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Where,

- (A) M_{CH_3OH} =methanol mass change, μg .
- (B) ρ_{CH_3OH} = 37.71 g/ft^3 , density of pure vapor at 68 °F.
- (C) V_{mix} =total dilute sample volume, in ft^3 , 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:

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

$$(1) \quad M_{DI} = \left(M_{HC} + \frac{14.3594}{32.042} \times 10^{-6} M_{CH_3OH} \right)_{DI}$$

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

$$(2) \quad M_{HS} = \left(M_{HC} + \frac{14.2284}{32.042} \times 10^{-6} M_{CH_3OH} \right)_{HS}$$

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

$$(3) \quad M_{RL} = \left(M_{HC} + \frac{14.2284}{32.042} \times 10^{-6} M_{CH_3OH} \right)_{RL}$$

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

Where,

- (A) M_{HC} =hydrocarbon mass change, g.
 - (B) ρ_{HC} = 16.88 g/ft^3 , density of pure vapor at 68 °F (for hydrogen to carbon ratio of 2.3).
 - (C) V_{mix} =total dilute sample volume, in ft^3 , 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.

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:

$$Y_{wm} = 0.43 \left(\frac{Y_{ct} + Y_s}{D_{ct} + D_s} \right) + 0.57 \left(\frac{Y_{ht} + Y_s}{D_{ht} + D_s} \right)$$

Where:

- (1) Y_{wm} =Weighted mass emissions of each pollutant, *i.e.*, HC, CO, NO_x or CO₂, in grams per vehicle mile and if appropriate, the weighted total hydrocarbon equivalent mass in grams per vehicle mile.
 - (2) Y_{ct} =Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.
 - (3) Y_{ht} =Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.
 - (4) Y_s =Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.
 - (5) D_{ct} =The measured driving distance from the "transient" phase of the cold start test, in miles.
 - (6) D_{ht} =The measured distance from the "transient" phase of the hot start test, in miles.
 - (7) D_s =The measured driving distance from the "stabilized" phase of the cold start test, in miles.
- (b) The mass of each pollutant for each phase of both the cold start test

and the hot start test is determined from the following:

- (1) Hydrocarbon mass:
 $HC_{mass} = V_{mix} \times \text{Density}_{HC} \times (HC_{conc} / 1,000,000)$
- (2) Oxides of nitrogen mass:
 $NO_{xmass} = V_{mix} \times \text{Density}_{NO_2 \times H} \times (NO_{xconc} / 1,000,000)$
- (3) Carbon monoxide mass:
 $CO_{mass} = V_{mix} \times \text{Density}_{CO} \times (CO_{conc} / 1,000,000)$
- (4) Carbon dioxide mass:
 $CO_{2mass} = V_{mix} \times \text{Density}_{CO_2} \times (CO_{2conc} / 100)$
- (5) Methanol mass:
 $CH_3OH_{mass} = V_{mix} \times \text{Density}_{CH_3OH} \times (CH_3OH_{conc} / 1,000,000)$
- (6) Formaldehyde mass:
 $HCHO_{mass} = V_{mix} \times \text{Density}_{HCHO} \times (HCHO_{conc} / 1,000,000)$
- (7) Total hydrocarbon equivalent mass:
 (i) THCE=

$$HC_{Mass} + \frac{13.8756}{32.042} (CH_3OH_{mass}) + \frac{13.8756}{30.0262} (HCHO_{mass})$$

(c) Meaning of symbols:

- (1)(i) HC_{mass} =Hydrocarbon emissions, in grams per test phase.
- (ii) Density_{HC} =Density of hydrocarbons is 16.33 g/ft³ (0.5768 kg/m³), assuming an average carbon to hydrogen ratio of 1:1.85, at 68 °F (20 °C) and 760 mm Hg (101.3 kPa) pressure.
- (iii)(A) HC_{conc} =Hydrocarbon concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent, *i.e.*, equivalent propane × 3.
- (B) $HC_{conc} = HC_e - HC_d(1 - 1/DF)$.

Where:

- (iv)(A) HC_e =Hydrocarbon concentration of the dilute exhaust sample or, for diesel (or methanol-fueled vehicles, if selected), average hydrocarbon concentration of the dilute exhaust sample

as calculated from the integrated HC traces, in ppm carbon equivalent.

- (B) $HC_e = \text{FID } HC_e - (r)C_{CH_3OH_e}$
- (v) $\text{FID } HC_e$ =Concentration of hydrocarbon plus methanol in dilute exhaust as measured by the FID, ppm carbon equivalent.
- (vi) r =FID response to methanol.
- (vii) $C_{CH_3OH_e}$ =Concentration of methanol in dilute exhaust as determined from the dilute exhaust methanol sample in ppm carbon. For vehicles not fueled with methanol, $C_{CH_3OH_e}$ equals zero.
- (viii)(A) HC_d =Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent.
- (B) $HC_d = \text{FID } HC_d - (r)C_{CH_3OH_d}$
- (ix) $\text{FID } HC_d$ =Concentration of hydrocarbon plus methanol in dilution air as

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measured by the FID, ppm carbon equivalent.

(x) C_{CH_3OHd} =Concentration of methanol in dilution air as determined from dilution air methanol sample in ppm carbon. For vehicles not fueled with methanol, C_{CH_3OHd} equal zero.

(2)(i) NO_{Xmass} =Oxides of nitrogen emissions, in grams per test phase.

(ii) $Density_{NO_2}$ =Density of oxides of nitrogen is 54.16 g/ft³ (1.913 kg/m³) assuming they are in the form of nitrogen dioxide, at 68 °F (20 °C) and 760 mm Hg (101.3kPa) pressure.

(iii)(A) NO_{Xconc} =Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm.

(B) $NO_{Xconc}=NO_{Xe}-NO_{Xd}(1-(1/DF))$.

Where:

(iv) NO_{Xe} =Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.

(v) NO_{Xd} =Oxides of nitrogen concentration of the dilution air as measured, in ppm.

(3)(i) CO_{mass} =Carbon monoxide emissions, in grams per test phase.

(ii) $Density_{CO}$ =Density of carbon monoxide is 32.97 g/ft³ (1.164 kg/m³), at 68 °F (20 °C) and 760 mm Hg (101.3 kPa) pressure.

(iii)(A) CO_{conc} =Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO₂ extraction, in ppm.

(B) $CO_{conc}=CO_e-CO_d(1-(1/DF))$.

Where:

(iv)(A) CO_e =Carbon monoxide concentration of the dilute exhaust volume corrected for water vapor and carbon dioxide extraction, in ppm.

(B) $CO_e=(1-0.01925CO_{2c}-0.000323R)CO_{em}$ for petroleum fuel with hydrogen to carbon ratio of 1.85:1.

(C) $CO_e=[1-(0.01+0.005HCR)CO_{2c}-0.000323R]CO_{em}$ for methanol fuel, where HCR is hydrogen-to-carbon ratio as measured for the fuel used.

(v) CO_{em} =Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.

(vi) CO_{2c} =Carbon dioxide concentration of the dilute exhaust sample, in percent.

(vii) R=Relative humidity of the dilution air, in percent (see §86.142(n)).

(viii)(A) CO_d =Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm.

(B) $CO_d=(1-0.000323R)CO_{dm}$.

Where:

(ix) CO_{dm} =Carbon monoxide concentration of the dilution air sample as measured, in ppm.

NOTE: If a CO instrument which meets the criteria specified in §86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e and CO_{dm} must be substituted directly for CO_d .

(4)(i) CO_{2mass} =Carbon dioxide emissions, in grams per test phase.

(ii) $Density_{CO_2}$ =Density of carbon dioxide is 51.81 g/ft³ (1.830 kg/m³), at 68 °F (20 °C) and 760 mm Hg (101.3 kPa) pressure.

(iii)(A) CO_{2conc} =Carbon dioxide concentration of the dilute exhaust sample corrected for background, in percent.

(B) $CO_{2conc}=CO_{2c}-CO_{2d}(1-(1/DF))$.

Where:

(iv) CO_{2d} =Carbon dioxide concentration of the dilution air as measured, in percent.

(5)(i) CH_3OH_{mass} =Methanol emissions corrected for background, in grams per test phase.

(ii) $Density_{CH_3OH}$ =Density of methanol is 37.71 g/ft³ (1.332 kg/m³), at 68 °F (20 °C) and 760 mmHg (101.3kPa) pressure.

(iii)(A) CH_3OH_{conc} =Methanol concentration of the dilute exhaust corrected for background, ppm.

(B) $CH_3OH_{conc}=C_{CH_3OHc}-C_{CH_3OHd}(1-(1/DF))$

Where:

(iv)(A) C_{CH_3OHc} =Methanol concentration in the dilute exhaust, ppm.

(B)

$$C_{CH_3OHc} = \frac{3.813 \times 10^{-2} \times C_{CH_3OHR} \times T_{EM} [(A_{S1} \times AV_{S1}) + (A_{S2} \times AV_{S2})]}{A_{CH_3OHR} \times P_B \times V_{EM}}$$

- (v)(A) C_{CH_3OHd} = Methanol concentration in the dilution air, ppm.
- (B)

$$C_{CH_3OHd} = \frac{3.813 \times 10^{-2} \times C_{CH_3OHR} \times T_{DM} [(A_{D1} \times AV_{D1}) + (A_{D2} \times AV_{D2})]}{A_{CH_3OHR} \times P_B \times V_{DM}}$$

- (vi) C_{CH_3OHR} = Concentration of methanol in standard sample for calibration of GC, µg/ml.
- (vii) A_{CH_3OHR} = GC peak area of standard sample.
- (viii) T_{EM} = Temperature of methanol sample withdrawn from dilute exhaust, °R.
- (ix) T_{DM} = Temperature of methanol sample withdrawn from dilution air, °R.
- (x) P_B = Barometric pressure during test, mm Hg.
- (xi) V_{EM} = Volume of methanol sample withdrawn from dilute exhaust, ft³.
- (xii) V_{DM} = Volume of methanol sample withdrawn from dilution air, ft³.
- (xiii) A_S = GC peak area of sample drawn from dilute exhaust.
- (xiv) A_D = GC peak area of sample drawn from dilution air.
- (xv) AV_S = Volume of absorbing reagent (deionized water) in impinger

through which methanol sample from dilute exhaust is drawn, ml.

(xvi) AV_D = Volume of absorbing reagent (deionized water) in impinger through which methanol sample from dilution air is drawn, ml.

(6)(i) $HCHO_{mass}$ = Formaldehyde emissions corrected for background, in grams per test phase.

(ii) $Density_{HCHO}$ = Density of formaldehyde is 35.36 g/ft³ (1.249 kg/m³), at 68 °F (20 °C) and 760 mmHg (101.3 kPa) pressure.

(iii)(A) $HCHO_{conc}$ = Formaldehyde concentration of the dilute exhaust corrected for background, in ppm.

(B) $HCHO_{conc} = C_{HCHOe} - C_{HCHOd} (1 - (1/DF))$

Where:

(iv)(A) C_{HCHOe} = Formaldehyde concentration in dilute exhaust, in ppm.

(B)

$$C_{HCHOe} = \frac{4.069 \times 10^{-2} \times C_{FDE} \times V_{AE} \times Q \times T_{EF}}{V_{SE} \times P_B}$$

- (v)(A) C_{HCHOd} = Formaldehyde concentration in dilution air in ppm.
- (B)

$$C_{HCHOd} = \frac{4.069 \times 10^{-2} \times C_{FDA} \times V_{AA} \times Q \times T_{DF}}{V_{SA} \times P_B}$$

(vi) C_{FDE} = Concentration of DNPH derivative of formaldehyde from dilute exhaust sample in sampling solution, µg/ml.

(vii) V_{AE} = Volume of sampling solution for dilute exhaust formaldehyde sample, ml.

(viii)(A) Q = Ratio of molecular weights of formaldehyde to its DNPH derivative.

(B) $Q = 0.1429$.

(ix) T_{EF} = Temperature of formaldehyde sample withdrawn from dilute exhaust, °R.

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(x) V_{SE} = Volume of formaldehyde sample withdrawn from dilute exhaust, ft^3 .

(xi) P_B = Barometric pressure during test, mm Hg.

(xii) C_{FDA} = Concentration of DNPH derivative of formaldehyde from dilution air sample in sampling solution, $\mu g/ml$.

(xiii) V_{AA} = Volume of sampling solution for dilution air formaldehyde sample, ml.

(xiv) T_{DF} = Temperature of formaldehyde sample withdrawn from dilution air, $^{\circ}R$.

(xv) V_{SA} = Volume of formaldehyde sample withdrawn from dilution air, ft^3 .

(7)(i) $DF = 13.4/[CO_{2e} + (HC_e + CO_e) 10^{-4}]$ for petroleum-fueled vehicles.

(ii)

$$DF = \frac{100 \left(\frac{X}{x + y/2 + 3.76(x + y/4 - z/2)} \right)}{CO_{2e} + (HC_e + CO_e + C_{CH_3OH_e} + C_{HCHO_e}) 10^{-4}}$$

for methanol-fueled vehicles where fuel composition is $C_x H_y O_z$ as measured for the fuel used.

(iii)(A) K_H = Humidity correction factor.

(B) $K_H = 1/[1 - 0.0047(H - 75)]$.

(C) For SI units, $K_H = 1/[1 - 0.0329(H - 10.71)]$.

Where:

(iv)(A) H = Absolute humidity in grains (grams) of water per pound (kilogram) of dry air.

(B) $H = [(43.478)R_a \times P_d]/[P_B - (P_d \times R_d/100)]$.

(C) For SI units, $H = [(6.211)R_a \times P_d]/[P_B - (P_d \times R_d/100)]$.

(v) R_a = Relative humidity of the ambient air, percent.

(vi) P_d = Saturated vapor pressure, mm Hg (kPa) at the ambient dry bulb temperature.

(vii) P_B = Barometric pressure, mm Hg (kPa),

(viii)(A) V_{mix} = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528 $^{\circ}R$ (293 $^{\circ}K$) and 760 mm Hg (101.3 kPa)).

(B) For PDP-CVS, V_{mix} is:

$$V_{mix} = \frac{V_o \times N \times (P_B - P_d) \times 528}{760 \times T_p}$$

(C) For SI units,

$$V_{mix} = \frac{V_o \times N \times (P_B - P_d) \times 293}{101.3 \times T_p}$$

Where:

(ix) V_o = Volume of gas pumped by the positive displacement pump, in cubic feet (m^3) per revolution. This volume is dependent on the pressure dif-

ferential across the positive displacement pump.

(x) N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected.

(xi) P_B = Barometric pressure, mm Hg (kPa).

(xii) P_4 = Pressure depression below atmospheric measured at the inlet to the positive displacement pump, in mm Hg (kPa) (during an idle mode).

(xiii) T_p = Average temperature of dilute exhaust entering positive displacement pump during test, °R(°K).

(d) For petroleum-fueled vehicles, example calculation of mass values of exhaust emissions using positive displacement pump:

(1) For the “transient” phase of the cold start test assume the following:

$V_o = 0.29344 \text{ ft}^3/\text{rev}$; $N = 10,485$; $R = 48.0$ pct; $R_a = 48.2$ percent; $P_B = 762$ mm Hg; $P_d = 22.225$ mm Hg; $P_4 = 70$ mm Hg; $T_p = 570$ °R; $HC_c = 105.8$ ppm, carbon equivalent; $NO_{xc} = 11.2$ ppm; $CO_{em} = 306.6$ ppm; $CO_{2c} = 1.43$ percent; $HC_d = 12.1$ ppm; $NO_{xd} = 0.8$ ppm; $CO_{dm} = 15.3$ ppm; $CO_{2d} = 0.032$ percent; $D_{ct} = 3.598$ miles.

Then:

(i) $V_{mix} = (0.29344)(10,485)(762 - 70) / (528)/(760)(570) = 2595.0 \text{ ft}^3$ per test phase.

(ii) $H = (43.478)(48.2)(22.225)/762 - (22.225)(48.2/100) = 62$ grains of water per pound of dry air.

(iii) $K_H = 1/[1 - 0.0047(62 - 75)] = 0.9424$

(iv) $CO_c = [1 - 0.01925(1.43) - 0.000323(48)](306.6) = 293.4$ ppm.

(v) $CO_d = [1 - 0.000323(48)](15.3) = 15.1$ ppm.

(vi) $DF = 13.4/[1.43 + 10^{-4}(105.8 + 293.4)] = 9.116$.

(vii) $HC_{conc} = 105.8 - 12.1(1 - 1/9.116) = 95.03$ ppm.

(viii) $HC_{mass} = (2595)(16.33)(95.03/1,000,000) = 4.027$ grams per test phase.

(ix) $NO_{xconc} = 11.2 - 0.8(1 - 1/9.116) = 10.49$ ppm.

(x) $NO_{xmass} = (2595)(54.16)(10.49/1,000,000)(0.9424) = 1.389$ grams per test phase.

(xi) $CO_{conc} = 293.4 - 15.1(1 - 1/9.116) = 280.0$ ppm.

(xii) $CO_{mass} = (2595)(32.97)(280/1,000,000) = 23.96$ grams per test phase.

(xiii) $CO_{2conc} = 1.43 - 0.032(1 - 1/9.116) = 1.402$ percent.

(xiv) $CO_{2mass} = (2595.0)(51.85)(1.402/100) = 1886$ grams per test phase.

(2) For the stabilized portion of the cold start test assume that similar calculations resulted in the following:

(i) $HC_{mass} = 0.62$ grams per test phase.

(ii) $NO_{xmass} = 1.27$ grams per test phase.

(iii) $CO_{mass} = 5.98$ grams per test phase.

(iv) $CO_{2mass} = 2346$ grams per test phase.

(v) $D_s = 3.902$ miles.

(3) For the “transient” portion of the hot start test assume that similar calculations resulted in the following:

(i) $HC_{mass} = 0.51$ gram per test phase.

(ii) $NO_{xmass} = 1.38$ grams per test phase.

(iii) $CO_{mass} = 5.01$ grams per test phase.

(iv) $CO_{2mass} = 1758$ grams per test phase.

(v) $D_{ht} = 3.598$ miles.

(4) Weighted mass emission results:

(i) $HC_{wm} = 0.43[(4.027 + 0.62)/(3.598 + 3.902)] + 0.57[(0.51 + 0.62)/(3.598 + 3.902)] = 0.352$ grams per vehicle mile.

(ii) $NO_{xwm} = 0.43[(1.389 + 1.27)/(3.598 + 3.902)] + 0.57[(1.38 + 1.27)/(3.598 + 3.902)] = 0.354$ grams per vehicle mile.

(iii) $CO_{wm} = 0.43[(23.96 + 5.98)/(3.598 + 3.902)] + 0.57[(5.01 + 5.98)/(3.598 + 3.902)] = 2.55$ grams per vehicle mile.

(iv) $CO_{2wm} = 0.43[(1886 + 2346)/(3.598 + 3.902)] + 0.57[(1758 + 2346)/(3.598 + 3.902)] = 555$ grams per vehicle mile.

