

contain less than 1 ppm equivalent carbon response. 98 to 100 percent hydrogen fuel may be used with advance approval by the Administrator.

(f) The allowable zero gas (air or nitrogen) impurity concentrations shall not exceed 1 ppm equivalent carbon response, 1 ppm carbon monoxide, 0.04 percent (400 ppm) carbon dioxide and 0.1 ppm nitric oxide.

(g)(1) "Zero-grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18 and 21 mole percent.

(2) Calibration gases (not including methanol) shall be traceable to within one percent of NIST (formerly NBS) gas standards, or other gas standards which have been approved by the Administrator.

(3) Span gases (not including methanol) shall be accurate to within two percent of true concentration, where true concentration refers to NIST (formerly NBS) gas standards, or other gas standards which have been approved by the Administrator.

(4) Methanol in air gases used for response factor determination shall:

(i) Be traceable to within  $\pm 2$  percent of NIST (formerly NBS) gas standards, or other standards which have been approved by the Administrator; and

(ii) Remain within  $\pm 2$  percent of the labeled concentration. Demonstration of stability shall be based on a quarterly measurement procedure with a precision of  $\pm 2$  percent (two standard deviations), or other method approved by the Administrator. The measurement procedure may incorporate multiple measurements. If the true concentration of the gas changes by more than two percent, but less than ten percent, the gas may be relabeled with the new concentration.

(h) The use of precision blending devices (gas dividers) to obtain the required calibration gas concentrations is acceptable, provided that the blended gases are accurate to within  $\pm 1.5$  percent of NBS gas standards, or other gas standards which have been approved by the Administrator. This accuracy implies that primary gases used for blending must be "named" to an accuracy of at least  $\pm 1$  percent, traceable

to NBS or other approved gas standards.

[59 FR 48530, Sept. 21, 1994, as amended at 60 FR 34371, June 30, 1995]

**§ 86.1316-94 Calibrations; frequency and overview.**

(a) Calibrations shall be performed as specified in §§ 86.1318 through 86.1326.

(b) At least monthly or after any maintenance which could alter calibration, the following calibrations and checks shall be performed:

(1) Calibrate the hydrocarbon analyzer, carbon dioxide analyzer, carbon monoxide analyzer, and oxides of nitrogen analyzer (certain analyzers may require more frequent calibration depending on the equipment and use). New calibration curves need not be generated each month if the existing curve meets the requirements of §§ 86.1321 through 86.1324.

(2) Calibrate the engine dynamometer flywheel torque and speed measurement transducers, and calculate the feedback signals to the cycle verification equipment.

(3) Check the oxides of nitrogen converter efficiency.

(c) At least weekly or after any maintenance which could alter calibration, the following checks shall be performed:

(1) Perform a CVS system verification.

(2) Check the shaft torque feedback signal at steady-state conditions by comparing:

(i) Shaft torque feedback to dynamometer beam load; or

(ii) By comparing in-line torque to armature current; or

(iii) By checking the in-line torque meter with a dead weight per § 86.1308(e).

(d) The CVS positive displacement pump or critical flow venturi shall be calibrated following initial installation, major maintenance or as necessary when indicated by the CVS system verification (described in § 86.1319).

(e) Sample conditioning columns, if used in the CO analyzer train, should be checked at a frequency consistent with observed column life or when the indicator of the column packing begins to show deterioration.

**§ 86.1318-84**

**40 CFR Ch. I (7-1-11 Edition)**

(f) For diesel fuel testing only. The carbon monoxide analyzer shall be calibrated at least every two months or after any maintenance which could alter calibration.

[59 FR 48530, Sept. 21, 1994, as amended at 60 FR 34371, June 30, 1995; 62 FR 47126, Sept. 5, 1997]

**§ 86.1318-84 Engine dynamometer system calibrations.**

(a) The engine flywheel torque and engine speed measurement transducers shall be calibrated at least once each month with the calibration equipment described in § 86.1308-84.

(b) The engine flywheel torque feedback signals to the cycle verification equipment shall be electronically checked before each test, and adjusted as necessary.

(c) Other engine dynamometer system calibrations shall be performed as dictated by good engineering practice.

(d) When calibrating the engine flywheel torque transducer, any lever arm used to convert a weight or a force through a distance into a torque shall be used in a horizontal position ( $\pm 5$  degrees).

(e) Calibrated resistors may not be used for engine flywheel torque transducer calibration, but may be used to span the transducer prior to engine testing.

**§ 86.1319-90 CVS calibration.**

(a) The CVS is calibrated using an accurate flowmeter and restrictor valve. The flowmeter calibration shall be traceable to the NBS, and will serve as the reference value (NBS "true" value) for the CVS calibration. (*Note:* In no case should an upstream screen or other restriction which can affect the flow be used ahead of the flowmeter unless calibrated throughout the flow range with such a device.) The CVS calibration procedures are designed for use of a "metering venturi" type flowmeter. Large radius or ASME flow nozzles are considered equivalent if traceable to NBS measurements. Other measurement systems may be used if shown to be equivalent under the test conditions in this section and traceable to NBS measurements. Measurements of the various flowmeter parameters are recorded and related to flow

through the CVS. Procedures used by EPA for both PDP-CVS and CFV-CVS are outlined below. Other procedures yielding equivalent results may be used if approved in advance by the Administrator.

(b) After the calibration curve has been obtained, verification of the entire system may be performed by injecting a known mass of gas into the system and comparing the mass indicated by the system to the true mass injected. An indicated error does not necessarily mean that the calibration is wrong, since other factors can influence the accuracy of the system (e.g., analyzer calibration, leaks, or HC hangup). A verification procedure is found in paragraph (e) of this section.

(c) *PDP calibration.* (1) The following calibration procedure outlines the equipment, the test configuration, and the various parameters which must be measured to establish the flow rate of the CVS pump.

(i) All the parameters related to the pump are simultaneously measured with the parameters related to a flowmeter which is connected in series with the pump.

(ii) The calculated flow rate,  $\text{ft}^3/\text{min}$ , (at pump inlet absolute pressure and temperature) can then be plotted versus a correlation function which is the value of a specific combination of pump parameters.

(iii) The linear equation which relates the pump flow and the correlation function is then determined.

(iv) In the event that a CVS has a multiple speed drive, a calibration for each range used must be performed.

(2) This calibration procedure is based on the measurement of the absolute values of the pump and flowmeter parameters that relate the flow rate at each point. Two conditions must be maintained to assure the accuracy and integrity of the calibration curve:

(i) The temperature stability must be maintained during calibration. (Flowmeters are sensitive to inlet temperature oscillations; this can cause the data points to be scattered. Gradual changes in temperature are acceptable as long as they occur over a period of several minutes.)

(ii) All connections and ducting between the flowmeter and the CVS