

(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, CO<sub>2</sub>, CH<sub>4</sub>, and NO<sub>x</sub> 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.

NOTE: In order to minimize errors, HFID flow rate and pressure during zero and span (and background bag reading) must be exactly the same as that used during testing.

(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 CH<sub>3</sub>OH (methanol-fueled vehicles), introduce test samples into the gas chromatograph and measure the concentration. This concentration is C<sub>MS</sub> 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<sub>FS</sub> in the calculations.

(e) For CH<sub>4</sub> analysis:

(1) In the event that the procedure results in negative NMHC<sub>wm</sub> values (as may occur with high methane fractions), any negative NMHC<sub>wm</sub> value whose absolute value is less than 10 percent of the NMHC standard shall be rounded to zero. Negative NMHC<sub>wm</sub> values whose absolute value is more than 10 percent of the 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.

[56 FR 25777, June 5, 1991, as amended at 59 FR 48510, Sept. 21, 1994; 60 FR 34347, June 30, 1995]

#### § 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.

(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  $\pm 0.1$  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 ( $V_{mix}$ ) for each phase of the exhaust test.

(m) PDP-CVS: Test measurements required to calculate the  $V_{mix}$ . Total dilute exhaust volume ( $V_{mix}$ ) 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.

(3) The temperature of the gas flowing in the heated sample line before the heated filter, and also before the HFID, and the temperature of the control system of the heated hydrocarbon detector.

(4) Gas meter or flow measurement instrumentation readings at the start of each sample period and at the end of each sample period.

(5) The stabilized pre-test weight and post-test weight of each particulate sample and back-up filter.

(6) Continuous temperature and humidity recording of the ambient air in which the particulate filters were stabilized.

(p) Additional required records for methanol-fueled vehicles:

(1) Specification of the methanol-fuel or methanol-fuel mixtures used during the test.

(2) Volume of sample passed through the methanol sampling system and the volume of deionized water in each impinger.

(3) The concentration of the GC analyses of the test samples (methanol).

(4) Volume of sample passed through the formaldehyde sampling system and the volume of DNPH solution used.

(5) The concentration of the HPLC analysis of the test sample (formaldehyde).

(6) The temperatures of the sample lines before the HFID and the impinger, the temperature of the exhaust transfer duct (as applicable), and the temperature of the control system of the heated hydrocarbon detector.

(7) A continuous measurement of the dew point of the raw and diluted exhaust. This requirement may be omitted if the temperatures of all heated lines are kept above 220 °F, or if the manufacturer performs an engineering analysis demonstrating that the temperature of the heated systems remains above the maximum dew point of the gas stream throughout the course of the test.

(q) *Additional required records for natural gas-fueled vehicles.* Composition, including all carbon containing compounds; e.g. CO<sub>2</sub>, of the natural gas-fuel

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used during the test. C<sub>1</sub> and C<sub>2</sub> compounds shall be individually reported. C<sub>3</sub> and heavier hydrocarbons, and C<sub>6</sub> and heavier compounds may be reported as a group.

(r) *Additional required records for liquefied petroleum gas-fueled vehicles.* Composition of the liquefied petroleum gas-fuel used during the test. Each hydrocarbon compound present, through C<sub>4</sub> compounds, shall be individually reported. C<sub>5</sub> and heavier hydrocarbons may be reported as a group.

[54 FR 14533, Apr. 11, 1989, as amended at 58 FR 58422, Nov. 1, 1993; 59 FR 48510, Sept. 21, 1994; 60 FR 34348, June 30, 1995]

§ 86.143-90 Calculations; evaporative emissions.

(a) The calculation of the net hydrocarbon, methanol and hydrocarbon plus methanol (total hydrocarbon equivalent) mass change in the enclosure is used to determine the diurnal and hot soak mass emissions. The mass changes are calculated from initial and final hydrocarbon and methanol concentrations in ppm carbon, initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the following equations:

(1) For methanol:

$$M_{CH_3OH} = V_n X \times \frac{T_{Ef}}{(V_{Ef} \times T_{SHEDf})} \times [(C_{MS1f} \times AV_{1f}) + (C_{MS2f} \times AV_{2f})] - \frac{T_{Ei}}{(V_{Ei} \times T_{SHEDi})} \times [(C_{MS1i} \times AV_{1i}) + (C_{MS2i} \times AV_{2i})]$$

Where:

- (i) M<sub>CH<sub>3</sub>OH</sub> = Methanol mass change, μg.
- (ii) V<sub>n</sub> = Net enclosure volume, ft<sup>3</sup>, as determined by subtracting 50 ft<sup>3</sup> (1.42 m<sup>3</sup>) (volume of vehicle with trunk and windows open) from the enclosure volume. A manufacturer may use the measured volume of the vehicle (instead of the nominal 50 ft<sup>3</sup>) with advance approval by the Administrator: *Provided*, the measured volume is determined and used for all vehicles tested by that manufacturer.
- (iii) T<sub>E</sub> = Temperature of sample withdrawn, °R.

- (iv) V<sub>E</sub> = Volume of sample withdrawn, ft<sup>3</sup>.
  - (v) T<sub>SHED</sub> = Temperature of SHED, °R.
  - (vi) C<sub>MS</sub> = GC concentration of sample, μg/ml.
  - (vii) AV = Volume of absorbing reagent in impinger.
  - (viii) P<sub>B</sub> = Barometric pressure at time of sampling, in. Hg.
  - (ix) i = Initial sample.
  - (x) f = Final sample.
  - (xi) 1 = First impinger.
  - (xii) 2 = Second impinger.
- (2) For hydrocarbons:

$$M_{HC} = (kV_n \times 10^{-4}) \left[ \frac{(C_{HCf} - rC_{CH_3OHf})P_{Bf}}{T_f} - \frac{(C_{HCi} - rC_{CH_3OHi})P_{Bi}}{T_i} \right]$$

Where:

- (i) M<sub>HC</sub> = Hydrocarbon mass change, g.

- (ii) C<sub>HC</sub> = FID hydrocarbon concentration as ppm carbon including FID response to methanol in the sample.
- (iii) C<sub>CH<sub>3</sub>OH</sub> = Methanol concentration as ppm carbon.