(e) For methanol-fueled vehicle with measured fuel composition of $CH_{3.14}O_{0.6}$ example calculation of exhaust emissions using positive displacement pump:

(1) For the “transient” phase of the cold start test assume the following:

$V_o = 0.29344 \text{ ft}^3/\text{rev}$; $N = 10,485$; $R = 48.0$ pct; $R_a = 48.2$ percent; $P_B = 762$ mm Hg; $P_d = 22.225$ mm Hg; $P_4 = 70$ mm Hg; $T_p = 570$ °R; $FID\ HC_c = 81.6$ ppm, carbon equivalent; $r = 0.75$; $C_{CH3OHR} = 71$ ug/ml; $T_{EM} = 567$ °R; $A_{CH3OHR} = 3660$; $V_{EM} = 1.18 \text{ ft}^3$; $A_{S1} = 4460$; $AV_{S1} = 25.2 \text{ ml}$; $A_{S2} = 360$; $AV_{S2} = 24.9 \text{ ml}$; $T_{DM} = 532$ °R; $V_{DM} = 1.17 \text{ ft}^3$; $A_{D1} = 110$; $AV_{D1} = 25.0 \text{ ml}$; $A_{D2} = 10$; $AV_{D2} = 25.1 \text{ ml}$; $C_{FDE} = 20$ ug/ml; $V_{AE} = 5.0 \text{ ml}$; $Q = 0.1429$; $T_{EF} = 569$ °R; $V_{SE} = 0.30 \text{ ft}^3$; $C_{FDA} = 1$ ug/ml; $V_{AA} = 5.0 \text{ ml}$; $T_{DF} = 532$ °R; $V_{SA} = 0.31 \text{ ft}^3$; $NO_{xc} = 11.2$ ppm; $CO_{em} = 306.6$ ppm; $CO_{2c} = 1.43$ pct; $FID\ HC_d = 12.1$ ppm; $NO_{xd} = 0.8$ ppm; $CO_{dm} = 15.3$ ppm; $CO_{2d} = 0.032$ percent; $D_{ct} = 3.598$ miles.

Then:

(i) $V_{mix} = (0.29344)(10,485)(762 - 70) / (528)/(760)(570) = 2595.0 \text{ ft}^3$ per test phase.

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(ii) $H = (43.478)(48.2)(22.225)/[762 - (22.225 \times 48.2/100)] = 62$ grains of water per pound of dry air.

(iii) $K_H = 1/[1 - 0.0047(62 - 75)] = 0.9424$.

(iv) $CO_c = [1 - (0.01 + 0.005 \times 3.14 \times 1.43) - 0.000323(48)] \times 306.6 = 291.9$ ppm.

(v) $CO_d = (1 - 0.000323(48)) \times 15.3 = 15.1$ ppm.

(vi) $C_{CH_3OHc} = (3.813 \times 10^{-2})(71)(567)[(4460)(25.2) + (360)(24.9)] / (3660)(762)(1.18) = 56.60$ ppm.

(vii) $DF = 100(1/[1 + (3.14/2) + 3.76(1 + (3.14/4) - (0.6/2))]/1.43 + 10^{-4}[(81.6 + 291.9 + (1 - 0.75)(56.60)] + 8.350$

(viii) $C_{CH_3OHd} = (3.813 \times 10^{-2})(71)(532)[(110)(25.0) + (10)(25.1)] / (3660)(762)(1.17) = 1.32$ ppm.

(ix) $CH_3OH_{conc} = 56.60 - 1.32(1 - 1/8.350) = 55.44$ ppm.

(x) $CH_3OH_{mass} = 2595.0 \times 37.71 \times (55.44/1,000,000) = 5.43$ grams per test phase.

(xi) $HC_{conc} = [81.6 - (0.75)(56.60)] - [12.1 - (0.75)(1.32)](1 - 1/8.350) = 29.34$ ppm.

