

§ 92.119 Hydrocarbon analyzer calibration.

The HFID hydrocarbon analyzer shall receive the following initial and periodic calibration:

(a) *Initial and periodic optimization of detector response.* Prior to introduction into service and at least annually thereafter, the HFID hydrocarbon analyzer shall be adjusted for optimum hydrocarbon response. Alternate methods yielding equivalent results may be used, if approved in advance by the Administrator.

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 92.112) and zero-grade air.

(2) Optimize on the most common operating range. Introduce into the analyzer a propane-in-air mixture with a propane concentration equal to approximately 90 percent of the most common operating range.

(3) HFID optimization is performed:

(i) According to the procedures outlined in Society of Automotive Engineers (SAE) paper No. 770141, "Optimization of Flame Ionization Detector for Determination of Hydrocarbons in Diluted Automobile Exhaust", author, Glenn D. Reschke (incorporated by reference at § 92.5); or

(ii) According to the following procedures:

(A) If necessary, follow manufacturer's instructions for instrument start-up and basic operating adjustments.

(B) Set the oven temperature 5 °C hotter than the required sample-line temperature. Allow at least one-half hour after the oven has reached temperature for the system to equilibrate.

(C) *Initial fuel flow adjustment.* With the fuel and air-flow rates set at the manufacturer's recommendations, introduce a 350 ppmC ± 75 ppmC span gas to the detector. Determine the response at a given fuel flow from the difference between the span-gas response and the zero-gas response. Incrementally adjust the fuel flow above and below the manufacturer's specification. Record the span and zero response at these fuel flows. A plot of the difference between the span and zero response versus fuel flow will be similar to the one shown in Figure B119-1 of

this section. Adjust the fuel-flow rate to the rich side of the curve, as shown. This is initial flow-rate setting and may not be the final optimized flow rate.

(D) *Oxygen interference optimization.* Choose a range where the oxygen interference check gases (see § 92.112) will fall in the upper 50 percent. Conduct this test with the oven temperature set as required. Oxygen interference check gas specifications are found in § 92.112.

(1) Zero the analyzer.

(2) Span the analyzer with the 21-percent oxygen blend.

(3) Recheck zero response. If it has changed more than 0.5 percent of full scale repeat paragraphs (a)(3)(ii)(D) (1) and (2) of this section.

(4) Introduce the 5 percent and 10 percent oxygen interference check gases.

(5) Recheck the zero response. If it has changed more ± 1 percent of full scale, repeat the test.

(6) Calculate the percent of oxygen interference (%O₂I) for each mixture in step in paragraph (a)(3)(ii)(D)(4) of this section.

Percent O₂I = ((B - Analyzer response (ppmC)) / B) × 100

Analyzer response = ((A) / (Percent of full-scale analyzer response due to A)) × (Percent of full-scale analyzer response due to B)

Where:

A = hydrocarbon concentration (ppmC) of the span gas used in step in paragraph (a)(3)(ii)(D)(2) of this section.

B = hydrocarbon concentration (ppmC) of the oxygen interference check gases used in step in paragraph (a)(3)(ii)(D)(4) of this section.

(7) The percent of oxygen interference (%O₂I) must be less than ± 3.0 percent for all required oxygen interference check gases prior to testing.

(8) If the oxygen interference is greater than the specifications, incrementally adjust the air flow above and below the manufacturer's specifications, repeating paragraphs (a)(3)(ii)(D) (1) through (7) of this section for each flow.

(9) If the oxygen interference is greater than the specification after adjusting the air flow, vary the fuel flow and thereafter the sample flow, repeating paragraphs (a)(3)(ii)(D) (1) through (7) of this section for each new setting.

(10) If the oxygen interference is still greater than the specifications, repair or replace the analyzer, FID fuel, or burner air prior to testing. Repeat this section with the repaired or replaced equipment or gases.

(E) *Linearity check.* For each range used, check linearity as follows:

(1) With the fuel flow, air flow and sample flow adjust to meet the oxygen interference specification, zero the analyzer.

(2) Span the analyzer using a calibration gas that will provide a response of approximately 90 percent of full-scale concentration.

(3) Recheck the zero response. If it has changed more than 0.5 percent of full scale, repeat steps in paragraphs (a)(3)(ii)(E) (1) and (2) of this section.

(4) Record the response of calibration gases having nominal concentrations of 30, 60, and 90 percent of full-scale concentration. It is permitted to use additional concentrations.

(5) Perform a linear least square regression on the data generated. Use an equation of the form $y = mx$, where x is the actual chart deflection and y is the concentration.

(6) Use the equation $z = y/m$ to find the linear chart deflection (z) for each calibration gas concentration (y).

