$$= \frac{1.501 \times 10^{-3} \times T}{P_B \times V_E} \times \left[\left(C_{S1} \times AV_1 \right) + \left(C_{S2} \times AV_2 \right) \right]$$

(iv) V_n=Net enclosure volume ft³ (m³), as determined by subtracting 50 ft³ (1.42 m³) (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 ft³) with advance approval by the Administrator: *Provided,* the measured volume is determined and used for all vehicles tested by that manufacturer.

(v) r=FID response factor to methanol.

(vi) P_B=Barometric pressure, in Hg (kPa).

(vii) T=Enclosure temperature, °R(°K).

(viii) i=initial reading.

(ix) f=final reading.

(x) 1=First impinger.

(xi) 2=Second impinger.

(xii)(A) k=0.208 (12+H/C).

(B) *For SI units,* k=1.2 (12+H/C).

Where:

(xiii) H/C=hydrogen-carbon ratio.

(A) H/C=2.33 for diurnal emissions.

(B) H/C=2.2 for hot soak emissions.

(3) For total evaporative emissions:

Total Evaporative Emissions=Total Diurnal Emissions+Total Hot Soak Emissions

$$= \left(M_{HC} + \frac{14.3594}{32.042} \times 10^6 M_{CH3OH} \right) + \left(M_{HC} + \frac{14.2284}{32.042} \times 10^6 M_{CH3OH} \right), g$$

(b) The final reported results shall be computed by summing the individual evaporative emission results determined for the diurnal breathing-loss test, running-loss test and the hot-soak test.

[54 FR 14534, Apr. 11, 1989, as amended at 60 FR 34348, June 30, 1995]

§86.143–96 Calculations; evaporative emissions.

(a) The following equations are used to calculate the evaporative emissions from gasoline- and methanol-fueled vehicles, and for gaseous-fueled vehicles.

(b) Use the measurements of initial and final concentrations to determine the mass of hydrocarbons and methanol emitted. For testing with pure gasoline, methanol emissions are assumed to be zero.

(1) For enclosure testing of diurnal, hot soak, and running loss emissions:

(i) Methanol emissions:

$$M_{CH3OH} = V_n \times \left[\frac{\left(C_{MS1f} \times AV_{1f} \right) + \left(C_{MS2f} \times AV_{2f} \right)}{V_{E_f}} \right] - \left[\frac{\left(C_{MS1i} \times AV_{1i} \right) + \left(C_{MS2i} \times AV_{2i} \right)}{V_{E_i}} \right] + \left(M_{CH3OH,out} - M_{CH3OH,in} \right)$$

Where:

(A) M_{CH3OH} = Methanol mass change, µ g.

(B) V_n = Net enclosure volume, ft³, as determined by subtracting 50 ft³ (1.42 m³) (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 ft³)

with advance approval by the Administrator: *Provided,* the measured volume is determined and used for all vehicles tested by that manufacturer.

(C) [Reserved]

(D) V_E=Volume of sample withdrawn, ft³. Sample volumes must be corrected for differences in temperature to be consistent

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with determination of V_n, prior to being used in the equation.

(E) [Reserved]

(F) C_{MS} = GC concentration of sample, μ g/ml.

(G) AV = Volume of absorbing reagent in impinger.

(H) P_B = Barometric pressure at time of sampling, in. Hg.

(I) i = Initial sample.

(J) f = Final sample.

(K) 1 = First impinger.

(L) 2 = Second impinger.

(M) $M_{CH3OH,out}$=mass of methanol exiting the enclosure, in the case of fixed-volume enclosures for diurnal emission testing, μ g.

(N) $M_{CH3OH,in}$=mass of methanol entering the enclosure, in the case of fixed-volume enclosures for diurnal emission testing, μ g.

(ii) Hydrocarbon emissions:

$$M_{HC} = \left(kV_n \times 10^{-4}\right) \times \left(\frac{\left(C_{HC_f} - rC_{CH_3OH_f}\right)P_{B_f}}{T_f} - \frac{\left(C_{HC_i} - rC_{CH_3OH_i}\right)P_{B_i}}{T_i} \right) + M_{HC,out} - M_{HC,in}$$

Where,

(A) M_{HC}=Hydrocarbon mass change, g.

(B) C_{HC} = FID hydrocarbon concentration as ppm including FID response to methanol (or methane, as appropriate) in the sample.

(C) C_{CH3OH} = Methanol concentration as ppm carbon.

$$= \frac{1.501 \times 10^{-3} \times T}{P_B \times V_E} \times \left[\left(C_{S1} \times AV_1\right) + \left(C_{S2} \times AV_2\right)\right]$$

(D) V_n=Net enclosure volume ft³ (m³) as determined by subtracting 50 ft³ (1.42 m³) (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 ft³) with advance approval by the Administrator, provided the measured volume is determined and used for all vehicles tested by that manufacturer.

