

probe, but sufficiently distant (radially) from other probes and the tunnel wall so as to be free from the influences of any wakes or eddies.

(B) The sample probe for continuously intergrated NO_x, CO, and CO₂ must be heated and insulated over the entire length, to prevent water condensation, to a minimum temperature of 55 °C. Sample gas temperature immediately before the first filter in the system must be at least 55 °C.

(ii) Conform to the continuous NO_x, CO, or CO₂ sampling and analysis system to the specifications of part 86, subpart D of this chapter with the following exceptions and revisions:

(A) Heat the system components requiring heating only to prevent water condensation, the minimum component temperature is 55 °C.

(B) Coordinate analysis system response time with CVS flow fluctuations and sampling time/test cycle offsets, if necessary.

(C) Use only analytical gases conforming to the specifications of §90.312 of this subpart for calibration, zero and span checks.

(D) Use a calibration curve conforming to §90.321 for CO and CO₂ and §90.318 for NO_x for any range on a linear analyzer below 155 ppm.

(iii) Convert the chart deflections or voltage output of analyzers with non-linear calibration curves to concentration values by the calibration curve(s) specified in §90.321 of this chapter before flow correction (if used) and subsequent integration takes place.

§ 90.422 Background sample.

(a) Background samples are produced by drawing a sample of the dilution air during the exhaust collection phase of each test cycle mode.

(1) An individual background sample may be produced and analyzed for each mode. Hence, a unique background value will be used for the emission calculations for each mode.

(2) Alternatively, a single background sample may be produced by drawing a sample during the collection phase of each test cycle mode. Hence, a single cumulative background value will be used for the emission calculations for each mode.

(b) For analysis of the individual sample described in paragraph (a)(1) of this section, a single value representing the average chart deflection over a 10-second stabilized period must be stored. All readings taken during the data logging period must be stable within ± one percent of full scale.

(c) Measure HC, CO, CO₂, and NO_x exhaust and background concentrations in the sample bag(s) with approximately the same flow rates and pressures used during calibration.

§ 90.423 Exhaust gas analytical system; CVS grab sample.

(a) *Schematic drawings.* Figure 4 in Appendix B of this subpart is a schematic drawing of the exhaust gas analytical systems used for analyzing CVS grab "bag" samples from spark-ignition engines. Since various configurations can produce accurate results, exact conformance with the drawing is not required. Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of the component systems. Other components such as snubbers, which are not needed to maintain accuracy in some systems, may be excluded if their exclusion is based upon good engineering judgment.

(b) *Major component description.* The analytical system, Figure 4 in Appendix B of this subpart, consists of a flame ionization detector (FID) or a heated flame ionization detector (HFID) for the measurement of hydrocarbons, non-dispersive infrared analyzers (NDIR) for the measurement of carbon monoxide and carbon dioxide, and a chemiluminescence detector (CLD) (or heated CLD (HCLD)) for the measurement of oxides of nitrogen. The exhaust gas analytical system must conform to the following requirements:

(1) The CLD (or HCLD) requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator.

(2) If CO instruments are used which are essentially free of CO₂ and water

vapor interference, the use of the conditioning column may be deleted. (See § 90.317 and § 90.320.)

(3) A CO instrument is considered to be essentially free of CO₂ and water vapor interference if its response to a mixture of three percent CO₂ in N₂, which has been bubbled through water at room temperature, produces an equivalent CO response, as measured on the most sensitive CO range, which is less than one percent of full-scale CO concentration on ranges above 300 ppm full scale or less than three ppm on ranges below 300 ppm full scale. (See § 90.317.)

(c) *Alternate analytical systems.* Analysis systems meeting the specifications and requirements of this subpart for dilute sampling may be used upon approval of the Administrator.

(d) *Other analyzers and equipment.* Other types of analyzers and equipment may be used if shown to yield equivalent results and if approved in advance by the Administrator.

§ 90.424 Dilute sampling procedures—CVS calibration.

(a) The CVS is calibrated using an accurate flowmeter and restrictor valve.

(1) The flowmeter calibration must be traceable to the National Institute for Standards and Testing (NIST) and serves as the reference value (NIST “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.)

(2) The CVS calibration procedures are designed for use of a “metering venturi” type flowmeter. Large radius or American Society of Mechanical Engineers (ASME) flow nozzles are considered equivalent if traceable to NIST measurements. Other measurement systems may be used if shown to be equivalent under the test conditions in this section and traceable to NIST measurements.

(3) Measurements of the various flowmeter parameters are recorded and related to flow through the CVS.

(4) Procedures using both PDP-CVS and CFV-CVS are outlined in the following paragraphs. 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 (for example, analyzer calibration, leaks, or HC hangup). A verification procedure is found in paragraph (e) of this section.

(c) *PDP-CVS 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, in cm³/s, (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 pump must be absolutely void of leakage.