samples for weighing. This may include placing the samples in a special container.

(2) For manual weighing, use good engineering judgment to determine if substitution weighing is necessary to show that an engine meets the applicable standard. You may follow the substitution weighing procedure in paragraph (j) of this section, or you may develop your own procedure.

(g) Correct the measured weight for buoyancy as described in § 1065.690. These buoyancy-corrected values are the tare masses of the PM samples.

(h) You may repeat measurements to determine mean masses. Use good engineering judgment to exclude outliers and calculate mean mass values.

(i) If you use filters as sample media, load unused filters that have been tare-weighed into clean filter cassettes and place the loaded cassettes in a covered or sealed container before taking them to the test cell for sampling. 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 ( $C_2H_5OH$ ) might be an acceptable solvent. Your cleaning frequency will depend on your engine's level of PM and HC emissions.

(j) Substitution weighing involves measurement of a reference weight before and after each weighing of a PM sample. While substitution weighing requires more measurements, it corrects for a balance's zero-drift and it relies on balance linearity only over a small range. This is most advantageous when quantifying net PM masses that are less than 0.1% of the sample medium's mass. However, it may not be advantageous when net PM masses exceed 1% of the sample medium's mass. The following steps are an example of substitution weighing:

(1) Use electrically grounded tweezers or a grounding strap, as described in § 1065.190.

(2) Use a static neutralizer as described in § 1065.190 to minimize static electric charge on any object before it is placed on the balance pan.

(3) Place on the balance pan a metal calibration weight that has a similar mass to that of the sample medium and meets the specifications for calibration weights in § 1065.790. If you use filters, the weight's mass should be about (80 to 100) mg for typical 47 mm diameter filters.

(4) Record the stable balance reading, then remove the calibration weight.

(5) Weigh an unused sample, record the stable balance reading and record the balance environment's dewpoint, ambient temperature, and atmospheric pressure.

(6) Reweigh the calibration weight and record the stable balance reading.

(7) Calculate the arithmetic mean of the two calibration-weight readings that you recorded immediately before and after weighing the unused sample. Subtract that mean value from the unused sample reading, then add the true mass of the calibration weight as stated on the calibration-weight certificate. Record this result. This is the unused sample's tare weight without correcting for buoyancy.

(8) Repeat these substitution-weighing steps for the remainder of your unused sample media.

§ 1065.595

40 CFR Ch. I (7-1-07 Edition)

(9) Follow the instructions given in paragraphs (g) through (i) of this section.

**§ 1065.595 PM sample post-conditioning and total weighing.**

(a) Make sure the weighing and PM-stabilization environments have met the periodic verifications in § 1065.390.

(b) In the PM-stabilization environment, remove PM samples from sealed containers. If you use filters, you may remove them from their cassettes before or after stabilization. When you remove a filter from a cassette, separate the top half of the cassette from the bottom half using a cassette separator designed for this purpose.

(c) To handle PM samples, use electrically grounded tweezers or a grounding strap, as described in § 1065.190.

(d) Visually inspect PM samples. If PM ever contacts the transport container, cassette assembly, filter-separator tool, tweezers, static neutralizer, balance, or any other surface, void the measurements associated with that sample and clean the surface it contacted.

(e) To stabilize PM samples, place them in one or more containers that are open to the PM-stabilization environment, which is described in § 1065.190. A PM sample is stabilized as long as it has been in the PM-stabilization environment for one of the following durations, during which the stabilization environment has been within the specifications of § 1065.190:

(1) If you expect that a filter's total surface concentration of PM will be greater than about 0.473 mm/mm<sup>2</sup>, expose the filter to the stabilization environment for at least 60 minutes before weighing.

(2) If you expect that a filter's total surface concentration of PM will be less than about 0.473 mm/mm<sup>2</sup>, expose the filter to the stabilization environment for at least 30 minutes before weighing.

(3) If you are unsure of a filter's total surface concentration of PM, expose the filter to the stabilization environment for at least 60 minutes before weighing.

(f) Repeat the procedures in § 1065.590(f) through (i) to weigh used PM samples. Refer to a sample's post-

test mass, after correcting for buoyancy, as its total mass.

(g) Subtract each buoyancy-corrected tare mass from its respective buoyancy-corrected total mass. The result is the net PM mass,  $m_{PM}$ . Use  $m_{PM}$  in emission calculations in § 1065.650.

**Subpart G—Calculations and Data Requirements**

**§ 1065.601 Overview.**

(a) This subpart describes how to—

(1) Use the signals recorded before, during, and after an emission test to calculate brake-specific emissions of each regulated constituent.

(2) Perform calculations for calibrations and performance checks.

(3) Determine statistical values.

(b) You may use data from multiple systems to calculate test results for a single emission test, consistent with good engineering judgment. You may not use test results from multiple emission tests to report emissions. We allow weighted means where appropriate. You may discard statistical outliers, but you must report all results.

(c) You may use any of the following calculations instead of the calculations specified in this subpart G:

(1) Mass-based emission calculations prescribed by the International Organization for Standardization (ISO), according to ISO 8178.

(2) Other calculations that you show are equivalent to within  $\pm 0.1\%$  of the brake-specific emission results determined using the calculations specified in this subpart G.

**§ 1065.602 Statistics.**

(a) *Overview.* This section contains equations and example calculations for statistics that are specified in this part. In this section we use the letter "y" to denote a generic measured quantity, the superscript over-bar " $\bar{\phantom{y}}$ " to denote an arithmetic mean, and the subscript "<sub>ref</sub>" to denote the reference quantity being measured.

(b) *Arithmetic mean.* Calculate an arithmetic mean,  $\bar{y}$ , as follows: