State of California
AIR RESOURCES BOARD

PROPOSED

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1988 AND SUBSEQUENT MODEL PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

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NOTE: The regulatory amendments proposed in this rulemaking are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the version of the test procedures adopted on September 22, 1993. Modifications to the originally noticed text are designated by ***bold italics*** and ~~***bold strikeout***~~ to represent additions and deletions, respectively.

The numbering convention employed in this document, in order of priority, is: 1.a.1.i.A. Any references within specific sections in the Code of Federal Regulations are denoted in order of priority as: (a)(1)(i)(A) - the same numbering system employed in the Code of Federal Regulations.

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1988 AND SUBSEQUENT MODEL PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

The provisions of Subparts A, B, and C, Part 86, Title 40, Code of Federal Regulations as set forth in Appendix I, to the extent they pertain to Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles, are hereby adopted as the California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, with the following exceptions and additions.

1. Applicability

a. These test procedures are applicable to 1988 and subsequent model gasoline, gaseous, diesel, and, beginning in 1993, alcohol passenger cars, light-duty trucks, and medium-duty vehicles. Procedures specific to transitional low-emission, low-emission, ~~and~~ ultra-low-emission, ***and super-ultra-low-emission*** vehicles are applicable to 1992 and subsequent model-year gasoline and diesel, and to 1993 and subsequent model-year alternate fuel and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles. Procedures specific to zero-emission vehicles are applicable to 1992 and subsequent model-year passenger cars, light-duty trucks and medium-duty vehicles. References to "light-duty trucks" in 40 CFR 86 shall apply both to "light-duty trucks" and "medium-duty vehicles" in these procedures.

b. Any reference to vehicle sales throughout the United States shall mean vehicle sales in California.

c. Regulations concerning EPA hearings, EPA inspections, specific language on the Certificate of Conformity, evaporative emissions, high-altitude vehicles and testing, particulate and oxides of nitrogen averaging and engine family standards applicable in such averaging, alternative useful life, selective enforcement audit and heavy-duty engines and vehicles shall not be applicable to these procedures, except where specifically noted.

d. Any reference to gasoline-powered vehicles shall also apply to vehicles powered by gaseous fuels.

e. Regulations both herein and in Title 40, CFR Part 86, Subparts A, B, and C, concerning otto-cycle and diesel-cycle vehicles shall be applicable to alcohol vehicles, except where specifically noted otherwise.

f. Regulations concerning alcohol vehicles shall also be applicable to fuel-flexible vehicles, except where specifically noted otherwise.

g. For engines used in medium-duty vehicles which are not distinctly diesel engines nor derived from such, the Executive Officer shall determine whether the engines shall be subject to diesel or otto-cycle engine regulations, in consideration of the relative similarity of the engines' torque-speed characteristics and vehicle applications with those of otto-cycle and diesel engines.

2. Definitions

a. "**Administrator**" means the Executive Officer of the Air Resources Board (ARB).

~~Bd~~. "**Alcohol fuel**" means either methanol or ethanol as those terms are defined in these test procedures.

~~Aw~~. "**All-Electric Range Test**" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of alternating the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see 9.f. of these test procedures).

~~Ai~~. "**Battery assisted combustion engine vehicle**" means any vehicle which allows power to be delivered to the driven wheels solely by a combustion engine, but which uses a battery pack to store energy which may be derived through remote charging, regenerative braking, and/or a flywheel energy storage system or other means which will be used by an electric motor to assist in vehicle operation.

~~As~~. "**Battery pack**" means any electrical energy storage device consisting of any number of individual battery modules which is used to propel electric or hybrid electric vehicles.

~~b~~. "**Certificate of Conformity**" means Executive Order certifying vehicles for sale in California.

c. "**Certification**" means certification as defined in Section 39018 of the Health and Safety Code.

~~Ap~~. "**Certification level**" means the official exhaust or evaporative emission result from an emission-data vehicle which has been adjusted by the applicable mass deterioration factor and is submitted to the Executive Officer for use in determining compliance with an emission standard for the purpose of certifying a particular engine family. For those engine families which are certified using reactivity adjustment factors developed by the manufacturer pursuant to Appendix VIII of these test procedures, the exhaust NMOG certification level shall include adjustment by the ozone deterioration factor.

~~m~~. "**Continually regenerating trap oxidizer system**" means a trap oxidizer system that does not utilize an automated regeneration mode during normal driving conditions for cleaning the trap.

~~Am.~~ "**Conventional gasoline**" means any certification gasoline which meets the specifications of 40 CFR 86.113-90(a), including the specifications of (a)(1)(i) but excluding the specifications of (a)(1)(ii) as amended by Section 9.a.1. of these test procedures. For the purpose of determining the ozone-forming potential of conventional gasoline vehicle exhaust emissions, gasoline meeting the specifications of Appendix VIII, note (9) of these test procedures shall be used.

~~Bb.~~ "**Dedicated Ethanol Vehicle**" means any ethanol-fueled motor vehicle that is engineered and designed to be operated solely on ethanol.

u. "**Dedicated Methanol Vehicle**" means any methanol-fueled motor vehicle that is engineered and designed to be operated solely on methanol.

~~Ax.~~ "**Defeat Device**" means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use, unless (1) such conditions are substantially included in the Federal emission test procedure, (2) the need for the AECD is justified in terms of protecting the vehicle against damage or accident, or (3) the AECD does not go beyond the requirements of engine starting.

v. "**Diesel-cycle**" means powered by an engine where the primary means of controlling power output is by limiting of the amount of fuel that is injected into the combustion chambers of the engine.

~~Ak.~~ "**Diesel Engine**" means any engine powered with diesel fuel, gaseous fuel, ~~ethanol, or methanol~~ or alcohol fuel for which diesel engine speed/torque characteristics and vehicle applications are retained.

~~Aa.~~ "**Dual-fuel vehicle**" means any motor vehicle that is engineered and designed to be capable of operating on gasoline or diesel and on compressed natural gas or liquefied petroleum gas, with separate fuel tanks for each fuel on-board the vehicle.

~~Af.~~ "**Electric vehicle**" means any vehicle which operates solely by use of a battery or battery pack. This definition also includes vehicles which are powered mainly through the use of an electric battery or battery pack, but which use a flywheel that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

~~Ay.~~ "**Element of Design**" means any control system (i.e., computer software, electronic control system, emission control system, computer logic), and/or control system calibrations and/or the results of systems interaction, and/or hardware items on a motor vehicle or motor vehicle engine.

~~Bc.~~ "**Ethanol**" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure ethanol (CH_3CH_2OH)

and gasoline as specified in section 9.a. (Fuel Specifications) of these test procedures. The required fuel blend is based on the type of ethanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

~~Ba~~. "**Ethanol vehicle**" means any motor vehicle that is engineered and designed to be operated using ethanol as a fuel.

~~Al~~. "**Fuel fired heater**" means a fuel burning device which creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

t. "**Fuel-Flexible Vehicle**" or "**FFV**" means any methanol-fueled or ethanol-fueled motor vehicle that is engineered and designed to be operated using any gasoline-methanol or gasoline-ethanol fuel mixture or blend.

i. "**Gaseous fuels**" means liquefied petroleum gas, compressed natural gas, or liquefied natural gas fuels for use in motor vehicles.

e. "**Heavy-duty engine**" means an engine which is used to propel a heavy-duty vehicle.

f. "**Heavy-duty vehicle**" means any motor vehicle having a manufacturer's gross vehicle weight rating greater than 6000 pounds, except passenger cars.

~~Aj~~. "**Hybrid electric vehicle**" or "HEV" means any vehicle which is included in the definition of a "series hybrid electric vehicle", a "parallel hybrid electric vehicle", or a "battery assisted combustion engine vehicle".

y. "**Incomplete vehicle**" means any vehicle which does not have the primary load carrying device or container attached. In situations where individual marketing relationships makes the status of the vehicle questionable, the Executive Officer shall determine whether a specific model complies with the definition of incomplete vehicle.

~~Az~~. "**Intermediate Temperature Cold Testing**" means testing done pursuant to the driving cycle and testing conditions contained in 40 CFR Part 86 Subpart C, at temperatures between 25° F (-4° C) and 68° F (20° C).

~~Ao~~. "**Intermediate volume manufacturer**" is any vehicle manufacturer with California sales between 3,001 and 35,000 new light- and medium-duty vehicles per model year based on the average number of vehicles sold by the manufacturer each year from 1989 to 1993; however, for manufacturers certifying for the first time in California, model year sales shall be based on projected California sales.

g. "**Light-duty truck**" or "LDT" means any motor vehicle, rated at 6000 pounds gross vehicle weight or less, which is designed primarily for purposes of transportation

of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"Loaded Vehicle Weight" or "LVW" means the vehicle curb weight plus 300 pounds.

~~Ac.~~ "**Low-emission vehicle**" or "**LEV**" means any vehicle certified to low- emission standards.

~~h.~~ "**Medium-duty vehicle**" or "MDV" means any pre-1995 model year heavy-duty vehicle having a manufacturer's gross vehicle weight rating of 8,500 pounds or less, any 1992 and subsequent model-year heavy-duty low-emission, ultra-low-emission, ***super-ultra-low-emission*** or zero-emission vehicle having a manufacturer's gross vehicle weight rating of 14,000 pounds or less, or any 1995 and subsequent model year heavy duty vehicle having a manufacturer's gross vehicle weight rating of 14,000 pounds or less.

~~Be.~~ "**Methane Reactivity Adjustment Factor**" means a factor applied to the mass of methane emissions from natural gas fueled vehicles for the purpose of determining the gasoline equivalent ozone-forming potential of the methane emissions.

r. "**Methanol**" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH_3OH) and gasoline as specified in section 9.a. (Fuel Specifications) of these procedures. The required fuel blend is based on the type of methanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

s. "**Methanol vehicle**" means any motor vehicle that is engineered and designed to be operated using methanol as a fuel.

~~Bf.~~ "**Natural gas**" means either compressed natural gas or liquefied natural gas.

~~Bg.~~ "**Natural gas vehicle**" means any motor vehicle that is engineered and designed to be operated using either compressed natural gas or liquefied natural gas.

z. "**Non-methane organic gas**" (or "**NMOG**") means the sum of non- oxygenated and oxygenated hydrocarbons contained in a gas sample as measured in accordance with the "California Non-Methane Organic Gas Test Procedures" as adopted July 12, 1991 and last amended ~~September 22, 1993~~ _____.

n. "**Non-regeneration emission test**" means a complete emission test which does not include a regeneration.

x. "**Organic Material Hydrocarbon Equivalent**" (or "**OMHCE**") means the sum of the carbon mass contributions of non-oxygenated hydrocarbons, methanol, and

formaldehyde as contained in a gas sample, expressed as gasoline-fueled vehicle hydrocarbons. In the case of exhaust emissions, the hydrogen-to-carbon ratio of the equivalent hydrocarbon is 1.85:1. In the case of diurnal and hot-soak emissions, the hydrogen-to-carbon ratios of the equivalent hydrocarbons are 2.33:1 and 2.2:1, respectively.

~~ar~~. "**Organic material non-methane hydrocarbon equivalent**" (or "**OMNMHCE**") for methanol-fueled vehicles means the sum of the carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, and formaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons. For ethanol-fueled vehicles, "organic material non-methane hydrocarbon equivalent" (or "OMNMHCE") means the sum of carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, ethanol, formaldehyde and acetaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons.

~~w~~. "**Otto-cycle**" means powered by an engine where the primary means of controlling power output is by limiting the amount of air and fuel which can enter the combustion chambers of the engine. Gasoline-fueled engines are otto-cycle engines.

~~aq~~. "**Ozone deterioration factor**" means a factor applied to the mass of NMOG emissions from TLEVs, LEVs, or ULEVs which accounts for changes in the ozone-forming potential of the NMOG emissions from a vehicle as it accumulates mileage.

~~ah~~. "**Parallel hybrid electric vehicle**" means any vehicle which allows power to be delivered to the driven wheels by either a combustion engine and/or by a battery powered electric motor.

~~d~~. "**Passenger car**" or "PC" means any motor vehicle designed primarily for transportation of persons and having a design capacity of 12 persons or less.

~~t~~. "**Periodically regenerating trap oxidizer system**" means a trap oxidizer system that utilizes, during normal driving conditions for cleaning the trap, an automated regeneration mode which can be easily detected.

~~ar~~. "**Reactivity adjustment factor**" or "**RAF**" means a fraction applied to the mass of NMOG emissions from a vehicle powered by a fuel other than conventional gasoline for the purpose of determining a gasoline-equivalent NMOG emission value. The reactivity adjustment factor is defined as the ozone-forming potential of the exhaust from a vehicle powered by a fuel other than conventional gasoline divided by the ozone-forming potential of conventional gasoline vehicle exhaust.

~~k~~. "**Regeneration**" means the process of oxidizing accumulated particulate matter. It may occur continually or periodically.

o. **"Regeneration emission test"** means a complete emission test which includes a regeneration.

p. **"Regeneration interval"** means the interval from the start of a regeneration to the start of the next regeneration.

~~q.~~ **"Series hybrid electric vehicle"** means any vehicle which allows power to be delivered to the driven wheels solely by a battery powered electric motor, but which also incorporates the use of a combustion engine to provide power to the battery and/or electric motor.

"Super-*Ultra*-Low-Emission Vehicle" or "SULEV" means any medium-duty vehicle certified to super low-emission standards.

~~ab.~~ **"Transitional low-emission vehicle"** or **"TLEV"** means any vehicle certified to transitional low-emission standards.

j. **"Trap oxidizer system"** means an emission control system which consists of a trap to collect particulate matter and a mechanism to oxidize the accumulated particulate.

~~at.~~ **"Type A hybrid electric vehicle"** means a hybrid electric vehicle which achieves a minimum range of 60 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit.

~~au.~~ **"Type B hybrid electric vehicle"** means a hybrid electric vehicle which achieves a range of 40 to 59 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit.

~~av.~~ **"Type C hybrid electric vehicle"** means a hybrid electric vehicle which achieves a range of 0 to 39 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit, or which has been designated by the manufacturer as having a range of less than 40 miles without the use of the auxiliary power unit. This definition shall also apply to any hybrid electric vehicle which allows the operator to control the time or mode of operation of the auxiliary power unit either directly or indirectly (with the exception that a mechanism which allows the operator only to shut off the auxiliary power unit is permissible for Type A and Type B HEVs), to any hybrid electric vehicle which can be operated solely through the use of the auxiliary power unit, to any hybrid electric vehicle which utilizes a climate control system that cannot be operated without using the auxiliary power unit, and all other types of hybrid electric vehicles, excluding Type A and Type B hybrid electric vehicles.

~~d~~. **"Ultra-low-emission vehicle"** or **"ULEV"** means any vehicle certified to ultra-low emission standards.

q. **"Useful Life"** means a period of use denoted by the emission standards to which a given vehicle is certifying. For those light-duty and medium-duty vehicles certified to optional 100,000 mile standards and those 1993 and subsequent vehicles certified to 100,000 mile emission standards, and those transitional low-emission, low-emission, ***~~and~~*** ultra-low-emission ***and super-ultra-low-emission*** vehicles, including hybrid electric vehicles, certified to 100,000 mile emission standards, the useful life shall be 10 years or 100,000 miles, whichever first occurs. For 1995 and subsequent medium-duty vehicles and medium-duty low-emission ***~~and~~*** ultra-low emission ***and super-ultra-low-emission*** vehicles certified to 120,000 mile emission standards, the useful life shall be 11 years or 120,000 miles, whichever first occurs. For light-duty and medium-duty vehicles, certified only to 50,000 miles, the useful life shall be 5 years or 50,000 miles, whichever first occurs.

~~e~~. **"Zero-emission vehicle"** or **"ZEV"** means any vehicle which is certified by the Executive Officer to produce zero emissions of any criteria pollutants under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40° F and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.

3. Standards

The following standards represent the maximum projected exhaust emissions for the useful life of the vehicle.

a. The exhaust emissions from new 1988 model passenger cars, light-duty trucks, and medium-duty vehicles shall not exceed:

1988 EXHAUST EMISSIONS STANDARDS[5,6]
(grams per mile)

Vehicle Type[1]	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi)	Non-Methane Hydrocarbons[2]	Carbon Monoxide	Oxides of Nitrogen[3]
PC	All	50,000	0.39 (0.41)	7.0	0.4
PC[4]	All	50,000	0.39 (0.41)	7.0	0.7
PC (Option 1)	All	100,000	0.39 (0.41)	7.0	1.0
PC (Option 2)	All	100,000	0.46	8.3	1.0
LDT,MDV	0-3750	50,000	0.39 (0.41)	9.0	0.4
LDT,MDV[4]	0-3750	50,000	0.39 (0.41)	9.0	1.0
LDT,MDV (Option 1)	0-3750	100,000	0.39 (0.41)	9.0	1.0
LDT,MDV (Option 2)	0-3750	100,000	0.46	10.6	1.0
LDT,MDV	3751-5750	50,000	0.50 (0.50)	9.0	1.0
LDT,MDV (Option 1)	3751-5750	100,000	0.50 (0.50)	9.0	1.5
MDV	5751+	50,000	0.60 (0.60)	9.0	1.5
MDV (Option 1)	5751+	100,000	0.60 (0.60)	9.0	2.0

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"MDV" means medium-duty vehicles.

(2) Hydrocarbon standards in parentheses apply to total hydrocarbons. In order to demonstrate compliance with a non-methane hydrocarbon emission standard, hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures."

(3) The maximum projected emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall be not greater than 1.33 times the applicable passenger car standards and 2.00 times the applicable light-duty trucks and medium-duty vehicle standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(4) This set of standards for 1988 and later model vehicles is optional. A manufacturer may choose to certify to these optional standards pursuant to the conditions set forth in Section 1960.1.5 of Title 13, California Code of Regulations.

(5) Diesel passenger cars, light-duty trucks, and medium-duty vehicles, except those fueled with methanol, are subject to the following particulate exhaust emission standards: 0.2 g/mi for the 1988 model years. The particulate compliance shall be determined on a 50,000 mile durability vehicle basis.

(6) For gaseous-fueled vehicles the calculation procedures provided in Appendix V shall be used for determining emissions and fuel economy.

b. The exhaust emissions from (i) new 1989 through 1992 model passenger cars and light-duty trucks, except those produced by a small volume manufacturer, (ii) new 1991 through 1994 model passenger cars and light-duty trucks produced by a small volume manufacturer, (iii) new 1989 through 1994 model medium-duty vehicles, except those produced by a small volume manufacturer, and (iv) new 1991 through 1994 model medium-duty vehicles produced by a small volume manufacturer, shall not exceed:

1989 THROUGH 1994 MODEL YEAR EXHAUST EMISSIONS STANDARDS[5,6]
(grams per mile)

Vehicle Type[1]	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi)	Non-Methane Hydrocarbon[2]	Carbon Monoxide	Oxides of Nitrogen[3,4]
PC	All	50,000	0.39 (0.41)	7.0	0.4
PC[7]	All	50,000	0.39 (0.41)	7.0	0.7
Diesel PC (Option 2)	All	100,000[9]	0.46	8.3	1.0
LDT,MDV	0-3750	50,000	0.39 (0.41)	9.0	0.4
LDT,MDV[7]	0-3750	50,000	0.39 (0.41)	9.0	0.7[8]
Diesel LDT, MDV (Option 2)	0-3750	100,000[9]	0.46	10.6	1.0
LDT,MDV	3751-5750	50,000	0.50 (0.50)	9.0	1.0
LDT,MDV (Option 1)	3751-5750	100,000[9]	0.50 (0.50)	9.0	1.5
MDV	5751+	50,000	0.60 (0.60)	9.0	1.5
MDV (Option 1)	5751 +	100,000[9]	0.60 (0.60)	9.0	2.0

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"MDV" means medium-duty vehicles.

(2) Hydrocarbon standards in parentheses apply to total hydrocarbons. In order to demonstrate compliance with a non-methane hydrocarbon emission standard, hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures." For 1993 through 1994 model methanol-fueled vehicles certifying to these standards, including fuel-flexible vehicles, "Non-Methane Hydrocarbons" shall mean "Organic Material Hydrocarbon Equivalent" (or "OMHCE").

(3) The maximum projected emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall be not greater than 1.33 times the applicable passenger car standards and 2.00 times the applicable light-duty trucks and medium-duty vehicle standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(4) The standard for in-use compliance for passenger cars, light-duty trucks and medium-duty vehicles certifying to the 0.4 g/mi NOx standard shall be 0.55 g/mi NOx for 50,000 miles. If the in-use compliance level is above 0.4 g/mi NOx but does not exceed 0.55 g/mi NOx, and based on a review of information derived from a statistically valid and representative sample of vehicles, the Executive Officer determines that a substantial percentage of any class or category of such vehicles exhibits, prior to 50,000 miles or 5 years, whichever occurs first, an identifiable, systematic defect in a component listed in Section 1960.1.5(c)(2), Title 13, California Code of Regulations, which causes a significant increase in emissions above those exhibited by vehicles free of such defects and of the same class or category and having the same period of use and mileage, then the Executive Officer may invoke the enforcement authority under Subchapter 2.5, Title 13, California Code of Regulations, commencing with Section 2111, to require remedial action by the vehicle manufacturer. Such remedial action shall be limited to owner notification and repair or replacement of the defective component. As used in this section, the term "defect" shall not include failures which are the result of abuse, neglect, or improper maintenance. This provision is applicable for the 1989 through 1992 model years only. For small volume manufacturers, this provision is applicable for the 1991 through 1994 model years only.

(5) Diesel passenger cars, light-duty trucks, and medium-duty vehicles certifying to these standards are subject to a particulate exhaust emission standard of 0.08 g/mi for the 1989 and subsequent model years. The particulate compliance shall be determined on a 50,000 mile durability vehicle basis.

(6) For gaseous-fueled vehicles certifying to these standards, the calculation procedures provided in Appendix V shall be used for determining emissions and fuel economy.

(7) This set of standards is optional. A manufacturer may choose to certify to these standards pursuant to the conditions set forth in Section 1960.1.5 of Title 13, California Code of Regulations.

(8) Pursuant to Section 1960.1.5(a)(1)(B), Title 13, California Code of Regulations the optional standard for 1989 model year light-duty trucks and medium-duty vehicles only is 1.0 g/mi NOx.

(9) The optional 100,000 mile certification standards and provisions are not applicable to alcohol vehicles.

c. The exhaust emissions from new 1993 and subsequent model dedicated alcohol vehicles and fuel-flexible vehicles shall meet all the requirements in Sections 3.b., 3.e, and 3.f. of these test procedures with the following modifications and additions:

1993 AND SUBSEQUENT METHANOL-SPECIFIC AND ETHANOL-SPECIFIC FORMALDEHYDE EXHAUST EMISSION STANDARDS

Vehicle Type[1]	Loaded Vehicle Weight (lbs.)[3]	Durability Vehicle Basis (mi)	Formaldehyde (mg/mi) Certification	In-Use Compliance[2]
PC	All	50,000	15	23 (1993-1995) 15 (1996 and later)
LDT,MDV	0-3750	50,000	15	23 (1993-1995) 15 (1996 and later)
LDT,MDV	3751-5750	50,000	18	27 (1993-1995) 18 (1996 and later)
MDV	5751-8500	50,000	22	33 (1993-1995) 22 (1996 and later)
MDV	8501-10,000	50,000	28	36 (1995) 28 (1996 and later)
MDV	10,001-14,000	50,000	36	45 (1995) 36 (1996 and later)

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"MDV" means medium-duty vehicles.

(2) If the formaldehyde in-use compliance level is above the respective certification level but does not exceed the in-use compliance level, and based on a review of information derived from a statistically valid and representative sample of vehicles, the Executive Officer determines that a substantial percentage of any class or category of such vehicle exhibits, prior to 50,000 miles or 5 years, whichever occurs first, an identifiable, systematic defect in a component listed in Section 1960.1.5(c)(2), Title 13 California Code of Regulations, which causes a significant increase in emissions above those exhibited by vehicles free of such defects and of the same class or category and having the same period of use and mileage, the Executive Officer may invoke the enforcement authority under subchapter 2.5, Title 13, California Code of Regulations, commencing with Section 2111, to require remedial action by the vehicle manufacturer. Such remedial action shall be limited to owner notification and repair or replacement of the

defect component. As used in this section, the term "defect" shall not include failures which are the result of abuse, neglect, or improper maintenance.

(3) For 1995 and subsequent model year medium-duty vehicles certifying to the standards and test procedures specified in Section 1960.1(h)(1), Title 13, California Code of Regulations, "Loaded Vehicle Weight" shall mean "Test Weight", which is the average of the vehicle's curb weight and gross vehicle weight.

d. The exhaust emission levels from 1992 and subsequent model-year transitional low-emission vehicles, low-emission vehicles, ~~and~~ ultra-low-emission vehicles and super low-emission vehicles, including fuel-flexible and dual-fuel vehicles, shall meet all the requirements of Sections 3.g and 3.j of these test procedures with the following additions:

FORMALDEHYDE EXHAUST EMISSION STANDARDS
~~FOR TRANSITIONAL LOW-EMISSION VEHICLES, LOW-EMISSION VEHICLES, AND ULTRA-LOW-EMISSION VEHICLES~~
IN THE LIGHT-DUTY AND MEDIUM-DUTY VEHICLE WEIGHT CLASSES[5,6]
["milligrams per mile" (or "mg/mi")]

Vehicle Type[1]	Vehicle Weight (lbs.)[2]	Durability Vehicle Basis (mi)	Vehicle Emission Category[3]	Formaldehyde (mg/mi)[4]
PC and LDT	All 0-3750	50,000	TLEV	15 (23)
			LEV	15 (15)
			ULEV	8 (12)
		100,000	TLEV	18
			LEV	18
			ULEV	11
LDT	3751-5750	50,000	TLEV	18 (27)
			LEV	18 (18)
			ULEV	9 (14)
		100,000	TLEV	23
			LEV	23
			ULEV	13
MDV	0-3750	50,000	LEV	15 (15)
			ULEV	8 (12)
		120,000	LEV	22
			ULEV	12
MDV	3751-5750	50,000	LEV	18 (18)
			ULEV	9 (14)
			SULEV	4 (7)
		120,000	LEV	27
			ULEV	13
			SULEV	6
MDV	5751-8500	50,000	LEV	22 (22)
			ULEV	11 (17)
			SULEV	6 (8)
		120,000	LEV	32
			ULEV	16
			SULEV	8
MDV	8501-10,000	50,000	LEV	28 (28)
			ULEV	14 (21)
			SULEV	7 (10)
		120,000	LEV	40
			ULEV	21
			SULEV	10
MDV	10,001-14,000	50,000	LEV	36 (36)
			ULEV	18 (27)
			SULEV	9 (14)
		120,000	LEV	52
			ULEV	26
			SULEV	13

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"MDV" means medium-duty vehicles.

(2) For light-duty or medium-duty vehicles, Vehicle Weight shall mean "Loaded Vehicle Weight" (or "LVW") or "Test Weight" (or "TW"), respectively.

(3) "TLEV" means transitional low-emission vehicle.
"LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"SULEV" means super *ultra*-low-emission vehicle.

(4) The standards in parentheses are intermediate in-use compliance standards for 50,000 miles.

a. For PCs and LDTs from 0-5750 lbs. LVW, including fuel-flexible and dual-fuel vehicles, intermediate in-use compliance standards shall apply to TLEVs through the 1995 model year, ~~and~~ to LEVs ~~and ULEVs~~ through the 1998 model year, and to ULEVs through the 2000 model year. In-use compliance with standards beyond 50,000 miles shall be waived through the 1995 model year for TLEVs, and through the 1998 model year for LEVs and ULEVs.

b. For MDVs from 0-14,000 lbs. TW, including fuel-flexible and dual-fuel vehicles, intermediate in-use compliance standards shall apply to LEVs ~~and ULEVs~~ through the 1999 model year and to ULEVs through the 2000 model year. In-use compliance with standards beyond 50,000 miles shall be waived through the 1999 model year for LEVs and ULEVs.

(5) Manufacturers shall demonstrate compliance with the above standards for formaldehyde at 50° F, according to the procedure specified in Section 11k of these test procedures. Hybrid electric vehicles, natural gas vehicles, and diesel-fueled vehicles shall be exempt from 50°F test requirements.

(6) In-use compliance testing shall be limited to PCs and LDTs with fewer than 75,000 miles and MDVs with fewer than 90,000 miles.

e. The exhaust emissions from new 1993 and 1994 model passenger cars and light-duty trucks, except those produced by a small volume manufacturer, shall not exceed:

1993 AND 1994 MODEL-YEAR PASSENGER CAR AND LIGHT-DUTY TRUCK EXHAUST EMISSIONS STANDARDS[5,6,10]

(grams per mile)

Vehicle Type[1]	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Non-Methane Hydrocarbons[2,8,9]	Carbon Monoxide[8,9]	Oxides of Nitrogen[1,3,4]
PC	All	50,000	0.39 (0.25)	7.0 (3.4)	0.4
PC[7]	All	50,000	0.39 (0.25)	7.0 (3.4)	0.7
PC	All	100,000	(0.31)	(4.2)	n/a
Diesel PC (Option 2)	All	100,000	0.46 (0.31)	8.3 (4.2)	1.0
LDT	0-3750	50,000	0.39 (0.25)	9.0 (3.4)	0.4
LDT[7]	0-3750	50,000	0.39 (0.25)	9.0 (3.4)	0.7
LDT	0-3750	100,000	(0.31)	(4.2)	n/a
Diesel LDT (Option 2)	0-3750	100,000	0.46 (0.31)	10.6 (4.2)	1.0
LDT	3751-5750	50,000	0.50 (0.32)	9.0 (4.4)	1.0
LDT	3751-5750	100,000	(0.40)	(5.5)	n/a
Diesel LDT (Option 1)	3751-5750	100,000	0.50 (0.40)	9.0 (5.5)	1.5

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"n/a" means not applicable.

(2) In order to demonstrate compliance with a non-methane hydrocarbon emission standard, hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures." For methanol-fueled vehicles certifying to these standards, including fuel-flexible vehicles when certifying on methanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Hydrocarbon Equivalent" (or "OMHCE"). For alcohol vehicles certifying to the phase-in standards in parenthesis, including fuel-flexible vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent" (or "OMNMHCE").

(3) The maximum projected emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall be not greater than 1.33 times the applicable passenger car standards and 2.00 times the applicable light-duty truck and medium-duty vehicle standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(4) The standard for in-use compliance for passenger cars and light-duty trucks certifying to the 0.4 g/mi NOx standard shall be 0.55 g/mi NOx for 50,000 miles. If the in-use compliance level is above 0.4 g/mi NOx but does not exceed 0.55 g/mi NOx, and based on a review of information derived from a statistically valid and representative sample of vehicles, the Executive Officer determines that a substantial percentage of any class or category of such vehicles exhibits, prior to 50,000 miles or 5 years, whichever occurs first, an identifiable, systematic defect in a component listed in Section 1960.1.5(c)(2), Title 13 California Code of Regulations, which causes a significant increase in emissions above those exhibited by vehicles free of such defects and of the same class or category and having the same period of use and mileage, then the Executive Officer may invoke the enforcement authority under subchapter 2.5, Title 13, California Code of Regulations, commencing with Section 2111, to require remedial action by the vehicle manufacturer. Such remedial action shall be limited to owner notification and repair or replacement of the defective component. As used in this section, the term "defect" shall not include failures which are the result of abuse, neglect, or improper maintenance. This provision is applicable for the 1993 model year only.

(5) Diesel passenger cars and light-duty trucks certifying to these standards are subject to a particulate exhaust emission standard of 0.08 g/mi, determined on a 50,000 mile durability vehicle basis.

(6) For gaseous-fueled vehicles certifying to these standards, the calculation procedures provided in Appendix V shall be used for determining emissions and fuel economy.

(7) This set of standards is optional. A manufacturer may choose to certify to these standards pursuant to the conditions set forth in Section 1960.1.5 of Title 13, California Code of Regulations.

(8) The emission standards in parenthesis are phase-in standards. For the 1993 model year, each manufacturer must certify a minimum of 40% of their vehicles to the phase-in standards or to the more stringent standards in Section 3.g of these test procedures. The percentage shall be applied to the manufacturers' total projected sales of California-certified passenger cars and light-duty trucks for the 1993 model year. For 1994 and subsequent model years, manufacturers shall comply with the fleet average requirements specified in Section 3.h. of these test procedures.

(9) The following conditions shall apply to the in-use compliance standards of 1993 and 1994 model-year passenger cars and light-duty trucks only.

(a) The in-use compliance standards for those passenger cars and light-duty trucks certifying to the 0.25 g/mi non-methane hydrocarbon and 3.4 g/mi carbon monoxide standards shall be 0.32 g/mi non-methane hydrocarbon and 5.2 g/mi carbon monoxide for 50,000 miles.

(b) The in-use compliance standards for those light-duty trucks certifying to the 0.32 g/mi non-methane hydrocarbon and 4.4 g/mi carbon monoxide standards shall be 0.41 g/mi non-methane hydrocarbon and 6.7 g/mi carbon monoxide for 50,000 miles.

(c) In-use compliance standards shall be waived beyond 50,000 miles.

(10) All passenger cars and light-duty trucks, except those diesel vehicles certifying to optional 100,000 mile standards, are subject to non-methane hydrocarbon, carbon

monoxide, and oxides of nitrogen standards determined on a 50,000 mile durability basis and non-methane hydrocarbon and carbon monoxide standards determined on a 100,000 mile basis.

f. The exhaust emissions from new 1995 and subsequent model passenger cars and light-duty trucks shall not exceed:

1995 AND SUBSEQUENT MODEL-YEAR PASSENGER CAR AND LIGHT-DUTY TRUCK EXHAUST EMISSIONS STANDARDS[5,6,8,9,11]
(grams per mile)

Vehicle Type[1]	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Non-Methane Hydrocarbons[2,7]	Carbon Monoxide[7]	Oxides of Nitrogen[1,3]
PC	All	50,000	0.25	3.4	0.4[4]
PC	All	100,000	0.31	4.2	0.6[10]
Diesel PC (Option 2)	All	100,000	0.31	4.2	1.0
LDT	0-3750	50,000	0.25	3.4	0.4[4]
LDT	0-3750	100,000	0.31	4.2	0.6[10]
Diesel LDT (Option 2)	0-3750	100,000	0.31	4.2	1.0
LDT	3751-5750	50,000	0.32	4.4	0.7
LDT	3751-5750	100,000	0.40	5.5	0.97[10]
Diesel LDT (Option 1)	3751-5750	100,000	0.40	5.5	1.5

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.

(2) In order to demonstrate compliance with a non-methane hydrocarbon emission standard, hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures." For alcohol-fueled vehicles certifying to these standards, including fuel-flexible vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent" (or "OMNMHCE").

(3) The maximum projected emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall be not greater than 1.33 times the applicable passenger car standards and 2.00 times the applicable light-duty truck standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(4) Small volume manufacturers may choose to certify to an optional 0.7 g/mi NOx standard for the 1995 model year only, pursuant to the conditions set forth in Title 13, California Code of Regulations, Sections 1960.1(f)(1) and 1960.1.5.

(5) Diesel passenger cars and light-duty trucks certifying to these standards are subject to a particulate exhaust emission standard of 0.08 g/mi, determined on a 50,000 mile durability vehicle basis.

(6) For gaseous-fueled vehicles certifying to these standards, the calculation procedures provided in Appendix V shall be used for determining fuel economy.

(7) For all vehicles, except those certifying to optional diesel standards, in-use compliance with the exhaust emission standards shall be limited to vehicles with less than 75,000 miles.

(8) For the 1995 and 1996 model years, all manufacturers, except those certifying to optional diesel standards, are permitted alternative in-use compliance. Alternative in-use compliance is permitted for 60% of a manufacturer's vehicles in the 1995 model year and 20% of a manufacturer's vehicles in the 1996 model year. For the 1995 and 1996 model years, small volume manufacturers only are permitted alternative in-use compliance for 100% of the fleet. The percentages shall be applied to the manufacturers' total projected sales of California-certified passenger cars and light-duty trucks for the model year. "Alternative in-use compliance" shall consist of the following:

a. For all passenger cars and those light-duty trucks from 0-3750 lbs., loaded vehicle weight, except those diesel vehicles certifying to optional 100,000 mile standards, in-use compliance standards shall be 0.32 g/mi non-methane hydrocarbon and 5.2 g/mi carbon monoxide for 50,000 miles.

b. For light-duty trucks from 3751-5750 lbs., loaded vehicle weight, except those diesel light-duty trucks certifying to optional 100,000 mile standards, in-use compliance standards shall be 0.41 g/mi non-methane hydrocarbon and 6.7 g/mi carbon monoxide for 50,000 miles.

c. In-use compliance standards shall be waived beyond 50,000 miles.

(9) All passenger cars and light-duty trucks, except those diesel vehicles certifying to optional standards, are subject to non-methane hydrocarbon, carbon monoxide, and oxides of nitrogen standards determined on a 50,000 mile durability basis and non-methane hydrocarbon and carbon monoxide standards determined on a 100,000 mile durability basis.

(10) All 1996 and subsequent model-year PCs and LDTs shall comply with the applicable 100,000 mile standards for NOx.

(11) Each manufacturer shall certify PCs or LDTs to the exhaust emission standards of Sections 3.f. and 3.g. of these test procedures, or as Zero-Emission Vehicles, such that the manufacturer's fleet average NMOG values for California-certified PCs and LDTs from 0-3750 lbs. Loaded Vehicle Weight (or "LVW"), and LDTs from 3751-5750 lbs. LVW produced and delivered for sale in California are less than or equal to the requirement for the corresponding Model Year, Vehicle Type, and LVW Class in Section 3.h. of these test procedures.

g. The exhaust emissions from new 1992 and subsequent model-year transitional low-emission vehicles, low-emission vehicles, and ultra-low-emission vehicles shall not exceed:

EXHAUST MASS EMISSION STANDARDS
FOR TRANSITIONAL LOW-EMISSION VEHICLES, LOW-EMISSION VEHICLES, AND ULTRA-LOW-EMISSION VEHICLES IN
PASSENGER CAR AND LIGHT-DUTY TRUCK VEHICLE CLASSES[6,7,8,9,10]
["grams per mile" (or "g/mi")]

Vehicle Type[1]	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane Organic Gases[3,4]	Carbon Monoxide	Oxides of Nitrogen[5]
PC and LDT	All 0-3750	50,000	TLEV	0.125 ~~(0.188)~~	3.4 ~~(3.4)~~	0.4 ~~(0.4)~~
			LEV	0.075 ~~(0.100)~~	3.4 ~~(3.4)~~	0.2 ~~(0.3)~~
			ULEV	0.040 ~~(0.058)~~	1.7 ~~(2.6)~~	0.2 ~~(0.3)~~
		100,000	TLEV	0.156	4.2	0.6
			LEV	0.090	4.2	0.3
			ULEV	0.055	2.1	0.3
LDT	3751-5750	50,000	TLEV	0.160 ~~(0.238)~~	4.4 ~~(4.4)~~	0.7 ~~(0.7)~~
			LEV	0.100 ~~(0.128)~~	4.4 ~~(4.4)~~	0.4 ~~(0.5)~~
			ULEV	0.050 ~~(0.075)~~	2.2 ~~(3.3)~~	0.4 ~~(0.5)~~
		100,000	TLEV	0.200	5.5	0.9
			LEV	0.130	5.5	0.5
			ULEV	0.070	2.8	0.5

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"LVW" means loaded vehicle weight.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

(2) "TLEV" means transitional low-emission vehicle.
"LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.

(3) **Compliance with NMOG Standard**. ~~"Non-Methane Organic Gases" (or "NMOG") shall mean the total mass of oxygenated and non-oxygenated hydrocarbon emissions.~~ To demonstrate compliance with an NMOG standard, NMOG emissions shall be measured in accordance with the "California Non-Methane Organic Gas Test Procedures" ~~as~~ adopted July 12, 1991 and as last amended _____.

a. **Reactivity Adjustment**. For TLEVs, LEVs, and ULEVs certified to operate on a fuel other than conventional gasoline, including fuel-flexible and dual-fuel vehicles when certifying on a fuel other than gasoline, manufacturers shall multiply the exhaust NMOG certification levels by the applicable reactivity adjustment factor set

forth in Section 13 of these test procedures, or established by the Executive Officer pursuant to Appendix VIII of these test procedures. In addition, natural gas ~~(NG)~~ vehicles certifying to TLEV, LEV or ULEV standards shall calculate a reactivity-adjusted methane exhaust emission value by multiplying the methane exhaust certification level by the applicable methane reactivity adjustment factor set forth in section 13 of these test procedures. The product of the exhaust NMOG certification levels and the reactivity adjustment factor shall be compared with the exhaust NMOG mass emission standards established for the particular vehicle emission category and fuel to determine compliance. For ~~NG~~ natural gas vehicles, the reactivity-adjusted NMOG value shall be added to the reactivity-adjusted methane value and then compared to the exhaust NMOG mass emission standards established for the particular vehicle emission category to determine compliance.

~~a~~b. **Fleet Average Requirement**. Each manufacturer shall certify PCs or LDTs to meet the exhaust mass emission standards for TLEVs, LEVs, ULEVs, or to the exhaust emission standards of Sections 3.b., 3.e., or 3.f. of these test procedures, or as Zero-Emission Vehicles, such that the manufacturer's fleet average NMOG values for California-certified PCs and LDTs from 0-3750 lbs. LVW, and LDTs from 3751-5750 lbs. LVW, produced and delivered for sale in California are less than or equal to the requirement for the corresponding Model Year, Vehicle Type, and LVW Class in Section 3.h. of these test procedures.

(4) **NMOG Standards for Fuel-Flexible and Dual-Fuel Vehicles**. Fuel-flexible and dual-fuel PCs and LDTs from 0-5750 lbs. LVW shall be certified to exhaust mass emission standards for NMOG established for the operation of the vehicle on an available fuel other than gasoline, and gasoline as specified in Section 9.a.1. of these test procedures.

a. **Reactivity Adjustment**. For TLEVs, LEVs, and ULEVs, when certifying for operation on a fuel other than gasoline, manufacturers shall multiply the exhaust NMOG certification levels by the applicable reactivity adjustment factor. In addition to multiplying the exhaust NMOG emission results by the applicable reactivity adjustment factor, ~~NG vehicles shall multiply~~ the exhaust methane certification level for natural gas vehicles shall be multiplied by the applicable methane reactivity adjustment factor and the resulting value shall be added ~~add that value~~ to the reactivity-adjusted NMOG value. The certification levels for fuel-flexible or dual-fuel vehicles when certifying on gasoline shall not be multiplied by a reactivity adjustment factor.

b. **Standards for Fuel-Flexible and Dual Fuel Vehicles Operating on Gasoline**. For PCs and LDTs from 0- ~~3750~~ 5750 lbs. LVW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:

Vehicle Type	Weight (LVW)	Emission Category	Durability Vehicle Basis (g/mi)	
			50,000 Mile	100,000 Mile
PCs, LDT	All, 0-3750	TLEV	0.25	0.31
		LEV	0.125	0.156
		ULEV	0.075	0.090
LDT	3751-5750	TLEV	0.32	0.40
		LEV	0.160	0.200
		ULEV	0.100	0.130

~~(i) For TLEVs, 0.25 g/mi and 0.31 g/mi for 50,000 and 100,000 miles, respectively.~~

~~(ii) For LEVs, 0.125 g/mi and 0.156 g/mi for 50,000 and 100,000 miles, respectively.~~

~~(iii) For ULEVs, 0.075 g/mi and 0.090 g/mi for 50,000 and 100,000 miles, respectively.~~

~~c. For LDTs from 3751-5750 lbs. LVW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:~~

~~(i) For TLEVs, 0.32 g/mi and 0.40 g/mi for 50,000 and 100,000 miles, respectively.~~

~~(ii) For LEVs, 0.160 g/mi and 0.200 g/mi for 50,000 and 100,000 miles, respectively.~~

~~(iii) For ULEVs, 0.100 g/mi and 0.130 g/mi for 50,000 and 100,000 miles, respectively.~~

(5) **Highway NOx Standard**. The maximum projected emissions of Oxides of Nitrogen (or "NOx") measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B) shall not be greater than 1.33 times the applicable light-duty vehicle standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(6) **Intermediate In-Use Compliance Standards**. The following standards ~~in parentheses~~ are intermediate in-use compliance standards for 50,000 miles and 100,000 miles f~~F~~or PCs and LDTs from 0-5750 lbs. LVW, including fuel-flexible and dual-fuel vehicles when operating on an available fuel other than gasoline. ~~;~~ Iintermediate in-use compliance standards shall apply to TLEVs through the 1995 model year as follows: ~~;~~ ~~and to LEVs and ULEVs through the 1998 model year~~.

	NMOG (g/mi)
PCs and LDTs 0-3750 lbs. LVW	0.188
LDTs 3751 - 5750 lbs. LVW	0.238

In-use compliance with standards beyond 50,000 miles shall be waived through the 1995 model year for TLEVs, and through the 1998 model year for LEVs and ULEVs. For LEVs and ULEVs, the following intermediate in-use standards shall apply:

Vehicle Type	Durability Vehicle Basis	LEV (g/mi)			ULEV (g/mi)			
		Model Year	NMOG	NOx	Model Year	NMOG	CO	NOx
PCs, 0-3750 lb. LVW LDTs	50,000	through 1998	0.100	0.3	through 1998	0.058	2.6	0.3
	50,000	1999	~~0.090~~ *0.100*	0.3	1999-2002	0.055	2.1	0.3
	100,000		0.125	0.4	1999-2002	0.075	3.4	0.4
3751-5750 lb. LVW LDTs	50,000	through 1998	0.128	0.5	through 1998	0.075	3.3	0.5
	50,000	1999	0.130	0.5	1999-2002	0.070	2.8	0.5
	100,000		0.160	0.7	1999-2002	0.100	4.4	0.7

a. **Reactivity Adjustment**. For TLEVs, LEVs, and ULEVs designed to operate on a fuel other than conventional gasoline, including fuel-flexible and dual-fuel vehicles when operating on a fuel other than ~~conventional~~ gasoline, exhaust NMOG emission results shall be multiplied by the reactivity adjustment factor to determine compliance with intermediate in-use compliance standards for NMOG. In addition to multiplying the exhaust NMOG emission results by the applicable reactivity adjustment factor, ~~NG vehicles shall multiply~~ the exhaust methane emission results for natural gas vehicles shall be multiplied by the applicable methane reactivity adjustment factor and the resulting value shall be added ~~add that value~~ to the reactivity-adjusted NMOG value.

b. **Intermediate In-Use Standards for Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline**. For fuel-flexible and dual-fuel PCs and LDTs from 0-~~3750~~ 5750 lbs. LVW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles when the vehicle is operated on gasoline shall be:

Vehicle Type	Loaded Vehicle Weight (LVW)	Emission Category	Durability Vehicle Basis (g/mi) 50,000 mi
PCs, LDT	All, 0-3750	TLEV	0.32
		LEV	0.188
		ULEV	0.100
LDT	3751-5750	TLEV	0.41
		LEV	0.238
		ULEV	0.128

Intermediate in-use compliance standards shall apply to TLEVs through the 1995 model year, and to LEVs and ULEVs through the 1998 model year. In-use compliance with standards beyond 50,000 miles shall be waived through the 1995 model year for TLEVs, and through the 1998 model year for LEVs and ULEVs.
~~0.32 g/mi, 0.188 g/mi and 0.100 g/mi for TLEVs, LEVs and ULEVs, respectively.~~

~~c. For fuel-flexible and dual-fuel LDTs from 3751-5750 lbs. LVW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles, when the vehicle is operated on gasoline, shall be 0.41 g/mi, 0.238 g/mi and 0.128 g/mi for TLEVs, LEVs and ULEVs, respectively.~~

(7) **Diesel Standards**. Manufacturers of diesel vehicles shall also certify to particulate standards at 100,000 miles. For all PCs and LDTs from 0-~~5750~~ 3750 lbs. LVW, the particulate standard is 0.08 g/mi, 0.08 g/mi, and 0.04 g/mi for TLEVs, LEVs, and ULEVs, respectively. For LDTs from 3751-5750 lbs. LVW, the particular standard is 0.10 g/mi, 0.10 g/mi, and 0.05 g/mi for TLEVs, LEVs, and ULEVs, respectively. For diesel vehicles certifying to the standards set forth in section 3.g. of these test procedures, "NMOG" shall mean non-methane hydrocarbons.

(8) **50°F Requirement**. Manufacturers shall demonstrate compliance with the above standards for NMOG, carbon monoxide and NOx at 50° F, according to the procedure specified in Section 11k of these test procedures. Hybrid electric ~~vehicles~~, natural gas, and diesel-fueled vehicles shall be exempt from 50° F test requirements.

(9) **Limit on In-Use Testing**. In-use compliance testing shall be limited to vehicles with fewer than 75,000 miles.

(10) **HEV Requirements**. Deterioration factors for hybrid electric vehicles shall be based on the emissions and mileage accumulation of the auxiliary power unit. For certification purposes only, Type A hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors), and demonstrating compliance with 100,000 mile emission standards shall not be required. For certification purposes only, Type B hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors) and 100,000 mile emission standards (using 75,000 mile deterioration factors). For certification purposes only, Type C hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors) and 100,000 mile emission standards (using 100,000 mile deterioration factors).

h. The fleet average non-methane organic gas exhaust mass emission values from the passenger cars and light-duty trucks produced and delivered for sale in California by a manufacturer each model year shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES[7,8,9]

[grams per mile" (or "g/mi")]

Vehicle Type[1]	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi)[7]	Model Year	Fleet Average Non-Methane Organic Gases[2,3,4,5,6]
PC and LDT	All 0-3750	50,000	1994	0.250
			1995	0.231
			1996	0.225
			1997	0.202
			1998	0.157
			1999	0.113
			2000	0.073
			2001	0.070
			2002	0.068
			2003 and subsequent	0.062
LDT	3751-5750	50,000	1994	0.320
			1995	0.295
			1996	0.287
			1997	0.260
			1998	0.205
			1999	0.150
			2000	0.099
			2001	0.098
			2002	0.095
			2003 and subsequent	0.093

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"MDV" means medium-duty vehicles.
"LVW" means loaded vehicle weight.

(2) "Non-Methane Organic Gases" (or "NMOG") shall mean the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

(3) For the purpose of calculating fleet average NMOG values, vehicles which have no tailpipe emissions but use fuel fired heaters and which are not certified as ZEVs shall be treated as Type A Hybrid Electric Vehicles Ultra-Low-Emission Vehicles (or "Type A HEV ULEVs").

(4) **Calculation of Fleet Average NMOG Value (PCs and LDTs from 0-3750 lbs. LVW).** Each manufacturer's fleet average NMOG value for the total number of PCs and LDTs from 0-3750 lbs. ~~"Loaded Vehicle Weight" (or "LVW")~~ produced and delivered for sale in California shall be calculated in units of g/mi NMOG according to the following equation, where the term "Produced" means produced and delivered for sale in California:

{[(No. of vehicles certified to the exhaust emission standards in Section 3.b. of these test procedures and produced) x (0.39)] +
[(No. of vehicles certified to the phase-in exhaust emission standards in Section 3.e. of these test procedures and produced) x (0.25)] +
[(No. of vehicles certified to the phase-out exhaust emission standards in 3.e. of these test procedures and produced) x (0.39)] +
[(No. of vehicles certified to the exhaust emission standards in Section 3.f. of these test procedures and produced) x (0.25)] +
[(No. of TLEVs produced excluding HEVs) x (0.125)] +
[(No. of LEVs produced excluding HEVs) x (0.075)] +
[(No. of ULEVs produced excluding HEVs) x (0.040)] +
(HEV contribution factor)} ÷
[Total No. of vehicles produced, including ZEVs and HEVs].

a. "HEV contribution factor" shall mean the NMOG emission contribution of HEVs to a manufacturer's fleet average NMOG value. The HEV contribution factor shall be calculated in units of g/mi as follows, where the term "Produced" means produced and delivered for sale in California:

HEV contribution factor =

{[No. of "Type A HEV" TLEVs produced] x (0.100) +
[No. of "Type B HEV" TLEVs produced] x (0.113) +
[No. of "Type C HEV" TLEVs produced] x (0.125)} +
{[No. of "Type A HEV" LEVs produced] x (0.057) +
[No. of "Type B HEV" LEVs produced] x (0.066) +
[No. of "Type C HEV" LEVs produced] x (0.075)} +
{[No. of "Type A HEV" ULEVs produced] x (0.020) +
[No. of "Type B HEV" ULEVs produced] x (0.030) +
[No. of "Type C HEV" ULEVs produced] x (0.040)}

b. ZEVs classified as LDTs 3751-5750 lbs. LVW which have been counted toward the ZEV requirement for PCs and LDTs 0-3750 lbs. LVW as specified in note (9) shall be included in the above equation of note (4).

c. Beginning with the 1996 model year, manufacturers that produce and deliver for sale in California PCs and LDTs 0-3750 lbs. LVW that are certified to the Tier I exhaust emission standards in 40 CFR 86.094-8 and 86.094-9 shall add the following term to the numerator of the fleet average NMOG equation in note (4) and

calculate their fleet average values accordingly: [(No. of Vehicles Certified to federal Tier I exhaust emission standards and Produced) x (0.25)].

(5) **Calculation of Fleet Average NMOG Value (LDTs 3751-5750 lbs. LVW.)**
Manufacturers that certify LDTs from 3751-5750 lbs. LVW, shall calculate a fleet average NMOG value in units of g/mi NMOG according to the following equation, where the term "Produced" means produced and delivered for sale in California:

{[(No. of vehicles certified to the exhaust emission standards in Section 3.b. of these test procedures and produced x (0.50)] +
[(No. of vehicles certified to the phase-in exhaust emission standards in Section 3.e. of these test procedures and produced) x (0.32)] +
[(No. of vehicles certified to the phase-out exhaust emission standards in Section 3.e. of these test procedures and produced) x (0.50)] +
[(No. of vehicles certified to the exhaust emission standards in Section 3.f. of these test procedures and produced) x (0.32)] +
[(No. of TLEVs produced excluding HEVs) x (0.160)] +
[(No. of LEVs produced excluding HEVs) x (0.100)] +
[(No. of ULEVs produced excluding HEVs) x (0.050)] +
(HEV contribution factor)} ÷
(Total No. of vehicles produced, including ZEVs and HEVs).

a. "HEV contribution factor" shall mean the NMOG emission contribution of HEVs to a manufacturer's fleet average NMOG value. The HEV contribution factor shall be calculated in units of g/mi as follows, where the term "Produced" means produced and delivered for sale in California:

HEV contribution factor =

{[No. of "Type A HEV" TLEVs Produced] x (0.130) +
[No. of "Type B HEV" TLEVs Produced] x (0.145) +
[No. of "Type C HEV" TLEVs Produced] x (0.160)} +
{[No. of "Type A HEV" LEVs Produced] x (0.075) +
[No. of "Type B HEV" LEVs Produced] x (0.087) +
[No. of "Type C HEV" LEVs Produced] x (0.100)} +
{[No. of "Type A HEV" ULEVs Produced] x (0.025) +
[No. of "Type B HEV" ULEVs Produced] x (0.037) +
[No. of "Type C HEV" ULEVs Produced] x (0.050)}

b. Only ZEVs which have been certified as LDTs 3751-5750 lbs. LVW and which have not been counted toward the ZEV requirements for PCs and LDTs 0-3750 lbs. LVW as specified in note (9) shall be included in the equation of note (5).

c. Beginning with the 1996 model year, manufacturers that produce and deliver for sale in California LDTs 3751-5750 lbs. LVW that are certified to the Tier I exhaust emission standards in 40 CFR 86.094-9 shall add the following term to the numerator of the fleet average NMOG equation in note (5) and calculate their fleet

average NMOG values accordingly: [(No. of Vehicles Certified to federal Tier I exhaust emission standards and Produced and Delivered for Sale in California) x (0.32)]

(6) **Requirements for Small Volume Manufacturers**. As used in this section 3.h. of these test procedures, the term "small volume manufacturer" shall mean any vehicle manufacturer with California sales less than or equal to 3000 new PCs, LDTs, and MDVs per model year based on the average number of vehicles sold by the manufacturer each model year from 1989 to 1991, except as otherwise noted below. For manufacturers certifying for the first time in California, model-year sales shall be based on projected California sales. In 2000 and subsequent model years, small volume manufacturers shall comply with the fleet average NMOG requirements set forth below.

a. Prior to the model year 2000, compliance with the specified fleet average NMOG requirements shall be waived.

b. In 2000 and subsequent model years, small volume manufacturers shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW calculated in accordance with note (4).

c. In 2000 and subsequent model years, small volume manufacturers shall not exceed a fleet average NMOG value of 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with note (5).

d. If a manufacturer's average California sales exceeds 3000 units of new PCs, LDTs, and MDVs based on the average number of vehicles sold for any three consecutive model years, the manufacturer shall no longer be treated as a small volume manufacturer and shall comply with the fleet average requirements applicable for larger manufacturers as specified in Section 3.h. of these test procedures beginning with the fourth model year after the last of the three consecutive model years.

e. If a manufacturer's average California sales falls below 3000 units of new PCs, LDTs, and MDVs based on the average number of vehicles sold for any three consecutive model years, the manufacturer shall be treated as a small volume manufacturer and shall be subject to requirements for small volume manufacturers as specified in Section 3.h. of these test procedures beginning with the next model year.

(7) **Calculation of NMOG Credits/Debits and Procedure for Offsetting Debits**.

a. In 1992 and subsequent model years, manufacturers that achieve fleet average NMOG values lower than the fleet average NMOG requirement for the corresponding model year shall receive credits in units of g/mi NMOG determined as:

[(Fleet Average NMOG Requirement) - (Manufacturer's Fleet Average NMOG Value)] x (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

a. Manufacturers with 1994 and subsequent model year fleet average NMOG values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG equal to the amount of negative credits determined by the aforementioned equation. For any given model year, the total g/mi NMOG credits or debits earned for PCs and LDTs 0-3750 lbs. LVW and for LDTs

3751-5750 lbs. LVW shall be summed together. The resulting amount shall constitute the g/mi NMOG credits or debits accrued by the manufacturer for the model year.

b. For the 1994 through 1997 model years, manufacturers shall equalize emission debits within three model years and prior to the end of the 1998 model year by earning g/mi NMOG emission credits in an amount equal to their g/mi NMOG debits, or by submitting a commensurate amount of g/mi NMOG credits to the Executive Officer that were earned previously or acquired from another manufacturer. For 1998 and subsequent model years, manufacturers shall equalize emission debits by the end of the following model year. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the emission debits are not equalized by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG emission debits for the model year by the g/mi NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW applicable for the model year in which the debits were first incurred.

c. The g/mi NMOG emission credits earned in any given model year shall retain full value through the subsequent model year. ~~d.~~ The g/mi NMOG value of any credits not used to equalize the previous model-year's debit, shall be discounted by 50% at the beginning of second model year after being earned, discounted to 25% of its original value if not used by the beginning of the third model year after being earned, and will have no value if not used by the beginning of the fourth model year after being earned.

d. In order to verify the status of a manufacturer's compliance with the fleet average requirements for a given model year, and in order to confirm the accrual of NMOG credits or debits, each manufacturer shall submit an annual report to the Executive Officer which sets forth the production data used to establish compliance by no later than March 1 of the calendar year following the close of the model year.

(8) **Credits for Pre-1994 Model Year Vehicles**. Manufacturers that produce and deliver for sale in California vehicles certified to the phase-in exhaust emission standards in Section 3.e. of these test procedures or vehicles certified to the exhaust emission standards in Sections 3.f. or 3.g. of these test procedures and/or ZEVs in the 1992 and 1993 model years, shall receive emission credits as determined by the equations in notes (4), (5), and (7).

a. For PCs and LDTs from 0-3750 lbs. LVW, the fleet average NMOG requirement for calculating a manufacturer's emission credits shall be 0.390 and 0.334 g/mi NMOG for vehicles certified in the 1992 and 1993 model years, respectively.

b. For LDTs from 3751-5750 lbs. LVW, the fleet average NMOG requirement for calculating a manufacturer's emission credits shall be 0.500 and 0.428 g/mi NMOG for vehicles certified in the 1992 and 1993 model years, respectively.

c. Emission credits earned prior to the 1994 model year shall be considered as earned in the 1994 model year and discounted in accordance with the schedule specified in note (7).

(9) **ZEV Requirements**. While meeting the fleet average requirements, each manufacturer shall certify, produce, and deliver for sale in California at least the percentages of ZEVs set forth in the table below.

Model Year	Required Percentage per Model Year
1998	2
1999	2
2000	2
2001	5
2002	5
2003 and subsequent model years	10

~~2% ZEVs each model year from 1998 through 2000, 5% ZEVs in 2001 and 2002, and 10% ZEVs in 2003 and subsequent model years.~~ These percentages shall be applied to the manufacturer's total production of PCs and LDTs 0-3750 lbs. LVW delivered for sale in California.

a. **Calculation of ZEV Credits**. Manufacturers which produce for sale in California more ZEVs than required in a given model year shall earn ZEV credits, which shall ~~have~~ be expressed in units of g/mi NMOG. The amount of ZEV credits earned shall be equal to the number of ZEVs required to be produced and delivered for sale in California for the model year subtracted from the number of ZEVs actually produced and delivered for sale in the model year and then multiplied by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year. All ZEV credits earned prior to the 1998 model year shall be treated as if earned in the 1998 model year and shall be discounted in accordance with notes (7)c ~~and (7)~~d.

b. **Submittal of ZEV Credits**. A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits. These credits may be earned previously by the manufacturer or acquired from another manufacturer. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year.

c. **Requirement to Make Up a ZEV Deficit**. Manufacturers which certify, produce, and deliver for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs actually produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirements for PCs and LDTs 0-3750 lbs. LVW for the model year in which the deficit is incurred.

d. **Penalty for Failure to Meet ZEV Requirements**. Any manufacturer which fails to produce and deliver for sale in California the required number of ZEVs or submit an appropriate amount of ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation:

(No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No of ZEVs actually produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model year)].

e. **ZEV Credits for MDVs and LDTs 3751-5750 lbs. LVW**. ZEVs classified as MDVs or as LDTs 3751-5750 lbs. LVW may be counted toward the ZEV requirement for PCs and LDTs 0-3750 lbs. LVW and included in the calculation of ZEV credits as specified in note (9)a., if the manufacturer so designates.

f. Small volume manufacturers shall not be required to meet the percentage ZEV requirements. However, small volume manufacturers may earn and market credits for ZEVs they produce and deliver for sale in California.

g. Intermediate volume manufacturers shall not be required to meet the percentage ZEV requirements before the 2003 model year.

i. The exhaust emissions from new 1995 and subsequent model medium-duty vehicles shall not exceed:

1995 AND SUBSEQUENT MODEL-YEAR MEDIUM-DUTY VEHICLE EXHAUST EMISSIONS STANDARDS [1,2,3,7,8]

(grams per mile)

Test Weight(lbs.)	Durability Vehicle Basis(mi)	Non-Methane Hydrocarbons[4]	Carbon Monoxide	Oxides of Nitrogen[5]	Particulates[6]
0-3,750	50,000	0.25	3.4	0.4	n/a
0-3,750	120,000	0.36	5.0	0.55	0.08
3,751-5,750	50,000	0.32	4.4	0.7	n/a
3,751-5,750	120,000	0.46	6.4	0.98	0.10
5,751-8,500	50,000	0.39	5.0	1.1	n/a
5,751-8,500	120,000	0.56	7.3	1.53	0.12
8,501-10,000	50,000	0.46	5.5	1.3	n/a
8,501-10,000	120,000	0.66	8.1	1.81	0.12
10,001-14,000	50,000	0.60	7.0	2.0	n/a
10,001-14,000	120,000	0.86	10.3	2.77	0.12

(1) "n/a" means not applicable.
"Test Weight" (or "TW") shall mean the average of the vehicle's curb weight and gross vehicle weight.

(2) Manufacturers have the option of certifying engines used in incomplete and diesel medium-duty vehicles from 8501-14,000 pounds gross vehicle weight to the heavy-duty engine standards and test procedures set forth in Section 1956.8(eg), Title 13, California Code of Regulations. Manufacturers certifying incomplete or diesel medium-duty vehicles to the heavy-duty engine standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in Sections 2139(c), Title 13, California Code of Regulations.

(3) For the 1995 model year only, manufacturers of medium-duty vehicles may certify a maximum of 50 percent of their vehicles to the applicable 1994 model year standards and test procedures. The percentage shall be based upon each manufacturer's projected sales of California-certified medium-duty vehicles. For the 1995 model year only, small volume manufacturers may certify 100 percent of their vehicles to the applicable 1994 model-year standards and test procedures.

(4) For alcohol-fueled vehicles certifying to these standards, including fuel-flexible vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent" (or "OMNMHCE").

(5) The maximum projected emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall be not greater than 2.00 times the applicable medium-duty vehicle standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(6) Particulate standards are only applicable for diesel vehicles and shall be determined on a 120,000 mile basis.

(7) In-use compliance testing shall be limited to vehicles with less than 90,000 miles. For the 1995 through 1997 model years, alternative in-use compliance is available for medium-duty vehicle manufacturers. A manufacturer may use alternative in-use compliance for up to 100 percent of its fleet in the 1995 and 1996 model years and up to 50 percent of its fleet in the 1997 model year. Small volume manufacturers only may use alternative in-use compliance for up to 100 percent of their fleet in the 1995 through 1997 model years. The percentages shall be determined only from the manufacturer's projected California sales of medium-duty vehicles. For vehicles certified to the standards and test procedures of this subsection, "alternative in-use compliance" shall consist of an in-use allowance of 25 percent over the applicable 1995 model-year hydrocarbon, carbon monoxide, and oxides of nitrogen 50,000 mile emission standards and a waiver of the emission standards beyond 50,000 miles.

(8) All medium-duty vehicles, except diesel-fueled vehicles and those incomplete and diesel vehicles certifying to heavy-duty engine test procedures, are subject to 50,000 mile and 120,000 mile non-methane hydrocarbon, carbon monoxide, and oxides of nitrogen standards. Diesel-fueled vehicles shall be subject to 120,000 mile non-methane hydrocarbon, carbon monoxide, oxides of nitrogen, and particulate standards only.

j. The exhaust emission levels from new 1992 and subsequent model-year medium-duty low-emission vehicles, ~~and~~ ultra-low-emission vehicles, and super low-emission vehicles shall not exceed:

EXHAUST EMISSION STANDARDS FOR LOW-EMISSION VEHICLES, ~~AND~~ ULTRA-LOW-EMISSION VEHICLES AND SUPER-LOW-EMISSION VEHICLES IN THE MEDIUM-DUTY VEHICLE WEIGHT CLASS[8,9,10, 11, 12, 14, 15, 16]

[grams per mile (or "g/mi")]

Test Weight (lbs)[1]	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane Organic Gases[1,3,4]	Carbon Monoxide	Oxides of Nitrogen[5]	Particulates[6,7]
0-3750	50,000	LEV	0.125 ~~(0.188)~~	3.4 ~~(3.4)~~	0.4 ~~(0.4)~~	n/a
		ULEV	0.075 ~~(0.100)~~	1.7 (2.6)	0.2 (0.3)	n/a
	120,000	LEV	0.180	5.0	0.6	0.08
		ULEV	0.107	2.5	0.3	0.04
3751-5750	50,000	LEV	0.160 ~~(0.238)~~	4.4 ~~(4.4)~~	~~0.7~~ 0.4	n/a
		ULEV	0.100 ~~(0.128)~~ ~~2.2 (3.3)~~	4.4	0.4 ~~(0.5)~~	n/a
		SULEV	0.050	2.2	0.2	n/a
	120,000	LEV	0.230	6.4	~~1.0~~ 0.6	0.10
		ULEV	0.143	~~3.2~~ 6.4	~~0.5~~ 0.6	0.05
		SULEV	0.072	3.2	0.3	0.05
5751-8500	50,000	LEV	0.195 ~~(0.293)~~	5.0 ~~(5.0)~~	~~1.1~~ 0.6	n/a
		ULEV	0.117 ~~(0.156)~~ ~~2.5 (3.8)~~	5.0	0.6 ~~(0.8)~~	n/a
		SULEV	0.059	2.5	0.3	n/a
	120,000	LEV	0.280	7.3	~~1.5~~ 0.9	0.12
		ULEV	0.167	~~3.7~~ 7.3	~~0.8~~ 0.9	0.06
		SULEV	0.084	3.7	0.45	0.06
8501-10,000	50,000	LEV	0.230 ~~(0.345)~~	5.5 ~~(5.5)~~	~~1.3~~ 0.7	n/a
		ULEV	0.138 ~~(0.184)~~ ~~2.8 (4.2)~~	5.5	0.7 ~~(1.0)~~	n/a
		SULEV	0.069	2.8	0.35	n/a
	120,000	LEV	0.330	8.1	~~1.8~~ 1.0	0.12
		ULEV	0.197	~~4.1~~ 8.1	~~0.9~~ 1.0	0.06
		SULEV	0.100	4.1	0.5	0.06
10,001-14,000	50,000	LEV	0.300 ~~(0.450)~~	7.0 ~~(7.0)~~	~~2.0~~ 1.0	n/a
		ULEV	0.180 ~~(0.240)~~ ~~3.5 (5.3)~~	7.0	1.0 ~~(1.5)~~	n/a
		SULEV	0.09	3.5	0.5	n/a
	120,000	LEV	0.430	10.3	~~2.8~~ 1.5	0.12
		ULEV	0.257	~~5.2~~ 10.3	~~1.4~~ 1.5	0.06

SULEV	0.130	5.2	0.7	0.06

(1) "Test Weight" (or "TW") shall mean the average of the vehicle's curb weight and gross vehicle weight.
"Non-Methane Organic Gases" (or "NMOG") means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

(2) "LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"SULEV" means super *ultra*-low-emission vehicle.

(3) **Compliance with NMOG Standards**. ~~"Non-Methane Organic Gases" (or "NMOG") shall mean the total mass of oxygenated and non-oxygenated hydrocarbon emissions.~~ To determine compliance with an NMOG standard, NMOG emissions shall be measured in accordance with "California Non-Methane Organic Gas Test Procedures" ~~as~~ adopted July 12, 1991 and last amended ~~September 22, 1993~~ _____.

a. **Reactivity Adjustment**. For LEVs and ULEVs certified to operate on an available fuel other than conventional gasoline, including fuel-flexible or dual-fuel vehicles when certifying on a fuel other than ~~conventional~~ gasoline, manufacturers shall multiply the NMOG exhaust certification levels by the applicable reactivity adjustment factor set forth in Section 13 of these test procedures or established by the Executive Officer pursuant to Appendix VIII of these test procedures. In addition, ~~NG~~ natural gas vehicles certifying to LEV or ULEV standards shall calculate a reactivity-adjusted methane exhaust emission value by multiplying the methane exhaust certification level by the applicable methane reactivity adjustment factor set forth in section 13 of these test procedures. The product of the exhaust NMOG certification levels and the reactivity adjustment factor shall be compared to the exhaust NMOG mass emission standard established for the particular vehicle emission category. For ~~NG~~ natural gas vehicles, the reactivity-adjusted NMOG value shall be added to the reactivity-adjusted methane value and then compared to the exhaust NMOG mass emission standards established for the particular vehicle emission category to determine compliance.

b. Prior to the 1998 model year, the LEV exhaust mass emission standard for NOx shall be 0.7 g/mi for MDVs from 3751-5750 lbs. TW, 1.1 g/mi for MDVs from 5751-8500 lbs. TW, 1.3 g/mi for MDVs from 8501-10,000 lbs. TW and 2.0 g/mi for MDVs from 10,001-14,000 lbs. TW.

(4) **NMOG Standards for Fuel-Flexible and Dual-Fuel Vehicles**. Fuel-flexible and dual-fuel "Medium-Duty Vehicles" (or "MDVs") from 0-14,000 lbs. TW shall be certified to exhaust mass emission standards for NMOG established for the operation of the vehicle on a fuel other than gasoline, and gasoline.

a. **Reactivity Adjustment Factor**. For LEVs and ULEVs when certifying on the fuel other than gasoline, manufacturers shall multiply the exhaust NMOG certification levels by the applicable reactivity adjustment factor. In addition to multiplying the exhaust NMOG certification levels by the applicable reactivity adjustment factor, ~~NG vehicles shall multiply~~ the exhaust methane certification level for natural gas vehicles shall be multiplied by the applicable methane reactivity adjustment factor and the resulting value shall be added ~~add that value~~ to the reactivity-adjusted NMOG value. When certifying on gasoline, the exhaust NMOG

certification levels of fuel-flexible and dual-fuel vehicles shall not be multiplied by a reactivity adjustment factor.

b. **Standards for Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline.** For MDVs from 0-~~3750~~ 14,000 lbs. TW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:

Test Weight (lbs.)	Vehicle Emission Category	Durability Vehicle Basis	
		50,000 (g/mi)	120,000 (g/mi)
0-3750	LEV	0.25	0.36
	ULEV	0.125	0.180
3751-5750	LEV	0.32	0.46
	ULEV	0.160	0.230
	SULEV	0.100	0.143
5751-8500	LEV	0.39	0.56
	ULEV	0.195	0.280
	SULEV	0.117	0.167
8501-10,000	LEV	0.46	0.66
	ULEV	0.230	0.330
	SULEV	0.138	0.197
10,001-14,000	LEV	0.60	0.86
	ULEV	0.300	0.430
	SULEV	0.180	0.257

~~(i) For LEVs, 0.25 g/mi and 0.36 g/mi for 50,000 and 120,000 miles, respectively.~~

~~(ii) For ULEVs, 0.125 g/mi and 0.180 g/mi for 50,000 and 120,000 miles, respectively.~~

~~c. For MDVs from 3751-5750 lbs. TW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:~~

~~(i) For LEVs, 0.32 g/mi and 0.46 g/mi for 50,000 and 120,000 miles, respectively.~~

~~(ii) For ULEVs, 0.160 g/mi and 0.230 g/mi for 50,000 and 120,000 miles, respectively.~~

~~d. For MDVs from 5751-8500 lbs. TW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:~~

~~(i) For LEVs, 0.39 g/mi and 0.56 g/mi for 50,000 and 120,000 miles, respectively.~~

~~(ii) For ULEVs, 0.195 g/mi and 0.280 g/mi for 50,000 and 120,000 miles, respectively.~~

~~e. For MDVs from 8501-10,000 lbs. TW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:~~

~~(i) For LEVs, 0.46 g/mi and 0.66 g/mi for 50,000 and 120,000 miles, respectively.~~

~~(ii) For ULEVs, 0.230 g/mi and 0.330 g/mi for 50,000 and 120,000 miles, respectively.~~

~~d. For MDVs from 10,001-14,000 lbs. TW, the applicable exhaust mass emission standard for NMOG when certifying the vehicle for operation on gasoline shall be:~~

~~(i) For LEVs, 0.60 g/mi and 0.86 g/mi for 50,000 and 120,000 miles, respectively.~~

~~(ii) For ULEVs, 0.300 g/mi and 0.430 g/mi for 50,000 and 120,000 miles, respectively.~~

(5) **Highway NOx**. The maximum projected emissions of Oxides of Nitrogen (or "NOx") measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B) shall not be greater than 2.00 times the applicable MDV standards shown in the table. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi before being compared.

(6) Particulate standards are only applicable for diesel vehicles and shall be determined on a 120,000 mile basis.

(7) "n/a" means not applicable.

(8) **Certification of Incomplete and Diesel Vehicles**. Manufacturers have the option of certifying engines used in incomplete and diesel MDVs to the heavy-duty engine standards and test procedures set forth in Section 1956.8(g) or (h) Title 13, California Code of Regulations. Manufacturers certifying incomplete or diesel MDVs to the heavy-duty engine standards and test procedures shall specify in the application for certification an in-use compliance procedure as provided in Section 2139(c), Title 13, California Code of Regulations. For diesel vehicles certifying to NMOG standards set forth in section 3.j of these test procedures, "NMOG" shall mean non-methane hydrocarbons.

(9) **Intermediate In-Use Compliance Standards**. Beginning with the 1998 model year, t~~T~~he following ~~standards in parentheses are~~ intermediate in-use compliance standards for 50,000 miles~~:~~ and 120,000 miles for ~~For~~ MDVs from 0-14,000 lbs. TW, including fuel-flexible and dual-fuel vehicles when operating on an available fuel other than gasoline shall apply: ~~intermediate in-use compliance standards shall apply to LEVs and ULEVs through the 1999 model year.~~

Intermediate In-Use Compliance Standards										
Emission Category	Model Year	Durability Vehicle Basis (mi)	3751-5750 lbs.		5751-8500 lbs.		8501-10,000 lbs.		10,001-14,000 lbs.	
			NMOG (g/mi)	NOx* (g/mi)	NMOG (g/mi)	NOx* (g/mi)	NMOG (g/mi)	NOx* (g/mi)	NMOG (g/mi)	NOx* (g/mi)
LEV	through 1999	50,000	0.238	0.6	0.293	0.9	0.345	1.0	0.450	1.5
	2000	50,000	--	0.6	--	0.9	--	1.0	--	1.5
		120,000	--	0.8	--	1.2	--	1.3	--	2.0
ULEV	through 1999	50,000	0.128	0.6	0.156	0.9	0.184	1.0	0.240	1.5
	2000-2002	50,000	0.128	0.6	0.156	0.9	0.184	1.0	0.240	1.5
		120,000	0.160	0.8	0.195	1.2	0.230	1.3	0.300	2.0
SULEV	***through 2002***	***50,000***	***0.072***	***0.3***	***0.084***	***0.45***	***0.100***	***0.5***	***0.130***	***0.7***
		120,000	***0.100***		***0.117***		***0.138***		***0.180***	

In-use compliance with the standards beyond 50,000 miles shall be waived through the 1999 model year for LEVs and ULEVs ***and through the 2001 model year for SULEVs.***

*Intermediate in-use NOx standards shall only apply to the 1998, 1999 and 2000 model year MDVs.

a. **Reactivity Adjustment**. For LEVs and ULEVs designed to operate on an available fuel other than conventional gasoline, including fuel-flexible and dual-fuel vehicles when operating on an available fuel other than gasoline, NMOG exhaust mass emission results shall be multiplied by the applicable reactivity adjustment factor to determine compliance with intermediate in-use compliance standards for NMOG. In addition to multiplying the exhaust NMOG mass emission levels by the applicable reactivity adjustment factor, ~~NG~~ natural gas vehicles shall multiply the exhaust methane mass emission level by the applicable methane reactivity adjustment factor and add that value to the reactivity-adjusted NMOG value. For fuel-flexible and dual-fuel vehicles when operating on gasoline, NMOG emission results shall not be multiplied by a reactivity adjustment factor.

b. **Gasoline Standards for Fuel-Flexible and Dual-Fuel Vehicles**. For fuel-flexible and dual-fuel MDVs from 0-~~3750~~ 14,000 lbs. TW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles, when the vehicle is operated on gasoline, shall be:

Fuel-Flexible and Dual-Fuel MDVs Intermediate In-Use Compliance Standards		
Test Weight (lbs.)	Vehicle Emission Category	50,000 (g/mi)
0-3750	LEV	0.32
	ULEV	0.188
3751-5750	LEV	0.41
	ULEV	0.238
	SULEV	0.128
5751-8500	LEV	0.49
	ULEV	0.293
	SULEV	0.156
8501-10,000	LEV	0.58
	ULEV	0.345
	SULEV	0.184
10,001-14,000	LEV	0.75
	ULEV	0.450
	SULEV	0.240

Intermediate in-use compliance standards shall to apply to LEVs and ULEVs through the 1999 model year and to SULEVs through the ~~2005~~ ***2001*** model year. Compliance with the standards beyond 50,000 miles shall be waived through the 1999 model year for LEVs and ULEVs and through the 2001 model year for SULEVs. ~~0.32 g/mi and 0.188 g/mi for LEVs and ULEVs, respectively.~~

~~c. For fuel-flexible and dual-fuel MDVs from 3751-5750 lbs. TW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles, when the vehicle is operated on gasoline, shall be 0.41 g/mi and 0.238 g/mi for LEVs and ULEVs, respectively.~~

~~d. For fuel-flexible and dual-fuel MDVs from 5751-8500 lbs. TW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles, when the vehicle is operated on gasoline, shall be 0.49 g/mi and 0.293 g/mi for LEVs and ULEVs, respectively.~~

~~e. For fuel-flexible and dual-fuel MDVs from 8501-10,000 lbs. TW, intermediate in-use compliance standards for NMOG emissions at 50,000 miles, when the vehicle is operated on conventional gasoline, shall be 0.58 g/mi and 0.345 g/mi for LEVs and ULEVs, respectively.~~

~~f. For fuel-flexible and dual-fuel MDVs from 10,001-14,000 lbs. TW, intermediate compliance standards for NMOG emissions at 50,000 miles, when the~~

~~vehicle is operated on gasoline, shall be 0.75 g/mi and 0.450 g/mi for LEVs and ULEVs, respectively~~.

(10) **Medium-Duty Vehicle Phase-In Requirements**. Each manufacturer's MDV fleet shall be defined as the total number of California certified MDVs from 0-14,000 lbs. TW produced and delivered for sale in California.

a. Manufacturers of MDVs shall certify an equivalent percentage of ~~25% of~~ their MDV fleet ~~to~~ according to the following phase-in schedule: ~~LEV standards in the 1998 model year, 50% of their MDV fleet to LEV standards in the 1999 model year, 75% of their MDV fleet to LEV standards in the 2000 model year, 95% of their MDV fleet to LEV standards in the 2001 model year, 90% of their MDV fleet to LEV standards in the 2002 model year, and 85% of their MDV fleet to LEV standards in the 2003 and subsequent model years.~~

~~b. Manufacturers of MDVs shall certify an equivalent of 2% of their MDV fleet to ULEV standards in each model year from 1998 to 2000, 5% of their MDV fleet to ULEV standards in the 2001 model year, 10% of their MDV fleet to ULEV standards in the 2002 model year, and 15% of their MDV fleet to ULEV standards in the 2003 and subsequent model years.~~

Model Year	Vehicles Certified to Title 13 CCR Section 1960.1(h)(1) and(2) (%)			Vehicles Certified to Title 13 CCR Section 1956.8(g) or (h) (%)		
	Tier 1	LEV	ULEV	Tier 1	LEV	ULEV
1998	73	25	2	100	0	0
1999	48	50	2	100	0	0
2000	23	75	2	100	0	0
2001	0	80	20	100	0	0
2002	0	70	30	0	100	0
2003	0	60	40	0	100	0
2004 +	0	60	40	0	0	100

c. The percentages shall be applied to the manufacturers' total production of California-certified medium-duty vehicles delivered for sale in California.

d. These requirements shall not apply to small volume manufacturers. Small volume manufacturers shall comply with the requirements of note (16) below.

(11) For the purpose of calculating "Vehicle Equivalent Credits" (or "VECs"), vehicles which have no tailpipe emissions but use fuel fired heaters and which are not certified as ZEVs shall be treated as Type A Hybrid Electric Vehicle Ultra-Low-Emission Vehicles (or "Type A HEV ULEVs").

(12) **Calculation of Vehicle Equivalent Credits**. In 1992 and subsequent model years, manufacturers that produce and deliver for sale in California MDVs in excess of the equivalent requirements for LEVs and/or ULEVs certified to the exhaust emission standards set forth in Title 13, CCR, Sections 1960.1(h)(2) or 1956.8(h), shall receive "Vehicle-Equivalent Credits" (or "VECs") calculated in accordance with the following equation, where the term "Produced" means produced and delivered for sale in California:

{[(No. of LEVs Produced excluding HEVs) + (No. of "Type C HEV" LEVs Produced)] +
[(No. of "Type A HEV" LEVs Produced) x (1.2)] +
[(No of "Type B HEV" LEVs Produced) x (1.1)] -
(Equivalent No. of LEVs Required to be Produced)} +
{(1.4) x [(No. of ULEVs Produced excluding HEVs) + (No. of "Type C HEV" ULEVs Produced)] +
[(1.7) x (No. of "Type A HEV" ULEVs Produced)] +
[(1.5) x (No. of "Type B HEV" ULEVs Produced)] -
[(1.4) x (Equivalent No. of ULEVs Required to be Produced)]} +
{[(1.7) x [(No. of SULEVs Produced excluding HEVs) + (No. of "Type C HEV" SULEVs Produced)] +
[(No. of "Type A HEV" SULEVs Produced) x (1.7)] +
[No. of "Type B HEV" SULEVs) x (1.5)] -
[(1.7) x [(Equivalent No. of SULEVs Required to be Produced)]} +
[(2.0) x (No. of ZEVs Certified and Produced as MDVs)].

a. Manufacturers which fail to produce and deliver for sale in California the equivalent quantity of MDVs certified to LEV and/or ULEV exhaust emission standards, shall receive "Vehicle-Equivalent Debits" (or "VEDs") equal to the amount of negative VECs determined by the aforementioned equation.

b. Manufacturers shall equalize emission debits within one model year by earning VECs in an amount equal to their previous model-year's total of VEDs, or by submitting a commensurate amount of VECs to the Executive Officer that were earned previously or acquired from another manufacturer. Any manufacturer which fails to equalize emission debits within the specified time period shall be subject to the Health and Safety Code civil penalty applicable to a manufacturer which sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the emission debits are not equalized by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

c. The VECs earned in any given model year shall retain full value through the subsequent model year.

d. The value of any VECs not used to equalize the previous model- year's debit, shall be discounted by 50% at the beginning of second model year after being earned, discounted to 25% of its original value if not used by the beginning of the third

model year after being earned, and will have no value if not used by the beginning of the fourth model year after being earned.

e. Any VECs earned prior to the 1998 model year shall be treated as earned in the 1998 model year and discounted in accordance with the schedule specified in note (12)(d).

f. Only ZEVs certified as MDVs shall be included in the calculation of VECs.

g. In order to verify the status of a manufacturer's compliance with the phase-in requirements of this section and in order to confirm the accrual of VECs or VEDs, each manufacturer shall submit an annual report which sets forth the production data used to establish compliance by no later than March 1 of the calendar year following the close of the model year.

(13) **50° F Requirement.** Manufacturers shall demonstrate compliance with the above standards for NMOG, carbon monoxide, and oxides of nitrogen at 50° F, according to the procedure specified in Section 11k of these test procedures. Hybrid electric, natural gas and diesel-fueled vehicles are exempt from 50° F test requirements.

(14) In-use compliance testing shall be limited to vehicles with fewer than 90,000 miles.

(15) **HEV Requirements.** Deterioration factors for hybrid electric vehicles shall be based on the emissions and mileage accumulation of the auxiliary power unit. For certification purposes only, Type A hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors), and demonstrating compliance with 120,000 mile emission standards shall not be required. For certification purposes only, Type B hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors) and 120,000 mile emission standards (using 90,000 mile deterioration factors). For certification purposes only, Type C hybrid electric vehicles shall demonstrate compliance with 50,000 mile emission standards (using 50,000 mile deterioration factors) and 120,000 mile emission standards (using 120,000 mile deterioration factors).

(16) **Requirements for Small Volume Manufacturers.** As used in this subsection, the term "small volume manufacturer" shall mean any vehicle manufacturer with California sales less than or equal to 3000 new PCs, LDTs, and MDVs per model year based on the average number of vehicles sold by the manufacturer each model year from 1992 to 1994, except as otherwise noted below. For manufacturers certifying for the first time in California, model-year sales shall be based on projected California sales. In 2001 and subsequent model years, small volume manufacturers shall comply with the requirements set forth below.

a. Prior to the model year 2001, small volume manufacturers shall not be required to certify, produce, or deliver LEVs and ULEVs for sale in California.

b. In 2001 and subsequent model years, small volume manufacturers shall certify, produce, and deliver for sale in California LEVs in a quantity equivalent to 100% of their MDV fleet.

c. If a manufacturer's average California sales exceeds 3000 units of new PCs, LDTs, and MDVs based on the average number of vehicles sold for any three consecutive model years, the manufacturer shall no longer be treated as a small volume

manufacturer and shall comply with the LEV and ULEV requirements applicable for larger manufacturers as specified in this subsection beginning with the fourth model year after the last of the three consecutive model years.

d. If a manufacturer's average California sales falls below 3000 units of new PCs, LDTs, and MDVs based on the average number of vehicles sold for any three consecutive model years, the manufacturer shall be treated as a small volume manufacturer and shall be subject to requirements for small volume manufacturers as specified in this subsection beginning with the next model year.

k. The cold temperature exhaust carbon monoxide emission levels from new 1996 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles shall not exceed:

1996 AND SUBSEQUENT MODEL-YEAR COLD TEMPERATURE CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES[1,2]

(grams per mile)

Vehicle Type	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi)	Carbon Monoxide
Passenger Car	All	50,000	10.0
Light-Duty Truck	0-3750	50,000	10.0
Light-Duty Truck	3751-5750	50,000	12.5
Medium-Duty Vehicle	0-3750	50,000	10.0
Medium-Duty Vehicle	3751-8500[3]	50,000	12.5

(1) These standards are applicable to vehicles tested in accordance with 40 CFR Part 86 Subpart C, at a nominal temperature of 20° F (-7° C).

(2) Natural gas vehicles, diesel-fueled vehicles, hybrid electric vehicles, and zero-emission vehicles are exempt from these standards.

(3) Medium-duty vehicles with a gross vehicle weight rating greater than 8,500 lbs. are exempt from this standard.

4. Initial Requirements

a. Application for Certification

In paragraph 86.088-21, 86.090-21, 86.091-21, and 86.094-21:

1. Amend subparagraph (b)(1)(i) to read:

(i) Identification and description of the vehicles (or engines) covered by the application and a description (including a list and part numbers of all major emission control system parts and fuel system components) of their engine (vehicles only) emission control system and fuel system components, including if applicable, the turbocharger and intercooler. This shall include a detailed description of each auxiliary emission control device (AECD) to be installed in or on any certification test vehicle (or certification test engine).

2. Amend subparagraph (b)(2) to read:

(2) For 1992 and subsequent model-year TLEVs, LEVs, and ULEVs not certified exclusively on gasoline, projected California sales data and fuel economy data 19 months prior to January 1 of the calendar year with the same numerical designation as the model year for which the vehicles are certified, and projected California sales data for all vehicles, regardless of operating fuel or vehicle emission category, sufficient to enable the Executive Officer to select a test fleet representative of the vehicles (or engines) for which certification is requested at the time of certification.

3. Add subparagraph (g) which reads:

(1) For ZEVs and hybrid electric vehicles, the certification application shall include the following:

(i) Identification and description of the vehicle(s) covered by the application.

(ii) Identification of the vehicle weight category to which the vehicle is certifying: PC, LDT 0-3750 lbs. LVW, LDT 3751-5750 lbs. LVW, or MDV (state test weight range), and the curb weight and gross vehicle weight rating of the vehicle.

(iii) Identification and description of the propulsion system for the vehicle.

(iv) Identification and description of the climate control system used on the vehicle.

(v) Projected number of vehicles produced and delivered for sale in California, and projected California sales.

(vi) For electric and hybrid electric vehicles, identification of the energy usage in kilowatt-hours per mile from the point when electricity is introduced from the electrical outlet and the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test (see section 9.f. of these test procedures).

(vii) If the vehicle is equipped with a fuel fired heater, a description of the control system logic of the fuel fired heater, including an evaluation of the conditions under which the fuel fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist. Vehicles which utilize fuel fired heaters which can be operated at ambient temperatures above 40° F or which cannot be demonstrated to have zero evaporative emissions under any and all possible operation modes and conditions shall not be certified as ZEVs.

For ZEVs and HEVs which use fuel fired heaters, the manufacturer shall provide the exhaust emissions value per mile produced by the auxiliary fuel fired heater. This shall be accomplished by determining heater emissions in grams per minute when operating at a maximum heating capacity for a period of 20 minutes, and multiplying that number by 3.6 minutes per mile. At the time of certification, manufacturers shall submit their test plan which describes the procedure used to determine the mass emissions of the fuel fired heater.

(viii) All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel, method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

In paragraph 86.088-21 and 86.090-21:

4. Amend subparagraph (b)(4)(iii)(C)(1) and (C)(2) to read:

(1) A statement of maintenance and procedures consistent with the restrictions imposed under subparagraph 86.085-25(a)(1), necessary to assure that the vehicles (or engines) covered by a certificate of conformity in operation in normal use to conform to the regulations, and a description of the program for training of personnel for such maintenance, and the equipment required.

(2) A statement that the vehicles sold comply with the California high-altitude emission requirements as specified in Section 11.b. (High Altitude Requirements) in these procedures.

b. Required Data

In paragraph 86.085-23, 86.087-23, 86.088-23, 86.091-23, and 86.094-23:

1. Amend (c)(1) by adding the following paragraph which reads:

For all TLEVs, LEVs, and ULEVs certifying on a fuel other than conventional gasoline, manufacturers shall multiply the NMOG exhaust certification level for each emission-data vehicle by the appropriate reactivity adjustment factor listed in Section 13.a. of these test procedures or established by the Executive Officer pursuant to Appendix VIII of these test procedures to demonstrate compliance with the applicable NMOG emission standard. For all TLEVs, LEVs, and ULEVs certifying on natural gas, manufacturers shall multiply the NMOG exhaust certification level for each emission-data vehicle by the appropriate reactivity adjustment factor listed in Section 13.a. of these test procedures or established by the Executive Officer pursuant to Appendix VIII of these test procedures and add that value to the product of the methane exhaust certification level for each emission-data vehicle and the appropriate methane reactivity adjustment factor listed in Section 13.a. of these test procedures or established by the Executive Officer pursuant to Appendix VIII of these test procedures to demonstrate compliance with the applicable NMOG emission standard. Manufacturers requesting to certify to existing standards utilizing an adjustment factor unique to its vehicle/fuel system must follow the data requirements described in Appendix VIII of these test procedures. A separate formaldehyde exhaust certification level shall also be provided for demonstrating compliance with emission standards for formaldehyde.

c. Test Vehicles and Test Engines; Assigned Deterioration Factors (DFs)

In paragraphs 86.085-24, 86.090-24, 86.092-24, 86.094.24 and 86.095-24:

1. Amend subparagraph (a)(1) by adding the following additional statement:

(a)(1) The vehicles or engines covered by an application for certification will be divided into groupings of engines which are expected to have similar emission characteristics throughout their useful life. Each group of engines with similar emission characteristics shall be defined as a separate engine family. For 1995 and subsequent model-year vehicles or engines, all engines classified in the same engine family shall be certified to identical exhaust emission standards.

2. Delete subparagraph (b) (Emission-data vehicle selection provisions)

REPLACE WITH:

(b) Emission-data vehicles shall be selected according to the provisions of Appendix II. Selection shall be based on highest sales volume and will require only two emission-data vehicles for certification testing per engine family. (For fifty-state families, the reference in the federal procedures to configuration or sales shall mean California configurations and sales rather than total family configurations and sales.) The Executive Officer will accept data from California (or fifty-state) configuration vehicles or from federal vehicles which meet the requirements of subparagraph ~~4.b.4~~ 4.c.5. Federal vehicles may be reconfigured to California versions and tested to show compliance with California emission standards. The Executive Officer will also allow the manufacturer to reconfigure California vehicles.

3. Delete subparagraph (e)(1) (Reduced number of test vehicles)

REPLACE WITH:

(1) Any manufacturer whose projected California annual sales for the model year in which certification is sought is less than a combined total of 3,000 passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines may request a reduction in the number of test vehicles determined in accordance with the foregoing provisions of this paragraph. The Executive Officer may agree to such lesser numbers as he or she determines would meet the objectives of this procedure.

4. Delete subparagraph (e)(2) (Assigned deterioration factors)

REPLACE WITH:

(2)(i) Any manufacturer may request to certify engine families using assigned DFs for a combined total of 3,000 projected annual California sales of passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines per manufacturer regardless of total sales.

(2)(ii) Assigned DFs shall be used only where specific mileage accumulation data do not exist (i.e., if a vehicle manufacturer uses an engine/system combination where DFs derived from exhaust emission testing exist, then the assigned factors cannot be used).

Assigned DFs shall be used in lieu of data from durability vehicle(s) only when a manufacturer demonstrates that it has control over design specifications, can provide development data, has in-house testing capabilities including accelerated aging of components/systems, and has evaluation criteria to ensure emission control system (ECS) durability for the vehicle's useful life. The applying manufacturer must demonstrate engine durability and that the emission control system(s) developed or adapted for the particular engine will be durable and comply with the applicable emission standards for the engine's or vehicle's useful life. In evaluating any information provided, all relevant test data and design factors shall be considered, including but not limited to: vehicle application, engine design, catalyst loading and volume, space velocity in the catalyst, engine exhaust gas concentrations and catalyst temperatures for various operating modes, and the durability of any emission control system components which may have been used in other vehicle applications. The assigned DFs shall be applied only to entire families.

If emission control parts from other certified vehicles are utilized, then parameter comparisons of the above data must also be provided including part numbers where applicable. Emission control durability may include special in-house specifications.

(2)(iii) The criteria for evaluating assigned DFs for evaporative families are the same as those for exhaust families. However, in determining evaporative family DFs the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" require that an evaporative family DF be determined by averaging DFs obtained from durability vehicle testing and from bench testing. Therefore, if a manufacturer meets the criteria as specified above in (e)(2)(i) and (e)(2)(ii), the Executive Officer may grant assigned DFs for either (or both) the durability vehicle DF or the bench DF.

Assigned DFs for bench test requirements do not depend upon the 3,000 maximum sales limit. The assigned bench DF is applicable only to evaporative emission control systems which are similar to those used by the manufacturer for 1980 or later model-year vehicles and where an evaporative vehicle DF was determined. In evaluating a request for an assigned bench DF, all relevant information shall be considered, including but not limited to: fuel tank capacity, fuel tank temperatures, carburetor bowl "capacity", underhood temperatures, canister capacity and location, and any other comparisons to the certified application.

5. Amend subparagraph (f) and (h)(1)(v) by adding the following additional requirement which reads:

The durability or emission data submitted may be from vehicles previously certified by ARB. For 1993 through 1996 model-year passenger cars and light-duty trucks and 1995 through 1997 model-year medium-duty vehicles, the manufacturer shall submit durability data from only California (or fifty-state) configuration vehicles unless the durability data was generated from a vehicle certified by EPA or ARB prior to the 1993 model year (1995 for medium-duty vehicles). For 1997 (~~*1998*~~ ***2001*** for medium-duty vehicles) and subsequent model-year vehicles, durability data shall be submitted from only California (or fifty-state) configuration vehicles. For 1993 and (1995 for medium-duty vehicles) subsequent model-year vehicles, the Executive Officer shall permit the use of federal durability data vehicles if he or she determines that the federal data will adequately represent the durability characteristics of the California configuration. This determination shall be based upon similarity of catalyst location and configuration; similarity of fuel metering system; similarity of major features of emission control system logic and design; and similarity of any other features determined by the Executive Officer to be likely to affect durability. If data from a federal durability data vehicle is used, the requirements of subparagraph 6.b.5. (durability vehicles must meet emission standards) will refer to the federal emissions standards in effect for the model year for which the durability data was generated.

For the 1998 through 2000 model years, the Executive Officer shall allow the use of durability data for medium-duty vehicles certifying to the LEV standards as set forth in section 3.j. of these test procedures submitted from California only, federal, or fifty-state durability vehicles which line cross applicable NOx standards. This provision shall also be applicable to durability data generated using a federal or California alternate durability program. Medium-duty vehicles certifying to the optional heavy-duty engine standards as set forth in Title 13, CCR Section 1956.8(h) shall not be eligible for this NOx line-crossing exemption.

d. Compliance with the Inspection and Maintenance Program

All 1993 and subsequent model-year emission-data vehicles shall be required to be tail-pipe tested at 4,000 miles and demonstrate compliance with the California Inspection and Maintenance emission standards in place at the time of certification as specified in the "Mandatory Exhaust Emissions Inspection Standards and Test Procedures", Title 16, California Code of Regulations, Section 3340.42. Test vehicles shall undergo preconditioning procedures prior to the tail-pipe test which consist of idle conditions for a minimum period of ten minutes after the thermostat is open. Preconditioning and test procedures shall be conducted at an ambient temperature from 68° to 86° F. The manufacturer shall, in accordance with good engineering practice, attest that such test vehicles will meet the requirements of this section when preconditioned and tested at ambient temperatures from 35° to 68° F.

5. Maintenance Requirements

a. Maintenance[1]

Delete paragraph 86.090-25.
Delete paragraph 86.088-25.
Delete paragraph 86.087-25.

In paragraph 86.085-25:

1. Amend the title and first sentence of subparagraph (a) to read:

(a) Light-duty vehicles. Paragraph (a) of this section applies to passenger cars, light-duty trucks, and medium-duty vehicles.

2. Amend subparagraph (a)(1) to read:

(1) Scheduled maintenance on the engine, emission control system, and fuel system of durability vehicles shall, unless otherwise provided pursuant to paragraph (a)(5)(iii), be restricted as set forth in the following provisions. If a manufacturer must revise the maintenance schedule, prior approval by the Executive Officer is required. Unscheduled maintenance must not render a durability vehicle nonrepresentative of the production vehicles. The unscheduled maintenance must not be likely to be required in the normal use of the vehicle. Unauthorized or unjustifiable unscheduled maintenance may be cause for disqualification of a durability vehicle.

Manufacturers must submit durability maintenance logs to the Executive Officer. The maintenance logs shall include the mileage where maintenance occurred, the nature of the maintenance, and the name and part numbers of all fuel system and emission control parts involved with the maintenance. Manufacturers of series hybrid electric vehicles and parallel hybrid electric vehicles shall be required to incorporate into the vehicles a separate odometer or other device subject to the approval of the Executive Officer which can accurately gauge the mileage accumulation on the engines which are used in these vehicles.

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[1] These requirements are for vehicles certified to the primary 50,000 mile and 100,000 or 120,000 mile standards. Requirements for the vehicles certified to the optional 100,000 mile standards are found in section 10 (Optional 100,000 Mile Certification Procedure) of these procedures.

(i)(A) For otto-cycle vehicles and hybrid electric vehicles which use otto-cycle engines, maintenance shall be restricted to the inspection, replacement, cleaning, adjustment, and/or service of the following items at intervals no more frequent than indicated:

(1) Drive belts on engine accessories (tension adjustment only); (30,000 miles of engine operation).

(2) Valve lash (15,000 miles of engine operation).

(3) Spark plugs (30,000 miles of engine operation).

(4) Air filter (30,000 miles of engine operation).

(5) Exhaust gas sensor (30,000 miles of engine operation). Provided that:

(a) the manufacturer shall equip the vehicle with a maintenance indicator consisting of a light or flag, which shall be preset to activate automatically by illuminating in the case of a light or by covering the odometer in the case of a flag the first time the minimum maintenance interval established during certification testing is reached and which shall remain activated until reset. After resetting, the maintenance indicator shall activate automatically when the minimum maintenance interval, when added to the vehicle mileage at the time of resetting, is again reached and shall again remain activated until reset. When the maintenance indicator consists of a light, it shall also activate automatically in the engine-run key position before engine cranking to indicate that it is functioning. The maintenance indicator shall be located in the instrument panel and shall, when activated, display the words "oxygen sensor" or may display such other words determined by the Executive Officer to be likely to cause the vehicle owner to seek oxygen sensor replacement. The maintenance indicator shall be separate from the malfunction indicator light required by Section 1968, Title 13, California Code of Regulations;

(b) the manufacturer shall provide free replacement of the oxygen sensor, including both parts and labor, and shall reset the maintenance indicator without any charge, the first time the maintenance interval established during certification testing is reached for vehicles certified with scheduled sensor maintenance before 50,000 miles. If the oxygen sensor is replaced pursuant to the warranty provisions of Section 2037, Title 13, California Code of Regulations, before the first maintenance interval is reached, the manufacturer shall also replace the oxygen sensor and reset the maintenance indicator at the mileage point determined by adding the maintenance interval to the vehicle's mileage at the time of the warranty replacement. If the calculated mileage point for a second oxygen sensor replacement would exceed 50,000 miles, no free second replacement shall be required;

(c) The maintenance indicator shall be resettable. The maintenance instructions required by section 5.b. of these procedures shall provide instructions for the resetting of the maintenance indicator, and shall specify that the maintenance indicator shall be reset each time the oxygen sensor is replaced; and

(d) Notwithstanding the provisions of Section 2037(c), Title 13, California Code of Regulations; the oxygen sensor, including any replacement required pursuant to this section, shall be warranted for the applicable warranty period of the vehicle or engine in accordance with Section 2037(a), Title 13, California Code of Regulations. If such oxygen sensor fails during this period, it shall be replaced by the manufacturer in accordance with Section 2037(d), Title 13, California Code of Regulations.

(6) Choke (cleaning or lubrication only); (30,000 miles of engine operation).

(7) Positive crankcase ventilation valve (50,000 miles of engine operation).

(8) Ignition wires (50,000 miles of engine operation).

(9) In addition, adjustment of the engine idle speed (curb idle and fast idle), valve lash, and engine bolt torque may be performed once during the first 5,000 miles of scheduled driving, provided the manufacturer makes a satisfactory showing that the maintenance will be performed on vehicles in use. For hybrid electric vehicles, these adjustments may only be performed once during the first 5,000 miles of engine operation.

(10) Hybrid electric vehicle battery system (manufacturer's established performance limits). Provided that:

(a) The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light which shall activate automatically by illuminating the first time the minimum performance level is observed for all battery system components. Possible battery system components requiring monitoring are:

i. battery water level
ii. temperature control
iii. pressure control
iv. other parameters critical for determining battery condition

(b) The manufacturer shall equip the vehicle with a useful life indicator for the battery system consisting of a light which shall illuminate the first time the battery system is unable to achieve an all-electric operating range (starting from a full state-of-charge) which is at least 75% of the range determined for the vehicle in the All-Electric Range Test (see section 9.f. of these test procedures) and submitted in the certification application.

(i)(B) For diesel vehicles and hybrid electric vehicles which use diesel engines, maintenance shall be restricted to the following items at intervals no more frequently than every 12,500 miles of engine operation, provided that no maintenance may be performed within 5,000 miles of the final test point:

(1) Adjust low idle speed.
(2) Adjust valve lash if required.
(3) Adjust injector timing.
(4) Adjust governor.

(5) Clean and service injector tips.
(6) Adjust drive belt tension on engine accessories.
(7) Check engine bolt torque and tighten as required.
(8) Hybrid electric vehicle battery system. Manufacturers shall maintain the battery system according to the requirements in section 5.a.(2)(i)(A)(10) of these test procedures.

(ii) Change of engine and transmission oil, change or service of oil filter and, for diesel vehicles only, change or service of fuel filter and air filter, will be allowed at the mileage intervals specified in the manufacturer's maintenance instructions.

(iii) Maintenance shall be conducted in a manner consistent with service instructions and specifications provided by the manufacturer for use by customer service personnel.

3. Delete subparagraph (a)(3) (Service of exhaust gas recirculation system).

4. Delete subparagraph (a)(4) (Service of catalytic converter).

5. Amend subparagraph (a)(5), by adding a new subparagraph (iv) to read:

(iv) When a part has to be replaced while conducting unscheduled maintenance, a similarly aged part shall be used for those parts that affect emissions, unless it is impractical and unnecessary to age a part and prior approval has been obtained from the Executive Officer for use of the part without aging. In either case, an engineering report on the nature of the problem with the probable cause and corrective action shall be supplied to the Executive Officer.

6. Delete subparagraph (b) (Maintenance of light-duty trucks and heavy-duty engines).

b. Maintenance Instructions

Delete paragraph 86.087-38.
In paragraph 86.085-38:

1. Amend subparagraph (a) to read:

(a) The manufacturer shall furnish or cause to be furnished to the purchaser of each new motor vehicle subject to the standards prescribed in Section 3 of these procedures, written instructions for the maintenance and use of the vehicle by the purchaser as may be reasonable and necessary to assure the proper functioning of emission control systems in normal use. Such instructions

shall be consistent with and not require maintenance in excess of the restrictions imposed under subparagraph 86.085-25(a)(1) as amended above, except that the instructions may, subject to approval by the Executive Officer, require additional maintenance for vehicles operated under extreme conditions. In addition, subject to approval by the Executive Officer, the instructions may require inspections necessary to insure safe operation of the vehicle in use.

In addition to any maintenance which may be required pursuant to the preceding paragraph, the instructions may also recommend such inspections, maintenance, and repair as may be reasonable and necessary for the proper functioning of the vehicle and its emission control systems. If the instructions recommend maintenance in addition to that which may be required pursuant to the preceding paragraph, they shall distinguish clearly between required and recommended maintenance.

2. Amend both subparagraphs (c)(1) and (d)(1) to read:

(1) Such instructions shall specify the performance of all scheduled maintenance performed by the manufacturer under subparagraph 86.085-25(a)(1).

c. Submission of Maintenance Instructions

Amend subparagraph 86.079-39(a) to read:

(a) The manufacturer shall provide to the Executive Officer, no later than the time of the submission required by paragraph 86.088-23, 86.091-23, or 86.094-23, a copy of the maintenance instructions which the manufacturer proposes to supply to the ultimate purchaser in accordance with subparagraph 86.085-38(a). The Executive Officer will review such instructions to determine whether they are consistent with California requirements, and to determine whether the instructions for required maintenance are consistent with the restrictions imposed under subparagraph 86.085-25(a)(1). The Executive Officer will notify the manufacturer of his or her determinations.

6. Demonstrating Compliance

a. Mileage and Service Accumulation; Emission Measurements

In paragraphs 86.084-26 and 86.090-26:

1. Amend subparagraph (a)(1) to read:

   (a)(1) Paragraph (a) of this section applies to light-duty vehicles, except ZEVs which shall be exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

2. Amend (a)(2) to read:

   The procedure for mileage accumulation shall be the Durability Driving Schedule as specified in Appendix IV to Part 86 of the Code of Federal Regulations. A modified procedure may also be used if approved in advance by the Executive Officer. All passenger cars, light-duty trucks, pre-1995 model year medium-duty vehicles, and 1995 model- year vehicles certified to 1994 model-year emission standards shall accumulate mileage at a measured curb weight which is within 100 pounds of the estimated curb weight. All 1995 and subsequent model-year medium-duty vehicles (except those certified to 1994 model-year emission standards) and all 1992 and subsequent medium-duty LEVs ~~and~~ ULEVs, ***and SULEVs*** shall accumulate mileage at a loaded weight that is within 100 pounds of the average of the vehicle's curb weight and gross vehicle weight. If the vehicle weight is within 100 pounds of being included in the next higher inertia weight class, the manufacturer may elect to conduct the respective emission tests at the higher weight. All mileage accumulation of hybrid electric vehicles shall be conducted with the battery pack at the manufacturer's indicated lowest state-of-charge at the beginning of the test cycle. At no time throughout mileage accumulation shall the battery pack be charged using any off-board charging source.

3. Amend (a)(3)(i) and (a)(3)(ii) (Emission-data vehicle mileage accumulation) by adding the following additional requirement which reads:

   The Executive Officer will accept the manufacturer's determination of the mileage at which the engine-system combination is stabilized for emission data testing if (prior to testing) a manufacturer determines that the interval chosen yields emissions performance which is stable and representative of design intent. Sufficient mileage should be accumulated to reduce the possible effects of any emissions variability that is the result of insufficient vehicle operation. Of primary importance in making this determination is the behavior of the catalyst, EGR valve, trap oxidizer or any other part of the ECS which may have

non-linear aging characteristics. In the alternative, the manufacturer may elect to accumulate 4,000 mile ± 250 mile on each test vehicle within an engine family without making a determination.

4. Amend (a)(4)(i) and (a)(4)(ii) (Durability-data vehicle mileage accumulation) by adding the following new subparagraphs (A), (B), (C), and (D) to read:

(A) For otto-cycle and diesel vehicles and battery assisted combustion engine vehicles which use otto-cycle or diesel engines:

(1) Passenger cars, light-duty trucks and medium-duty vehicles certifying to exhaust emissions standards only on a 50,000 mile durability basis and selected by the Executive Officer or elected by the manufacturer under 86.085-24(c)(1), 86.090-24(c)(1), 86.092-24(c)(1), 86.094-24(c)(1), or 86.095-24(c)(1) shall be driven, with all emission control systems installed and operating, for 50,000 miles or such lesser distance as the Executive Officer may agree to as meeting the objective of this procedure.

(2) Prior to initiation of mileage accumulation in a durability-data vehicle, manufacturers must establish the mileage test interval for durability-data vehicle testing of the engine family. Once testing has begun on a durability-data vehicle, the durability test interval for that family may not be changed. At a minimum, multiple tests must be performed at 5,000 miles, 50,000 miles, and the final mileage point as long as they meet the requirements of Appendix III. The Executive Officer will accept durability test interval schedules determined by the manufacturer. The testing must provide a DF confidence level equal to or better than the confidence level using the former fixed mileage test and scheduled maintenance intervals. The procedure for making this determination is also given in Appendix III. The mileage intervals between test points must be approximately of equal length. The ± 250 mile test point tolerance and the requirement that tests be conducted before and after scheduled maintenance is still mandatory. Emission control systems for otto-cycle engines which have step function changes designed into the control system must use the 5,000 mile test interval schedule.

(3) Testing before and after scheduled (or unscheduled) maintenance points must be conducted, and these data are to be included in the deterioration factor calculation.[2]

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[2] Testing before unscheduled maintenance may be omitted with the prior consent of the Executive Officer when testing would be dangerous to a vehicle or an operator.

The number of tests before and after scheduled maintenance and the mileage intervals between test points should be approximately equal. Durability test interval schedules with multiple testing at test points within 10,000 miles of or at the 50,000 mile and the final mileage test point must be submitted for approval. Multiple testing at maintenance mileage tests points within 10,000 miles of the 50,000 mile and the final mileage test points may be approved if it can be demonstrated by previously generated data that the emission effects of the maintenance are insignificant.

(4) For engine families which are to be certified to the full useful life emission standards, each exhaust emission durability-data vehicle shall be driven with all emission control systems installed and operating, for the full useful life or such lesser distance as the Executive Officer may agree to as meeting the objective of this procedure. Durability tests shall be at every 5,000 miles, from 5,000 miles to the full useful life, however, the above procedures may be used to determine alternate test intervals subject to the following.

For engine families which are to be certified to the full useful life emission standards, durability vehicles may accumulate less than the full useful life if the manufacturer submits other data or information sufficient to demonstrate that the vehicle is capable of meeting the applicable emission standards for the full useful life. At a minimum, 75% of the full useful life shall be accumulated. For the purpose of conducting mileage accumulation on light-duty hybrid electric vehicles, the full useful life of the auxiliary power unit shall be defined as 50,000 miles for a Type A hybrid electric vehicle, 75,000 miles for a Type B hybrid electric vehicle, and 100,000 miles for a Type C hybrid electric vehicle. For medium-duty hybrid electric vehicles, the full useful life of the auxiliary power unit shall be defined as 60,000 miles for a Type A hybrid electric vehicle, 90,000 miles for a Type B hybrid electric vehicle, and 120,000 miles for a Type C hybrid electric vehicle. Alternative durability plans may also be used if the manufacturer provides a demonstration that the alternative plan provides equal or greater confidence that the vehicles will comply in-use with the emission standards. The demonstration shall include, but not be limited to, bench test data and engineering data. A manufacturer's in-use emission data may also be used. All alternative durability plans, including the use of durability vehicles which accumulate less than the full useful life are subject to approval in advance by the Executive Officer.

(B) For diesel vehicles equipped with periodically regenerating trap oxidizer systems, at least four regeneration emission tests (see 86.106 through 86.145) shall be made.[3] With the advance approval of the Executive Officer, the manufacturer may install (1) a manual override switch capable of preventing (i.e., delaying until the switch is turned off) the start of the regeneration process and (2) a light which indicates when the system would initiate regeneration if it had no override switch. Upon activation of the override switch the vehicle will be operated on a dynamometer to precondition it for the regeneration emission test in accordance with section 86.132-82 or 86.132-90 and section 9.b. of these procedures. The Urban Dynamometer Driving Schedule (UDDS) which is in progress at the time when the light comes on shall be completed and the vehicle shall proceed to the prescribed soak period followed by testing. With the advance approval of the Executive Officer, the manual override switch will be turned off at some predetermined point in the testing sequence permitting the regeneration process to proceed without further manual interaction. The mileage intervals between test points shall be approximately equal. The first regeneration emission test shall be made at the 5,000 mile point. The regeneration emission tests must provide a deterioration factor confidence level equal to or better than the confidence level achieved by performing regeneration emission tests at the following mileage point: 5,000; 20,000; 35,000; and 50,000. The procedure for making this determination is shown in Appendix IV.

(C) For gasoline-, gaseous-, and alcohol-fueled vehicles, the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles," as incorporated in Title 13, California Code of Regulations, Section 1976, specify evaporative durability testing at 5,000, 10,000, 20,000, 30,000, 40,000 and 50,000 mile test points. These requirements are also applicable to hybrid electric vehicles. With the exception of fuel-flexible vehicles, a manufacturer may conduct evaporative testing at test points used for exhaust emission durability testing provided that the same deterioration confidence level for the evaporative emission DF determination is retained (see Appendix III).

(D) For 1993 and 1994 fuel-flexible vehicles which are not certified to TLEV, LEV, or ULEV standards, the test schedule must include exhaust emission tests at 5,000, 10,000, and every 10,000 miles thereafter to the final mileage point using M85 or E85 for methanol and ethanol fuel-flexible vehicles, respectively. Exhaust emission tests shall also be conducted at 5,000 miles, 50,000 miles, and the final mileage point with certification gasoline. For all 1995 and subsequent fuel-flexible vehicles and all 1992 and subsequent fuel-flexible vehicles certifying to TLEV, LEV, ~~or~~ ULEV ***or SULEV*** standards,

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[3] Included in Appendix V are the pollutant mass emission calculation procedures for vehicles equipped with periodically regenerating trap oxidizer systems.

the test schedule shall include exhaust emission tests at 5,000 miles, 10,000 miles, and every 10,000 miles thereafter to the final mileage point using M85 or E85 and certification gasoline. For all fuel-flexible vehicles, if evaporative emission testing is conducted, exhaust and evaporative emission tests shall also be conducted using M35 or E10, or another approved fuel, at the mileage points where M85 or E85 testing is conducted. The results of these exhaust and evaporative emission tests will be used by the Executive Officer to evaluate the vehicle's emission control deterioration with various fuels (M85, M35, and unleaded gasoline; See Fuel Specifications, Section 9.a. of these procedures). Only the M85 or E85 and certification gasoline exhaust emission results and the M35 or E10 evaporative emission results will be used to determine applicable exhaust and evaporative emission deterioration factors, respectively, as required in Section 6.b. (Compliance with Emission Standards) of these procedures.

(E) The Executive Officer may determine under 86.085-24(f), 86.090-24(f), 86.092-24(f), 86.094-24(f), or 86.095-24(f) that no testing is required.

5. Amend subparagraph (a)(5)(i) by adding the following requirement which reads:

In addition, the emission tests performed on emission-data vehicles and durability-data vehicles shall be non-regeneration emission tests for diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems. For any of these vehicles equipped with continually regenerating trap oxidizer systems, manufacturers may use the provisions applicable to periodically regenerating trap oxidizer systems as an option.