(7) Determine the linearity (%L) for each calibration gas by:

Percent L = $(100)(z - x) / (\text{Full-scale linear chart deflection})$

(8) The linearity criterion is met if the %L is less than ± 2 percent for each data point generated. Below 40 ppmC the linearity criterion may be expanded to ± 4 percent. For each emission test, a calibration curve of the form $y = mx$ is to be used. The slope (m) is defined for each range by the spanning process.

(9) If the %L for any point exceeds the specifications in step in paragraph

(a)(3)(ii)(E)(8) of this section, the air fuel, and sample-flow rates may be varied within the boundaries of the oxygen interference specifications.

(10) If the %L for any data point still exceeds the specifications, repair or replace the analyzer, FID fuel, burner air, or calibration bottles prior to testing. Repeat the procedures of this section with the repaired or replaced equipment or gases.

(F) *Optimized flow rates.* The fuel-flow rate, air-flow rate and sample-flow rate and sample-flow rate are defined as "optimized" at this point.

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

(4) After the optimum flow rates have been determined they are recorded for future reference.

(b) *Initial and periodic calibration.* Prior to introduction into service and monthly thereafter, the HFID hydrocarbon analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate and pressures as when analyzing samples. Calibration gases shall be introduced directly at the analyzer.

(1) Adjust analyzer to optimize performance.

(2) Zero the hydrocarbon analyzer with zero-grade air.

(3) Calibrate on each used operating range with propane-in-air calibration gases having nominal concentrations of 15, 30, 45, 60, 75 and 90 percent of that range. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

FIGURE TO § 92.119

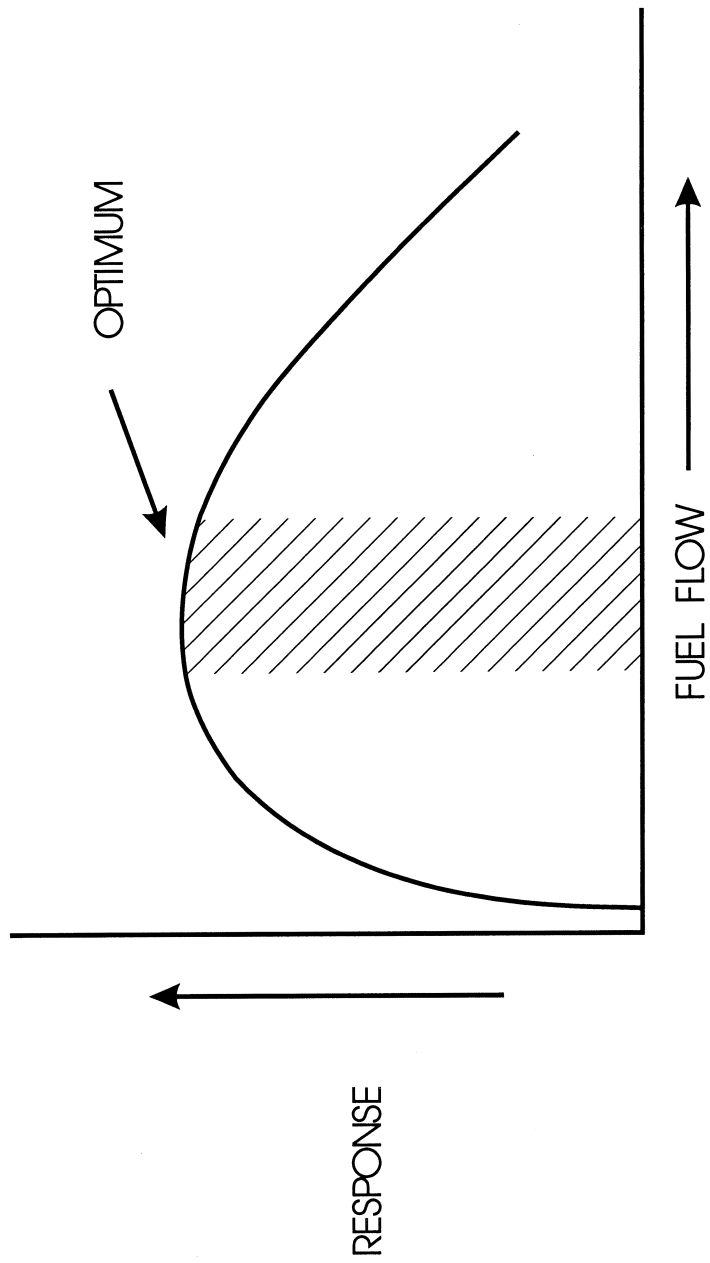


Figure B119-1 RESPONSE VS. FUEL FLOW