§ 86.140–94 Exhaust sample analysis.

The following sequence shall be performed in conjunction with each series of measurements:

(a) For CO, CO₂, CH₄, NOₓ, and for Otto-cycle and methanol-fueled, natural gas-fueled and liquefied petroleum gas-fueled (if non-heated FID option is used) diesel vehicle HC:

(1) Zero the analyzers and obtain a stable zero reading. Recheck after tests.

(2) Introduce span gases and set instrument gains. In order to avoid errors, span and calibrate at the same flow rates used to analyze the test sample. Span gases should have concentrations equal to 75 to 100 percent of full scale. If gain has shifted significantly on the analyzers, check the calibrations. Show actual concentrations on chart.

(3) Check zeroes; repeat the procedure in paragraphs (a) (1) and (2) of this section if required.

(4) Check flow rates and pressures.

(5) Measure THC, CO, CO₂, CH₄, and NOₓ concentrations of samples.

(6) Check zero and span points. If difference is greater than 2 percent of full scale, repeat the procedure in paragraphs (a) (1) through (5) of this section.

(b) For petroleum-fueled, natural gas-fueled and liquefied petroleum gas-fueled (if HFID is used) diesel vehicle HC:

(1) Zero HFID analyzer and obtain a stable zero reading.

(2) Introduce span gas and set instrument gains. Span gas should have concentration equal to 75 to 100 percent of full scale.

(3) Check zero as in paragraph (b)(1) of this section.

(4) Introduction of zero and span gas into the analyzer can be accomplished by either of the following methods:

   (i) Close heated valve in THC sample (see Figures B94–5 or B94–6) and allow gases to enter HFID. Extreme care should be taken not to introduce gases under high pressure.

   (ii) Connect zero and span line directly to THC sample probe and introduce gases at a flow rate greater than 125 percent of the HFID flow rate with the CVS blower operating (see Figures B94–5 or B94–6). Excess flow must be allowed to exit probe inlet.

(5) Continuously record (integrate electronically if desired) dilute THC emission levels during test. Background samples are collected in sample bags and analyzed as in paragraphs (b)(4) (i) or (ii) of this section.

(6) Check zero and span as in paragraphs (b) (1) through (4) of this section. If difference is greater than 2 percent of full scale, void test and check for THC “hangup” or electronic drift in analyzer.

(c) For CH₃OH (methanol-fueled vehicles), introduce test samples into the gas chromatograph and measure the concentration. This concentration is C₉₅ in the calculations.
(d) For HCHO (methanol-fueled vehicles), introduce formaldehyde test samples into the high pressure liquid chromatograph and measure the concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile. This concentration is \( C_{FS} \) in the calculations.

(e) For \( \text{CH}_4 \) analysis:

(1) In the event that the procedure results in negative \( \text{NMHC}_{\text{em}} \) values (as may occur with high methane fractions), any negative \( \text{NMHC}_{\text{em}} \) value whose absolute value is less than 10 percent of the \( \text{NMHC} \) standard shall be rounded to zero. Negative \( \text{NMHC}_{\text{em}} \) values whose absolute value is more than 10 percent of the \( \text{NMHC} \) standard shall require sample remeasurement. If the 10 percent criterion cannot be met after remeasurement, the test will be void.

(2) Other sampling procedures may be used if shown to yield equivalent or superior results and if approved in advance by the Administrator.

§ 86.142–90 Records required.

The following information shall be recorded with respect to each test:

(a) Test number.

(b) System or device tested (brief description).

(c) Date and time of day for each part of the test schedule.

(d) Test results. Also include a comparison of drive cycle energy and target cycle energy relative to both inertia and road load forces as specified in 40 CFR 1066.425 for each drive cycle or test phase, as appropriate.

(e) Driver and equipment operator IDs.

(f) Vehicle. ID number, manufacturer, model year, standards, engine family, evaporative emissions family, basic engine description (including displacement, number of cylinders, turbo-supercharger used, and catalyst usage), fuel system (including number of carburetors, number of carburetor barrels, fuel injection type, and fuel tank(s) capacity and location), engine code, gross vehicle weight rating, inertia weight class, actual curb weight at zero miles, actual road load at 50 mph (80 kph), transmission configuration, axle ratio, car line, system miles, idle rpm, and drive wheel tire pressure, as applicable.

(g) Dynamometer. Dynamometer ID, inertia weight setting, indicated power absorption setting, records to verify compliance with the vehicle speed versus time requirements of the test, and driving distance for each of the three phases of the test, calculated from the measured roll or shaft revolutions.

(h) Gas analyzers. Analyzer bench ID, analyzer ranges, recordings of analyzer output during zero, span, and sample readings.

(i) Recorder charts: Test number, date, vehicle ID, operator ID, and identification of the measurements recorded.

(j) Test cell barometric pressure, ambient temperature, and humidity.

NOTE: A central laboratory barometer may be used: Provided, that individual test cell barometric pressures are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(k) Temperatures. Records to verify compliance with the ambient temperature requirements throughout the test procedure and recordings of vehicle fuel temperature(s) during the diurnal test and of the enclosure temperatures during the diurnal and hot soak tests.

(l) CFV-CVS. Total dilute exhaust volume (Vmix) for each phase of the exhaust test.

(m) PDP-CVS. Test measurements required to calculate the Vmix. Total dilute exhaust volume (Vmix) for each phase of the exhaust test.

(n) The humidity of the dilution air.

NOTE: If conditioning columns are not used (see §§86.122 and 86.144) this measurement can be deleted. If the conditioning columns are used and the dilution air is taken from the test cell, the ambient humidity can be used for this measurement.

(o) Additional records required for diesel vehicles. (1) Pressure and temperature of the dilute exhaust mixture (and background air if sampled) at the inlet to the gas meter used for particulate sampling.

(2) The temperature of the dilute exhaust mixture inside the dilution tunnel near the inlet of the particulate probe.