(E) r=FID response factor to methanol.

(F) P_B=Barometric pressure, in Hg (Kpa).

(G) T=Enclosure temperature, °R(°K).

(H) i=initial reading.

(I) f=final reading.

(J) 1=First impinger.

(K) 2=Second impinger.

(L) Assuming a hydrogen to carbon ratio of 2.3:

(*1*) k=2.97; and

(*2*) For SI units, k=17.16.

(M) $M_{HC,out}$=mass of hydrocarbons exiting the enclosure, in the case of fixed-volume enclosures for diurnal emission testing, g.

(N) $M_{HC,in}$=mass of hydrocarbons entering the enclosure, in the case of fixed-volume enclosures for diurnal emission testing, g.

(iii) For variable-volume enclosures, defined in § 86.107(a)(1)(i), the following simplified form of the hydrocarbon mass change equation may be used:

$$M_{HC} = \left(\frac{kP_B V_n \times 10^{-4}}{T} \right) \times \left[\left(C_{HC_f} - rC_{CH_3OH_f}\right) - \left(C_{HC_i} - rC_{CH_3OH_i}\right)\right]$$

(2) For running loss testing by the point-source method, the mass emissions of each test phase are calculated below, then summed for a total mass emission for the running loss test. If emissions are continuously sampled, the following equations can be used in integral form.

(i) Methanol emissions:

M_{CH_3OH}=ρ_{CH_3OH} $V_{mix} \times$ $(C_{CH_3OH,rl} - C_{CH_3OH,d})$

Where,

(A) M_{CH_3OH}=methanol mass change, µg.

(B) ρ_{CH_3OH}= 37.71 g/ft³, density of pure vapor at 68 °F.

(C) V_{mix}=total dilute sample volume, in ft³, calculated as appropriate for the collection technique used.

(D) $C_{CH_3OH,rl}$=methanol concentration of diluted running loss sample, in ppm carbon equivalent.

(E) $C_{CH_3OH,d}$=methanol concentration of dilution air, in ppm carbon equivalent.

(ii) Hydrocarbon emissions:

$M_{HC}=\rho_{HC} V_{mix}10^{-6}\times(C_{HC,rl}-C_{HC,d})$

Where,

(A) M_{HC}=hydrocarbon mass change, g.

(B) ρ_{HC}= 16.88 g/ft³, density of pure vapor at 68 °F (for hydrogen to carbon ratio of 2.3).

(C) V_{mix}=total dilute sample volume, in ft³, calculated as appropriate for the collection technique used.

(D) $C_{HC,rl}$=hydrocarbon concentration of diluted running loss sample, in ppm carbon equivalent.

(E) $C_{HC,d}$=hydrocarbon concentration of dilution air, in ppm carbon equivalent.

(c) Calculate the adjusted total mass emissions for each test segment.

$$(1) \qquad M_{DI} = \left(M_{HC} + \frac{14.3594}{32.042}\times10^{-6} M_{CH_3OH} \right)_{DI}$$

where M_{DI}=mass emissions from the diurnal emission test (see §86.133), g.

$$(2) \qquad M_{HS} = \left(M_{HC} + \frac{14.2284}{32.042}\times10^{-6} M_{CH_3OH} \right)_{HS}$$

where M_{HS}=mass emissions from the hot soak test (see §86.138), g.

$$(3) \qquad M_{RL} = \left(M_{HC} + \frac{14.2284}{32.042}\times10^{-6} M_{CH_3OH} \right)_{RL}$$

where M_{RL}=mass emissions from the running loss test (see §86.134), g.

(d)(1) For the full three-diurnal test sequence, there are two final results to report:

(i) The sum of the adjusted total mass emissions for the diurnal and hot soak tests ($M_{DI}+M_{HS}$); and

(ii) The adjusted total mass emissions for the running loss test, on a grams per mile basis=M_{RL}/D_{RL}, where D_{RL}=miles driven for the running loss test (see §86.134–96(c)(6)).

(2) For the supplemental two-diurnal test sequence, there is one final result to report: the sum of the adjusted total mass emissions for the diurnal and hot soak tests ($M_{DI}+M_{HS}$), described in §§86.133–96(p) and 86.138–96(k), respectively.

[58 FR 16043, Mar. 24, 1993, as amended at 59 FR 48510, Sept. 21, 1994; 60 FR 34348, June 30, 1995; 60 FR 43897, Aug. 23, 1995]

§86.144–90 Calculations; exhaust emissions.

The final reported test results shall be computed by use of the following formula:

(a) For light-duty vehicles and light duty trucks: