

guidelines in paragraph (e)(7) of this section. Agreement of the fit should be within 1.0% of point. Install the new Cd curve fit in the test cell flow computing device and conduct the propane injection, flow verification test.

(f) *CVS system verification.* The following “gravimetric” technique can be used to verify that the CVS and analytical instruments can accurately measure a mass of gas that has been injected into the system. (Verification can also be accomplished by constant flow metering using critical flow orifice devices.)

(1) Obtain a small cylinder that has been charged with pure propane or carbon monoxide gas (CAUTION—carbon monoxide is poisonous).

(2) Determine a reference cylinder weight to the nearest 0.01 grams.

(3) Operate the CVS in the normal manner and release a quantity of pure propane into the system during the sampling period (approximately 5 minutes).

(4) Following completion of step (3) above (if methanol injection is required), continue to operate the CVS in the normal manner and release a known quantity of pure methanol (in gaseous form) into the system during the sampling period (approximately five minutes). This step does not need to be performed with each verification, provided that it is performed at least twice annually.

(5) The calculations of § 86.1342 are performed in the normal way except in the case of propane. The density of propane (17.30 g/ft<sup>3</sup>/carbon atom (0.6109 kg/m<sup>3</sup>/carbon atom)) is used in place of the density of exhaust hydrocarbons. In the case of methanol, the density of 37.71 g/ft<sup>3</sup> (1.332 kg/m<sup>3</sup>) is used.

(6) The gravimetric mass is subtracted from the CVS measured mass and then divided by the gravimetric mass to determine the percent accuracy of the system.

(7) The cause for any discrepancy greater than ±2 percent must be found and corrected. (For 1991–1995 calendar years, discrepancies greater than ±2 percent are allowed for the methanol test, provided that they do not exceed ±6 percent.)

(8) The Administrator, upon request, may waive the requirement to comply

with ±2 percent methanol recovery tolerance, and instead require compliance with a higher tolerance (not to exceed ±6 percent), provided that:

(i) The Administrator determines that compliance with these specified tolerances is not practically feasible; and

(ii) The manufacturer makes information available to the Administrator which indicates that the calibration tests and their results are consistent with good laboratory practice, and that the results are consistent with the results of calibration testing conducted by the Administrator.

[54 FR 14591, Apr. 11, 1989, as amended at 60 FR 34371, June 30, 1995; 63 FR 24449, May 4, 1998; 65 FR 8279, Feb. 18, 2000; 66 FR 5181, Jan. 18, 2001]

**§ 86.1320-90 Gas meter or flow instrumentation calibration; particulate, methanol, and formaldehyde measurement.**

(a) Sampling for particulate, methanol and formaldehyde emissions requires the use of gas meters or flow instrumentation to determine flow through the particulate filters, methanol impingers and formaldehyde impingers. These instruments shall receive initial and periodic calibrations as follows:

(1)(i) Install a calibration device in series with the instrument. A critical flow orifice, a bellmouth nozzle, or a laminar flow element or an NBS traceable flow calibration device is required as the standard device.

(ii) The flow system should be checked for leaks between the calibration and sampling meters, including any pumps that may be part of the system, using good engineering practice.

(2) Flow air through the calibration system at the sample flow rate used for particulate, methanol, and formaldehyde testing and at the backpressure which occurs during the sample test.

(3) When the temperature and pressure in the system have stabilized, measure the indicated gas volume over a time period of at least five minutes or until a gas volume of at least ±1 percent accuracy can be determined by the standard device. Record the stabilized air temperature and pressure

upstream of the instrument and as required for the standard device.

(4) Calculate air flow at standard conditions as measured by both the standard device and the instrument(s). (Standard conditions are defined as 68 °F (20 °C) and 29.92 in Hg (101.3 kPa).)

(5) Repeat the procedures of paragraphs (a) (2) through (4) of this section using at least two flow rates which bracket the typical operating range.

(6) If the air flow at standard conditions measured by the instrument differs by  $\pm 1.0$  percent of the maximum operating range or  $\pm 2.0$  percent of the point (whichever is smaller), then a correction shall be made by either of the following two methods:

(i) Mechanically adjust the instrument so that it agrees with the calibration measurement at the specified flow rates using the criteria of paragraph (a)(6) of this section, or

(ii) Develop a continuous best fit calibration curve for the instrument (as a function of the calibration device flow measurement) from the calibration points to determine corrected flow. The points on the calibration curve relative to the calibration device measurements must be within  $\pm 1.0$  percent of the maximum operating range of  $\pm 2.0$  percent of the point (whichever is smaller).

(7) For double dilution systems, the accuracy of the secondary dilution flow measurement device should be within  $\pm 1.0$  percent of the total flow through the filter.

(b) *Other systems.* A bell prover may be used to calibrate the instrument if the procedure outlined in ANSI B109.1-1973 is used. Prior approval by the Administrator is not required to use the bell prover.

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**§ 86.1321-94 Hydrocarbon analyzer calibration.**

The FID hydrocarbon analyzer shall receive the following initial and periodic calibration. The HFID used with petroleum-fueled, natural gas-fueled and liquefied petroleum gas-fueled diesel engines shall be operated to a set point  $\pm 10$  °F ( $\pm 5.5$  °C) between 365 and 385 °F (185 and 197 °C). The HFID used with methanol-fueled engines shall be operated at  $235 \pm 15$  °F ( $113 \pm 8$  °C).

(a) Initial and periodic optimization of detector response. Prior to introduction into service and at least annually thereafter, the FID hydrocarbon analyzer shall be adjusted for optimum hydrocarbon response.

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 86.1314) and zero-grade air.

(2) Optimize the FID's response on the most common operating range. The response is to be optimized with respect to fuel pressure or flow while meeting the analyzer response time given in § 86.1310(b)(3)(vii)(A) for continuous HC measurement. Efforts shall be made to minimize response variations to different hydrocarbon species that are expected to be in the exhaust. Good engineering judgement is to be used to trade off optimal FID response to propane-in-air against reductions in relative responses to other hydrocarbons. A good example of trading off response on propane for relative responses to other hydrocarbon species is given in Society of Automotive Engineers (SAE) Paper No. 770141, "Optimization of Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts"; author Glenn D. Reschke. It is also required that the response be set to optimum condition with respect to air flow and sample flow. Heated Flame Ionization Detectors (HFIDs) must be at their specified operating temperature.

(3) One of the following procedures is to be used for FID or HFID optimization:

(i) Use the procedures outlined in Society of Automotive Engineers (SAE) paper number 770141, "Optimization of Flame Ionization Detector for Determination of Hydrocarbons in Diluted Automobile Exhaust"; author, Glenn D. Reschke, as an example. Available from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA 15096-0001.

(ii) The procedure listed in § 86.331-79(c).

(iii) The procedures specified by the manufacturer of the FID or HFID.

(iv) Alternative procedures may be used if approved in advance by the Administrator.