(xii) $HC_{mass} = (2594)(16.33)(29.34/1,000,000) = 1.24$ grams per test phase.

(xiii) $C_{HCHOc} = 4.069 \times 10^{-2}(20)(5)(0.1429)(569)/(0.30)(762) = 1.4473$ ppm.

(xiv) $C_{HCHOd} = 4.069 \times 10^{-2}(1)(5)(0.1429)(532)/(0.31)(762) = 0.0655$ ppm.

(xv) $HCHO_{conc} = 1.4473 - 0.0655(1 - 1/8.350) = 1.3896$ ppm.

(xvi) $HCHO_{mass} = (2595)(35.36)(1.3896/1,000,000) = 0.1275$ grams per test phase.

(xvii) $THCE = 1.24 + (13.8756/32.042)(5.43) + (13.8756/30.0262)(0.1275) = 3.65$ grams per test phase.

(xviii) $NOx_{conc} = 11.2 - (0.8)(1 - 1/8.350) = 10.50$ ppm

(xix) $NOx_{mass} = (2595)(54.16)(10.50/1,000,000)(0.9424) = 1.390$ grams per test phase.

(xx) $CO_{conc} = 291.9 - 15.1(1 - 1/8.350) = 278.61$ ppm.

(xxi) $CO_{mass} = (2595.0)(32.97)(278.69/1,000,000) = 23.84$ grams per test phase.

(xxii) $CO_{2conc} = 1.43 - 0.032(1 - 1/8.350) = 1.402$ percent.

(xxiii) $CO_{2mass} = (2595.0)(51.85)(1.402/100) = 1886$ grams per test phase.

(2) For the stabilized portion of the cold start test assume that similar calculations resulted in the following:

(i) $THCE = 0.55$ grams per test phase.

(ii) $NOx_{mass} = 1.27$ grams per test phase.

(iii) $CO_{mass} = 5.98$ grams per test phase.

(iv) $CO_{2mass} = 2346$ grams per test phase.

(v) $D_s = 3.902$ miles.

(3) For the "transient" portion of the hot start test assume that similar calculations resulted in the following:

(i) $THCE = 0.67$ grams as carbon equivalent per test phase.

(ii) $NOx_{mass} = 1.38$ grams per test phase.

(iii) $CO_{mass} = 5.01$ grams per test phase.

(iv) $CO_{2mass} = 1758$ grams per test phase.

(v) $D_{ht} = 3.598$ miles.

(4) Weighted emission results:

(i) $THCE_{wm} = 0.43[(3.65 + 0.55)/(3.598 + 3.902)] + 0.57[(0.67 + 0.55)/(3.598 + 3.902)] = 0.334$ grams as carbon equivalent per mile.

(ii) $NOx_{wm} = 0.43[(1.390 + 1.27)/(3.598 + 3.902)] + 0.57[(1.38 + 1.27)/(3.598 + 3.902)] = 0.354$ grams per vehicle mile.

(iii) $CO_{wm} = 0.43[(23.84 + 5.98)/(3.598 + 3.902)] + 0.57[(5.01 + 5.98)/(3.598 + 3.902)] = 2.54$ grams per vehicle mile.

(iv) $CO_{2wm} = 0.43[(1886 + 2346)/(3.598 + 3.902)] + 0.57[(1758 + 2346)/(3.598 + 3.902)] = 555$ grams per vehicle mile.

[54 FR 14535, Apr. 11, 1989, as amended at 59 FR 39649, Aug. 3, 1994]

§ 86.144-94 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:

$$Y_{wm} = 0.43 \left(\frac{Y_{ct} + Y_s}{D_{ct} + D_s} \right) + 0.57 \left(\frac{Y_{ht} + Y_s}{D_{ht} + D_s} \right)$$

Where:

(1) Y_{wm} = Weighted mass emissions of each pollutant, *i.e.*, THC, CO, THCE,