Environmental Protection Agency

§ 91.414 Raw gaseous exhaust sampling and analytical system description.

(a) Schematic drawing. An example of a sampling and analytical system which may be used for testing under this subpart is shown in Figure 4 in Appendix B of this subpart. All components or parts of components that are wetted by the sample or corrosive calibration gases shall be either chemically cleaned stainless steel or inert material (e.g., polytetrafluoroethylene resin). The use of “gauge savers” or “protectors” with nonreactive diaphragms to reduce dead volumes is permitted.

(b) Sample probe. (1) The sample probe shall be a straight, closed end, stainless steel, multi-hole probe. The inside diameter shall not be greater than the inside diameter of the sample line + 0.03 cm. The wall thickness of the probe shall not be greater than 0.10 cm. The fitting that attaches the probe to the exhaust pipe shall be as small as practical in order to minimize heat loss from the probe.

(2) The probe shall have a minimum of three holes. The spacing of the radial planes for each hole in the probe must be such that they cover approximately equal cross-sectional areas of

of 2 percent of full scale chart deflection for any range used. Otherwise the test is void.

(d) Continuous sample analysis. For continuous sample analysis, perform the following sequence:

(1) Calibrate analyzers using the procedures described in §91.326.

(2) Leak check portions of the sampling system that operate at negative gauge pressures when sampling, and allow heated sample lines, filters, pumps, and so forth to stabilize at operating temperature.

(3) Option: Determine the hang-up for the FID or HFID sampling system:

(i) Zero the analyzer using zero air introduced at the analyzer port.

(ii) Flow zero air through the overflow sampling system. Check the analyzer response.

(iii) If the overflow zero response exceeds the analyzer zero response by two percent or more of the FID or HFID full-scale deflection, hang-up is indicated and corrective action must be taken (see paragraph (e) of this section).

(iv) The complete system hang-up check specified in paragraph (f) of this section is recommended as a periodic check.

(4) Obtain a stable zero reading.

(5) Good engineering practice dictates that analyzers used for continuous analysis should be operated such that the measured concentration falls between 15 percent and 100 percent of full scale.

(6) Record the most recent zero and span response as the pre-analysis values.

(7) Collect background HC, CO, CO\textsubscript{2}, and NO\textsubscript{X} in a sample bag (for dilute exhaust sampling only, see §91.422).

(8) Perform a post-analysis zero and span check for each range used at the conditions specified in paragraph (d)(1) of this section. Record these responses as the post-analysis values.

(9) Neither the zero drift nor the span drift between the pre-analysis and post-analysis checks on any range used may exceed three percent for HC, or two percent for NO\textsubscript{X}, CO, and CO\textsubscript{2}, of full scale chart deflection, or the test is void. (If the HC drift is greater than three percent of full-scale chart deflection, hydrocarbon hang-up is likely.)

(10) Determine background levels of NO\textsubscript{X}, CO, or CO\textsubscript{2} (for dilute exhaust sampling only) by the grab (“bag”) technique outlined in paragraph (c) of this section.

(e) Hydrocarbon hang-up. If HC hang-up is indicated, the following sequence may be performed:

(1) Fill a clean sample bag with background air.

(2) Zero and span the HFID at the analyzer ports.

(3) Analyze the background air sample bag through the analyzer ports.

(4) Analyze the background air through the entire sample probe system.

(5) If the difference between the readings obtained is two ppm or more, clean the sample probe and the sample line.

(6) Reassemble the sample system, heat to specified temperature, and repeat the procedure in paragraphs (e)(1) through (e)(5) of this section.
§ 91.415 Raw gaseous sampling procedures.

Fit all heated sampling lines with a heated filter to extract solid particles from the flow of gas required for analysis. The sample line for HC measurement must be heated. The sample line for CO, CO₂, and NOₓ may be heated or unheated.

§ 91.416 Intake air flow measurement specifications.

(a) If used, the engine intake air flow measurement method used must have a range large enough to accurately measure the air flow over the engine operating range during the test. Overall measurement accuracy must be ±2 percent of full-scale value of the measurement device for all modes except the idle mode. For the idle mode, the measurement accuracy shall be ±5 percent or less of the full-scale value. The Administrator must be advised of the method used prior to testing.

(b) When an engine system incorporates devices that affect the air flow measurement (such as air bleeds, air injection, pulsed air, and so forth) that result in understated exhaust emission results, make corrections to the exhaust emission results to account for such effects.