If such an option is elected, all references in these procedures to vehicles equipped with periodically regenerating trap oxidizer systems shall be applicable to the vehicles equipped with continually regenerating trap oxidizer systems.

6. Amend subparagraph (a)(8) to read:

(8) Once a manufacturer submits the information required in paragraphs (a)(7) of this section for a durability-data vehicle, the manufacturer shall continue to run the vehicle to 50,000 miles if the family is certified to 50,000 mile emission standards or to the full useful life if it is certified to emission standards beyond 50,000 miles (or to a lesser distance which the Executive Officer may have previously agreed to), and the data from the vehicle will be used in the calculations under 86.088-28, 86.090-28, and 86.091-28. Discontinuation of a durability-data vehicle shall be allowed only with the consent of the Executive Officer.

7. Delete subparagraph (b) (Emission-data and durability-data mileage accumulation for light duty trucks).

b. Compliance with Emission Standards

In paragraph 86.088-28, 86.090-28, and 86.091-28:

1. Amend subparagraph (a)(1) to read:

(1) Paragraph (a) of this section applies to passenger cars, light-duty trucks and medium-duty vehicles, except ZEVs.

2. Amend Subparagraph (a)(3) to read:

(3) Since it is expected that emission control efficiency will change with mileage accumulation on a vehicle, the emission level of a vehicle which has accumulated 50,000 miles will be used as the basis for determining compliance with the 50,000 mile emission standards.

3. Amend subparagraph (a)(4)(i) to read:

(i) Separate emission deterioration factors shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs, LEVs, or ULEVs), exhaust NMOG (all TLEVs, LEVs, ~~and~~ ULEVs, ***and SULEVs***), exhaust formaldehyde (alcohol vehicles, TLEVs, LEVs, ~~and~~ ULEVs, ***and SULEVs***), exhaust CO, exhaust NOx, and exhaust particulate (diesel vehicles only) for each engine- system combination. A separate evaporative emission deterioration factor shall be determined for each evaporative emission family-evaporative emission control system combination from the testing conducted by the manufacturer (gasoline- and alcohol-fueled vehicles only).

Separate emission correction factors (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs, LEVs, or ULEVs), exhaust NMOG (TLEVs, LEVs, ~~and~~ ULEVs, ***and SULEVs***), exhaust CO, exhaust NOx, and exhaust particulate for each engine-system combination.

4. Delete subparagraph (a)(4)(i)(A)(4) (Outlier test point procedure)..

REPLACE WITH:

(4) The manufacturer must use the California outlier identification procedure entitled "Calculation of t- Statistic for Deterioration Data Outlier Test", dated December 17, 1976 and set forth in Appendix VII, to test for irregular data from a durability-data set. If any data point is identified as a statistical outlier, the Executive Officer shall determine, on the basis of an engineering analysis of the causes of the outlier submitted by the manufacturer, whether the outlier is to be rejected. The outlier shall be rejected only if the Executive Officer determines that the outlier does not reflect representative characteristics of the emission control system i.e., the outlier is a result of an emission control system anomaly, test procedure error, or an extraordinary circumstance not expected to recur. Only the identified outlier shall be eliminated; other data at that test point (i.e., data for other pollutants) shall not be eliminated unless the Executive Officer determines, based on the engineering analysis, that they also do not reflect representative characteristics of the emission control system. Where the manufacturer chooses to apply both the outlier procedure and averaging (as allowed under 86.084-26(b)(6)(i) and 86.090- 26(a)(6)(1) to the same data set, the outlier procedure shall be completed prior to applying the averaging procedure. All durability test data, including any outliers and the manufacturer's engineering analysis, shall be submitted with the final application.

5. Amend subparagraph (a)(4)(i)(B) (durability vehicles must meet emissions standards) to read:

(B) All applicable exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The emission data will be acceptable for use in the calculation of the deterioration factor only if the interpolated 4,000-mile, 50,000-mile, and full useful life points on this line are within the emission standards given in subparagraph 3. or within the federal emission standards if a federal durability data vehicle is approved in accordance with subparagraph ~~4.b.4.~~ 4.c.5., as applicable. For hybrid electric vehicles, the emission data will be acceptable for use in the calculation of the deterioration factor only if the engine mileage points corresponding to the interpolated 4,000 mile, 50,000 mile, and full useful life points of the vehicle on this line are within the emission standards given in subparagraph 3. or within the federal emission standards if a federal durability data vehicle is approved in accordance with subparagraph ~~4.b.4.~~ 4.c.5., as applicable. The engine mileage points shall be determined based on the test schedule submitted to the Executive Officer as required in paragraphs 86.084-26 and 86.090-26. As an exception, the Executive Officer will review the data on a case-by-case basis and may approve its use in those instances where the best fit straight line crosses an applicable standard but no data point exceeds the standard or when the best fit straight line crosses the applicable standard at the 4,000-mile point but the 5,000- mile actual test point and the 50,000 mile and

full useful life interpolated points are both below the standards. ***For the 1998 through 2000 model years, the Executive Officer shall allow the use of durability data for medium-duty vehicles certifying to the LEV standards as set forth in section 3.j. of these test procedures submitted from California only, federal or fifty-state durability vehicles which line cross applicable NOx standards. Medium-duty vehicles certifying to the optional heavy-duty engine standards as set forth in Title 13, CCR Section 1956.8(h) shall not be eligible for this NOx line-crossing exemption.*** A multiplicative exhaust emission deterioration factor shall be calculated for each engine system combination as follows:

(1) For engine families certified to 50,000 mile emissions standards:

Factor = Exhaust emissions interpolated to 50,000 miles divided by exhaust emissions interpolated to 4,000 miles.

(2) For engine families certified to full useful life emissions standards beyond 50,000 miles:

Factor = Exhaust emissions interpolated to the full useful life divided by exhaust emissions interpolated to 4,000 miles.

6. Add subparagraph (a)(4)(i)(D) to read:

(D) The regeneration exhaust emission data (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) from the tests required under 86.084-26(a)(4) or 86.090-26(a)(4) shall be used to determine the regeneration exhaust emissions interpolated to the 50,000-mile point. The regeneration exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The interpolated 50,000-mile point of this line shall be used to calculate the multiplicative exhaust emission correction factor for each engine-system combination as follows:

$$\text{Factor} = 1 + \frac{R-1}{4505} n$$

where, R = the ratio of the regeneration exhaust emissions interpolated to 50,000 miles to the non-regeneration exhaust emissions interpolated to 50,000 miles.

n = the number of complete regenerations which occur during the durability test.

These interpolated values shall be carried out to a minimum of four places to the right of the decimal point before dividing one by the other to determine the correction factor. The results shall be rounded to three places to the right of the decimal point in accordance with ASTM E 29-67. For applicability to gaseous emission standards under the 100,000 mile option, R will be determined based upon projected 100,000 mile emissions.

7. Amend subparagraph (a)(4)(ii)(A) to read:

(A) The official exhaust emission test results for each emission-data vehicle at the 4,000 mile test point shall be multiplied by the appropriate deterioration factor, and correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only): Provided: that if a deterioration factor as computed in paragraph (a)(4)(i)(B) of this section or a correction factor as computed in paragraph (a)(4)(i)(D) of this section is less than one, that deterioration factor or correction factor shall be one for the purposes of this paragraph.

8. Amend subparagraph (a)(4)(iii) to read:

(iii) The emissions to compare with the standard (or the family particulate emission limit, as appropriate) shall be the adjusted emissions of paragraphs (a)(4)(ii)(A) and (B) of this section for each emission-data vehicle. Before any emission value is compared with the standard (or the family particulate limit, as appropriate), it shall be rounded, in accordance with ASTM E29-67 to one significant figure beyond the number of significant figures contained in the standard (or the family particulate emission limit, as appropriate). The rounded emission values may not exceed the standard (or the family particulate emission limit, as appropriate). Fleet average NMOG value calculations shall be rounded, in accordance with ASTM E29-67, to four significant figures before comparing with fleet average NMOG requirements.

9. Delete subparagraph (b) (Compliance provisions for light- duty trucks).

c. Prohibition of Defeat Devices

In paragraph 86.094-16:

1. Amend subparagraph (a) to read:

No new passenger car, light-duty truck, or medium-duty vehicle shall be equipped with a defeat device.

7. Small-Volume Manufacturer's Certification Procedures

a. In paragraphs 86.084-14, 86.090-14, 86.092-14, and 86.095-14:

1. Amend subparagraph (b)(1) to read:

(1) The optional small-volume manufacturers certification procedures apply to light-duty vehicles (passenger cars, light-duty trucks, and medium-duty vehicles), produced by manufacturers with California sales (for the model year in which certification is sought) of fewer than 3,000 units (PC, LDT and MDV combined). The optional small-volume manufacturers certification procedures shall not apply to hybrid electric vehicles. All hybrid electric vehicle manufacturers shall be subject to the certification requirements established for hybrid electric vehicles.

2. Delete subparagraphs (b)(2) through (b)(5) (Determining aggregated sales; aggregated sales provisions for small volume manufacturers).

3. Amend subparagraph (c)(4) to read:

(4) A small-volume manufacturer shall include in its records all of the information that ARB requires in 86.088- 21, 86.090-21, 86.091-21, or 86.094-21, including the modifications noted in Section 4.a. of these test procedures. This information will be considered part of the manufacturer's application for certification and must be submitted to the Executive Officer.

4. Delete subparagraph (c)(7)(i)(A) (Worst-case selection of emission-data vehicles).

5. Amend subparagraph (c)(11)(ii)(D)(1) to show the 3,000 total vehicle sales limit applicable to California for determining a small-volume manufacturer.

8. Alternative Procedures for Notification of Additions and Changes

a. Amend subparagraph 86.082-34(a) by adding the following additional requirements which read:

> A manufacturer must notify the Executive Officer within 10 working days of making an addition of a vehicle to a certified engine family or a change in a vehicle previously covered by certification.

The manufacturer shall also submit, upon request of the Executive Officer, the following items:

(1) service bulletin.
(2) driveability statement.
(3) test log.
(4) maintenance log.

All running changes and field fixes which do not adversely affect the system durability are deemed approved unless disapproved by the Executive Officer within 30 days of the receipt of the running change or field fix request. A change not specifically identified in the manufacturer's application must also be reported to the Executive Officer if the change may adversely affect engine or emission control system durability. Examples of such changes include any change that could affect durability, thermal characteristics , deposit formation, or exhaust product composition, i.e., combustion chamber design, cylinder head material, camshaft profile, computer modifications, turbocharger, intercooler wastegate characteristics, and transmission or torque converter specifications. Running changes and field fixes meeting the definitions contained in Appendix VI shall be automatically deemed approved by the Executive Officer, as long as the conditions set forth in Appendix VI are satisfied.

The manufacturer is required to update and submit to the Executive Officer the "supplemental data sheet" for all running changes and field fixes implemented with the change notification. The manufacturer shall submit, on a monthly basis, by engine family, a list of running changes/field fixes giving the document number date submitted and a brief description of the change.

9. Test Requirements

a. Fuel Specifications

In paragraph 86.113-90, 86.113-91, and 86.113-94:

1. Add subparagraphs (a)(1)(i) and (ii) which read:

(i) For 1992-1994 model-year Otto-cycle vehicles, gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in subparagraph (a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

Research Octane, minimum	93
Sensitivity, minimum	7.5
Lead (organic), maximum, g/US gal	0.050
Distillation Range	
IBP, degrees F	75-100
10 pct. point, degrees F	120-140
50 pct. point, degrees F	200-230
90 pct. point, degrees F	300-325
EP, maximum, degrees F	415
Sulfur, maximum weight pct.	0.03
Phosphorous, maximum, g/US gal	0.005
RVP, psi	7.5-8.0
Hydrocarbon composition	
Olefins, maximum pct.	10
Aromatics, maximum pct.	35
Saturates	remainder

(ii) For 1993-1994 model-year Otto-cycle TLEVs, LEVs, and ULEVs and for all 1995 and subsequent model-year Otto-cycle vehicles, gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in subparagraph (a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

Fuel Property a/	Limit	Test Method b/
Octane, (R+M)/2 (min)	91	D2699-88, D 2700-88
Sensitivity (min)	7.5	D 2699-88, D 2700-88
Lead, g/gal (max) (No lead added)	0-0.01	Title 13 CCR §2253.4(c)
Distillation Range, degrees F		Title 13 CCR §2263 c/
10 pct. point,	130-150	
50 pct. point,	200-210 d/	
90 pct. point,	290-300 e/	
EP, maximum	390	
Residue, vol% (max)	2.0	
Sulfur, ppm by wt.	30-40	Title 13 CCR §2263
Phosphorous, g/gal (max)	0.005	Title 13 CCR §2253.4(c)
RVP, psi	6.7-7.0	Title 13 CCR §2263
Olefins, vol %	4.0-6.0	Title 13 CCR §2263
Total Aromatic Hydrocarbons (vol%)	22-25	Title 13 CCR §2263
Benzene, vol %	0.8-1.0 f/	Title 13 CCR §2263
Multi-Substituted Alkyl Aromatic Hydrocarbons, vol %	12-14 g/	
MTBE, vol %	10.8-11.2	Title 13 CCR §2263
Additives : Sufficient to meet requirements of Title 13, CCR §2257		
Copper Corrosion	No. 1	D 130-88
Gum, Washed, mg/100 ml (max) 3.0	D 381-86	
Oxidation Stability, minutes (min)	1000	D 525-88
Specific Gravity	Report h/	
Heat of Combustion	Report h/	
Carbon, wt%	Report h/	
Hydrogen, wt%	Report h/	

a/ The gasoline must be blended from typical refinery feedstocks.

b/ ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

c/ Although Title 13 CCR § 2263 refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

d/ The range for interlaboratory testing is 195-215° F.

e/ The range for interlaboratory testing is 285-305° F.

f/ The range for interlaboratory testing is 0.7-1.1 percent by volume.

g/ "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

h/ The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

2. Delete subparagraph (a)(3) (Methanol test fuel for otto-cycle vehicles).

3. Delete subparagraph (a)(4) (Alternative methanol test fuels for otto-cycle vehicles).

4. Amend subparagraph (a)(5) to read:

(5) The specification range of the fuels to be used under paragraph (a)(2) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

5. Amend subparagraph (b)(2) to read:

(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 86.113-90(b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel, shall be used. For 1993 and subsequent model-year diesel vehicles, petroleum fuel meeting the specifications of 86.113-94(b)(2) may be used in exhaust emission testing as an option to the specifications in 86.113-90(b)(2). For 1995 and subsequent model-year diesel-fueled vehicles, the petroleum fuel used in exhaust emission testing may meet the specifications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in 86.113-90(b)(2) or 86.113-94(b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of 86.113-94(b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

Fuel Property	Limit	Test Method a/
Natural Cetane Number	47-55	D 613-86
Distillation Range, °F		D 86-82
IBP	340-420	
10% point	400-490	
50% point	470-560	
90% point	550-610	
EP	580-660	
API Gravity, degrees	33-39	D 287-82
Total Sulfur, wt. %	0.01-0.05	D 2622-82
Nitrogen Content, ppmw	100-500	D 4629-86
Total Aromatic Hydrocarbons, vol. %	8-12	D 1313-83, D 5186-91
Polycyclic Aromatic Hydrocarbons, wt. % (max)	1.4	D 2425-88
Flashpoint, °F (max)	130	D 93-80
Viscosity @ 40°F, centistokes	2.0-4.1	D 445-83

a/ ASTM specifications

6. Amend subparagraph (b)(3) to read:

(3) Except as noted below, petroleum fuel for diesel vehicles meeting the following specifications, or substantially equivalent specifications approved by the Executive Officer shall be used in service accumulation. The grade of diesel fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel fuel, shall be used. For 1993 and subsequent model-year diesel-fueled vehicles, petroleum fuel meeting the specifications of 86.113-94(b)(3) may be used in service accumulation. For 1995 and subsequent model-year diesel- fueled vehicles, diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

7. Delete subparagraph (b)(4) (Methanol test fuel for diesel vehicles).

8. Delete subparagraph (b)(5) (Alternative methanol test fuels for diesel vehicles)

9. Amend subparagraph (b)(6) to read:

(6) The specification range of the fuels to be used under paragraphs (b)(2) and (b)(3) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

10. Replace subparagraph (d) with:

(d) Methanol-Gasoline Fuel Specifications for 1993 Model-Year Vehicles.

Various methanol-gasoline fuel blends will be used according to the type of methanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted, as specified below. Gasoline used for blending fuel for use in mileage accumulation shall be representative of commercial regular unleaded gasoline which will be generally available through retail outlets. Gasoline used for blending fuel for use in emission testing shall conform with the unleaded gasoline specification noted in paragraph (a) above.

Fuel additives and ignition improvers intended for use in methanol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

(1) Otto-cycle methanol vehicles and hybrid electric vehicles which use otto-cycle methanol engines

Mileage-accumulation fuel: For methanol vehicles and hybrid electric vehicles which use otto-cycle methanol engines a methanol-gasoline blend composed of 85-percent methanol which is representative of commercially available methanol and 15-percent unleaded gasoline as noted above.

Emission-testing fuel: For vehicles certifying on methanol, a methanol-gasoline blend composed of 85 percent chemical grade methanol and 15-percent unleaded gasoline as noted above.

(2) Methanol-fueled diesel vehicles and hybrid electric vehicles which use methanol-fueled diesel engines.

Mileage-accumulation fuel: For methanol vehicles and hybrid electric vehicles which use methanol-fueled diesel engines, commercially available methanol fuel.

Emission-testing fuel: chemical grade methanol.

(3) Fuel-flexible vehicles

Mileage-accumulation fuel: For both durability-data vehicles and emission-data vehicles, mileage accumulation shall be conducted with one fuel. For vehicles designed to operate on methanol, a methanol- gasoline blend composed of 85-percent methanol and 15- percent unleaded gasoline both of which are representative of commercially available fuels shall be used. Alternative mileage accumulation fuels and procedures may be used if demonstrated to result in equivalent or more severe deterioration of the vehicle's emission control system, subject to the prior approval of the Executive Officer.

Emission-testing fuel: Case (1) For exhaust only emission testing of emission-data vehicles, a methanol-gasoline blend composed of 85-percent chemical grade methanol and 15-percent unleaded gasoline (M85), and unleaded gasoline shall be used. For evaporative emission testing, a blend of 35-percent chemical grade methanol and 65-percent unleaded gasoline (M35) shall be used.

Case (2) For the testing required under 6.a.4.(D) of these procedures (of durability-data vehicles), exhaust (exhaust OMHCE or OMNMHCE for non-TLEVs, non-LEVs, and non-ULEVs, exhaust NMOG for TLEVs, LEVs, and ULEVs, exhaust formaldehyde, exhaust CO, and exhaust NOx) and evaporative emission tests (evaporative OMHCE) shall be conducted at the specified mileage intervals and with the specified fuels using 85-percent chemical grade methanol and 15-percent unleaded gasoline (M85), unleaded gasoline, and/or 35-percent chemical grade methanol and 65-percent unleaded gasoline (M35), as applicable.

For both Case (1) and (2), alternative methanol-gasoline blends may be used in place of M35 if demonstrated to result in equivalent or higher evaporative emissions, subject to the prior approval of the Executive Officer.

(4) Other methanol fuels may be used for testing and service accumulation provided: (i) they are commercially available; (ii) information, acceptable to the Executive Officer, is provided to show that only the designated fuel would be used in customer service; (iii) use of a fuel listed in this section would not have a detrimental effect on emissions or durability; (iv) written approval from the Executive Officer of the fuel specifications must be provided prior to the start of testing.

(5) The specification of the fuels to be used under paragraphs (d)(1), (d)(2), and (d)(3) of this section shall be reported in accordance with 86.090- 21(b)(3), 86.091-21(b)(3), or 86.094-21(b)(3).

(6) The specifications set forth in subparagraph (e) may be used as an option for 1993 model-year vehicles.

11. Add new subparagraph (e) to read:

(e) Alcohol-Gasoline Fuel Specifications for 1994 and Subsequent Model-Year Vehicles.

Various alcohol-gasoline fuel blends will be used according to the type of alcohol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted, as specified below.

Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

(1) Otto-cycle alcohol vehicles and hybrid electric vehicles which use otto-cycle alcohol engines

Mileage-accumulation fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle methanol or ethanol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as applicable.

Emission-testing fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle methanol or ethanol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as modified by the following:

The fuel specification for Title 13, CCR, Section 2292.1 shall be modified to: a) require methanol content at 98.0 $\pm$ 0.5 volume percent; b) require ethanol content at 1.0 $\pm$ 0.1 volume percent; c) require certification gasoline conforming with specifications noted in section 9.a.1. of these test procedures at 1.0 $\pm$ 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.3 shall be modified to: a) require ethanol content at 98.0 $\pm$ 0.5 volume percent; b) require methanol content at 1.0 $\pm$ 0.1 volume

percent; c) require certification gasoline conforming with specifications noted in section 9.a.1. of these test procedures at 1.0 $\pm$ 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.2 and 2292.4 shall be modified to require certification gasoline conforming with specifications noted in section 9.a.1. of these test procedures as the hydrocarbon fraction. The vapor pressure specification for the emission-testing fuel shall be adjusted to 8.0 - 8.5 psi., using common blending components from the gasoline stream.

(2) Alcohol-fueled diesel vehicles and hybrid electric vehicles which use alcohol-fueled diesel engines

Mileage-accumulation fuel: For methanol, ethanol and hybrid electric vehicles which use alcohol-fueled diesel engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as applicable.

Emission-testing fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle alcohol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as modified by the following:

The fuel specification for Title 13, CCR, Section 2292.1 shall be modified to: a) require methanol content at 98.0 $\pm$ 0.5 volume percent; b) require ethanol content at 1.0 $\pm$ 0.1 volume percent; c) require certification gasoline as noted in section 9.a.1. of these test procedures at 1.0 $\pm$ 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.3 shall be modified to require ethanol content at 98.0 $\pm$ 0.5 volume percent and require certification gasoline conforming with specifications noted in section 9.a.1. of these test procedures at 1.0 $\pm$ 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.2 and 2292.4 shall be modified to require certification gasoline conforming with specifications noted in section 9.a.1. of these test procedures as the hydrocarbon fraction. The vapor pressure specification for the emission-testing fuel shall be adjusted to 8.0 - 8.5 psi., using common blending components from the gasoline stream.

(3) Fuel-flexible vehicles

Mileage-accumulation fuel: For both durability-data vehicles and emission-data vehicles, mileage accumulation shall be conducted with one fuel. For vehicles designed to operate on methanol, a fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 shall be used. For vehicles designed to operate on ethanol, a fuel that meets the specifications listed in Title 13, CCR, Section 2292.4 shall be used. Alternative mileage accumulation fuels and procedures may be used if demonstrated to result in equivalent or more severe deterioration of the vehicle's emission control system, subject to the prior approval of the Executive Officer.

Emission-testing fuel: Case (1) For exhaust only emission testing of emission-data vehicles, fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 or 2292.4. For evaporative emission testing, a blend of fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 or 2292.4 and gasoline meeting the specifications of section 9.a.1. of these test procedures such that the final blend is composed of either 35 volume percent methanol (plus or minus 1 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (plus or minus 1 volume percent of total blend) for ethanol-fueled vehicles shall be used.

Case (2) For the testing required under 6.a.4.(D) of these procedures (of durability-data vehicles), exhaust emission tests (exhaust OMHCE or OMNMHCE for non-TLEVs, non-LEVs, and non-ULEVs, exhaust NMOG for TLEVs, LEVs, and ULEVs, exhaust formaldehyde, exhaust CO, and exhaust NOx) and evaporative emission tests (evaporative OMHCE) shall be conducted at the specified mileage intervals using: (i) emission testing fuel that meets the specifications listed in subparagraph (e)(1) of section 9.a.11. of these test procedures and (ii) a blend of fuel produced by combining emission- testing fuel that meets the specifications in subparagraph (e)(1) of section 9.a.11. of these test procedures and certification gasoline described in section 9.a.1. of these test procedures such that the final fuel is either 35 volume percent methanol (plus or minus 1 volume percent of total blend) and 65 volume percent certification gasoline for methanol-fueled vehicles or 10 volume percent ethanol (plus or minus 1 volume percent of total blend) and 90 volume percent certification gasoline for ethanol-fueled vehicles.

For both Case (1) and (2), alternative alcohol-gasoline blends may be used in place of M35 or E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to the prior approval of the Executive Officer.

(4) The specification of the fuels to be used under paragraphs (e)(1), (e)(2), (e)(3) and (e)(4) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

12. Add new subparagraph (f) to read:

(f) Gaseous Fuel Specifications for 1988 Through 1993 Model Year Vehicles.

(1) Gaseous fuels representative of commercial gaseous fuels which will be generally available through retail outlets in California or liquid petroleum gas having the ASTM D1835 or NGPA HD-5 specification shall be used in service accumulation.

(2) Liquid petroleum gas having the ASTM D1835 or NGPA HD-5 specification shall be used for exhaust and evaporative emission testing.

(3) Natural gas representative of commercial natural gas which will be generally available through retail outlets in California shall be used for exhaust emission testing.

(4) Written approval from the Administrator of the fuel specifications must be provided prior to the start of testing.

(5) For dedicated gaseous- and dual-fueled vehicles and for hybrid electric vehicles which use gaseous-fueled engines, the mileage accumulation fuel for both durability-data vehicles and emission-data vehicles shall be conducted with one fuel. For vehicles designed to operate on natural gas, natural gas which meets the requirements of (3) shall be used. For vehicles designed to operate on liquefied petroleum gas, liquefied petroleum gas which meets the requirements of (2) shall be used.

(6) The specifications set forth in subparagraph (g) may be used as an option for 1993-model year vehicles.

(7) Alternative mileage-accumulation fuels and test procedures may be used if demonstrated to result in equivalent or more severe

deterioration of the vehicle's emission control system, subject to the prior approval of the Executive Officer.

(8) Alternative emission-test fuels may be used if demonstrated to result in equivalent or higher exhaust emissions, subject to the prior approval of the Executive Officer.

13. Add new subparagraph (g) to read:

(g) Gaseous Fuel Specifications for 1994 and Subsequent Model Year Vehicles.

(1) Dedicated gaseous- and dual-fueled vehicles and hybrid electric vehicles which use liquefied petroleum gas

Mileage accumulation fuel: Liquefied petroleum gas meeting the specifications listed in Title 13, CCR, Section 2292.6 shall be used in service accumulation.

Emission-testing fuel: Liquefied petroleum gas meeting the specifications listed in Title 13, CCR, Section 2292.6 shall be used for exhaust and evaporative emission testing with the following exceptions: a) propane content limited to 93.5 $\pm$ 1.0 volume percent; b) propene content limited to 3.8 $\pm$ 0.5 volume percent; c) butane and heavier components limited to 1.9 $\pm$ 0.3 volume percent.

(2) Dedicated gaseous- and dual-fueled vehicles and hybrid electric vehicles which use natural gas

Mileage accumulation fuel: Natural gas meeting the specifications listed in Title 13, CCR, Section 2292.5 shall be used in service accumulation.

Emission-testing fuel: Natural gas meeting the specifications listed in Title 13, CCR, Section 2292.5 as modified by the following: a) methane content limited to 90.0 $\pm$ 1.0 mole percent; b) ethane content limited to 4.0 $\pm$ 0.5 mole percent; c) C_3 and higher hydrocarbon content at 2.0 $\pm$ 0.3 mole percent; d) oxygen content at 0.5 mole percent maximum; e) inert gases (sum of CO_2 and N_2) content at 3.5 $\pm$ 0.5 mole percent.

b. Road Load Power Test Weight

In paragraph 86.129-80 and 86.129-94:

1. Amend subparagraph (a) to add:

ROAD LOAD POWER TEST WEIGHT AND INERTIA WEIGHT CLASS DETERMINATION

ROAD LOAD POWER @ 50 mph - Light-Duty Trucks

LOADED WEIGHT (POUNDS)[4]	EQUIVALENT TEST WEIGHT (POUNDS)	INERTIA WEIGHT CLASS (POUNDS)
10001 to 10250	10000	10000
10251 to 10750	10500	10500
10751 to 11250	11000	11000
11251 to 11750	11500	11500
11751 to 12250	12000	12000
12251 to 12750	12500	12500
12751 to 13250	13000	13000
13251 to 13750	13500	13500
13751 to 14000	14000	14000

2. Add subparagraph (d) to read:

(d) Power absorption unit adjustment- medium-duty vehicles.

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 mph true speed. The dynamometer power absorption shall take into account the dynamometer friction, as discussed in paragraph 86.118-78.

(2) The dynamometer road load setting is determined from the loaded test weight, the reference frontal area, vehicle protuberances, and an aerodynamic drag coefficient as determined appropriate by the Executive Officer. The vehicle manufacturer shall submit the procedure by which the aerodynamic drag coefficient was determined in the test vehicle information section in the certification application. The dynamometer road load setting shall be determined by the following equation.

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[4] For 1995 and subsequent medium-duty vehicles, "Loaded Weight" shall be the average of the vehicle's curb weight and gross vehicle weight.

(i) For medium-duty vehicles to be tested on twin or single, large roll dynamometers.

$$Hp = (0.00182)V((0.015)(W)+(0.0375)(Cd)(A)(V^2)/(32.2ft/s^2))+P$$

where:

Hp = the dynamometer power absorber setting at 50 mph (horse power)

0.00182 = conversion factor to horsepower.
V = velocity in feet/sec.
0.015 = coefficient of rolling resistance.
W = loaded vehicle weight in pounds.
0.0375 = air density in lbm/cubic ft.
Cd = aerodynamic drag coefficient.
A = reference frontal area in square ft.
32.2 ft/s^2 = gravitational acceleration
P = protuberance power (horsepower)

(ii) The protuberance power, P shall be determined per subparagraph 86.129-80(c)(2)(i).

(iii) The dynamometer power absorber setting for medium-duty vehicles shall be rounded to the nearest 0.1 horsepower.

(3) The road load power calculated above shall be used or the vehicle manufacturer may determine the road load power by an alternate procedure requested by the manufacturer and approved in advance by the Executive Officer.

(4) Where it is expected that more than 33 percent of a vehicle line within an engine-system combination will be equipped with air conditioning, per subparagraph 86.090-24(g)(2), 86.092-24(g)(2), 86.094-24(g)(2), or 86.095-24(g)(2), the road load power as determined in paragraph (d) (2) or (3) of this section shall be increased by 10 percent up to a maximum increment of 1.4 horsepower, for testing all test vehicles of that vehicle line within that engine-system combination if those vehicles are intended to be offered with air conditioning in production. This power increment shall be added to the indicated dynamometer power absorption setting prior to rounding off this value.

(5) For electric and hybrid electric vehicle lines where it is expected that more than 33 percent of a vehicle line will be equipped with air conditioning, per subparagraph 86.090-24(g)(2), 86.092-24(g)(2),

86.094-24(g)(2), or 86.095-24(g)(2), which derives power from the battery pack, the road load shall be increased by the incremental horsepower required to operate the air conditioning unit. The incremental increase shall be determined by recording the difference in energy required for a hybrid electric vehicle under all-electric power to complete the running loss test fuel tank temperature profile test sequence without air conditioning and the same vehicle tested over the running loss test fuel tank temperature profile test sequence with the air conditioning set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed over the time period needed to perform the test sequence, and converting this value into units of horsepower. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F. The running loss test fuel tank temperature profile test sequence is found in the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR.

c. Test Sequence; General Requirements

Amend paragraph 86.130-78 to read:

The test sequence shown in figure B78-10 shows the steps encountered as the test vehicle undergoes the procedures subsequently described to determine conformity with the standards set forth. Ambient temperature levels shall not be less than 68° F (20° C)nor more than 86° F (30° C). For purposes of determining conformity with 50° F test requirements, the procedures set forth in Section 11k of these test procedures shall apply. For all hybrid electric vehicles and all 1995 and subsequent model-year vehicles certifying to running loss and useful life evaporative emission standards, the test sequence specified in"California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR shall apply.

d. Vehicle Preconditioning

In paragraphs 86.132-82 and 86.132-90:

1. Amend subparagraph (a)(2) to read:

(2) Within one hour of being fueled the vehicle shall be placed, either by being driven or pushed, on a dynamometer and operated through one Urban Dynamometer Driving Schedule (UDDS) test procedure, see 86.115 and Appendix I of the federal procedures.

The UDDS performed prior to a non-regeneration emission test shall not contain a regeneration (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). A gasoline fueled test vehicle may not be used to set dynamometer horsepower.

2. Amend subparagraph (a)(3) to read:

(3) For those unusual circumstances where additional preconditioning is desired by the manufacturer, such preconditioning may be allowed with the advance approval of the Executive Officer. The Executive Officer may also choose to conduct or require the conduct of additional preconditioning to insure that the evaporative emission control system is stabilized in the case of otto-cycle engines, or to insure that the exhaust system is stabilized in the case of diesel engines. The additional preconditioning shall consist of an initial one hour minimum soak and, one, two, or three driving cycles of the UDDS (or more in the case of a diesel vehicle equipped with a periodically regenerating trap oxidizer system, which is being preconditioned for a regeneration emission test), as described in paragraph (a)(2) of this section, each followed by a soak of at least one hour with engine off, engine compartment cover closed and cooling fan off. The vehicle may be driven off the dynamometer following each UDDS for the soak period.

3. For all hybrid electric vehicles and all 1995 and subsequent model-year vehicles subject to running loss and useful life evaporative emission standards, the preconditioning sequence specified in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR shall apply.

e. Regeneration Recording Requirements

Amend paragraph 86.142-82 by adding the following subparagraph (r)which reads:

(r) The manufacturer shall record in the durability-data vehicle logbook, the number of regenerations which occur during the 50,000 mile durability test of each diesel passenger car, light-duty truck and medium-duty vehicle equipped with a periodically regenerating trap oxidizer system. The manufacturer shall include, for each regeneration: the date and time of the start of regeneration, the duration of the regeneration, and the accumulated mileage at the start and the end of regeneration. The number of regenerations will be used in the calculation of the correction factor in 40 CFR Part 86, Section 28.

Amend paragraph 86.142-90 by adding the following subparagraph (s)which reads:

(s) The manufacturer shall record in the durability-data vehicle logbook, the number of regenerations which occur during the 50,000 mile durability test of each diesel passenger car, light-duty truck and medium-duty vehicle equipped with a periodically regenerating trap oxidizer system. The manufacturer shall include, for each regeneration: the date and time of the start of regeneration, the duration of the regeneration, and the accumulated mileage at the start and the end of regeneration. The number of regenerations will be used in the calculation of the correction factor in 40 CFR Part 86, Section 28.

f. All-Electric Range Test Requirements

All 1993 and subsequent ZEVs and Type A and Type B hybrid electric vehicles shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of a ZEV or of a hybrid electric vehicle operating without the use of its auxiliary power unit. For hybrid electric vehicles, the manufacturer may elect to conduct the All-Electric Range Test prior to vehicle preconditioning in the exhaust and evaporative emission test sequence specified in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR.

(1) Cold soak. The vehicle shall be stored at an ambient temperature not less than 68° F (20° C) and not more than 86° F (30° C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge.

(2) Driving schedule. At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through a Highway Fuel Economy Driving Schedule, found in Part 600, Appendix I of the CFR, followed immediately by an Urban Dynamometer Driving Schedule, found in Part ~~600~~ 86, Appendix I of the CFR, followed by another Highway Fuel Economy Driving Schedule and an Urban Dynamometer Driving Schedule. This sequence of driving schedules shall be repeated until the vehicle is no longer able to maintain within 5 miles per hour of the speed requirements or within 2 seconds of the time requirements of the driving schedules in the case of a ZEV,or unable to maintain within 5 miles per hour of the speed requirements or within 2 seconds of the time requirement of the driving schedules without the use of the auxiliary power unit in the case of a hybrid electric vehicle.

(3) Recording requirements. Once the vehicle is no longer able to maintain the speed and time requirements specified in (2) above,or once the auxiliary power unit turns on, in the case of a hybrid electric vehicle, the accumulated mileage and energy usage of the vehicle from the point where electricity is introduced from the electrical outlet shall be recorded, and the

vehicle shall be brought to an immediate stop, thereby concluding the All-Electric Range Test.

(4) Regenerative braking. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications prior to the commencement of the test. The driving schedule speed and time tolerances specified in (2)shall not be exceeded due to the operation of the regenerative braking system.

g. Calculations; exhaust emissions

Amend paragraph 86.144-94 by adding the following subparagraph(b)(10) which reads:

(10) Organic material non-methane hydrocarbon equivalent mass for ethanol vehicles:

$$OMNMHCE_{mass} = NMHC_{mass} + (13.8756/32.042) \times (CH_3OH)_{mass} + (13.8756/46.064) \times (CH_3CH_2OH)_{mass} + (13.8756/30.0262) \times (HCHO)_{mass} + (13.8756/44.048) \times (CH_3CHO)_{mass}$$

10. Optional 100,000 Mile Certification Procedure

The following provisions and alternate emission standards shown in section (3) of these procedures shall apply to any engine family certified to the optional 100,000 mile certification standards.[5]

a. General Guidelines for Implementation

1. Designation

The manufacturer shall designate in the preliminary application for certification those engine families that will be certified to the 100,000 mile procedures. In order to allow the manufacturer as much flexibility as possible, the manufacturer may at any time designate additional engine families or remove any designated engine family. Families originally intended for 50,000 mile certification may be designated as 100,000 mile families after the start of durability testing and vice versa. The Executive Officer must be notified within ten working days of any such changes. Manufacturers are cautioned that any engine family certified to the 100,000 mile certification procedure must comply with the allowable maintenance provisions of section 10.b in these procedures during the engine mileage accumulation.

2. Mileage Accumulation

All durability vehicles must be run to at least 50,000 miles for established emission control systems; early termination of mileage accumulation may be requested by the manufacturer if sufficient evidence as described below is provided to satisfy the Executive Officer that further testing is unnecessary.

Testing beyond 50,000 miles must be conducted in accordance with the certification test procedures applicable prior to 50,000 miles. Exhaust emissions tests shall be performed at every 5,000 mile interval starting with the 55,000 mile point and ending with the 100,000 mile point, and before and after all scheduled maintenance.

The Executive Officer may, upon request by the manufacturer waive any exhaust emission testing beyond 50,000 miles, if he or she finds that (1) the extrapolated 100,000 mile points and interpolated 4,000 mile points on the least squares lines comply with the line crossing provisions of section 10.b. of the procedures, and (2) the system and engine designs, on the basis of previous engineering experience, would not be expected to exceed the applicable standards after 100,000 miles. For

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[5] The additional criteria outlined in Section 6.a. (Mileage and Service Accumulation: Emission Measurements) shall be used to determine the durability-data testing schedule and the emission-data 4,000 mile test point.

example, a diesel vehicle that shows a flat deterioration curve (D.F. = 1.0) for the first 50,000 miles and which is not equipped with any add-on emission control system (such as EGR) may be eligible for such a waiver. The Executive Officer will evaluate each request on a case-by-case basis. The manufacturer must submit its request to the Executive Officer to stop testing within ten working days after the last emission test.

If a durability vehicle accumulates less than 100,000 miles the manufacturer shall submit evidence that the engine is capable of meeting the applicable emission standards for 100,000 miles. Such evidence shall include engineering data on piston rings, piston, valves, cylinder head, fuel system ignition system, etc., as applicable.

Any decision to stop mileage accumulation before 100,000 miles does not relieve the manufacturer from its warranty and recall obligations.

For the last 50,000 miles, the Executive Officer may, upon the request of the manufacturer, allow driving schedules different from the standard AMA driving cycle for accelerated mileage accumulation and a reduced test frequency. The evaluation of alternate test programs will be based on the type of emission control system involved and the characteristic of the cumulative emission control system deterioration.

3. Scheduled Maintenance

A vehicle manufacturer who initially intends to certify a vehicle to the 50,000 mile procedure may not change to the 100,000 mile option after mileage accumulation unless the manufacturer starts initial mileage accumulation using, for each maintenance item, the most stringent maintenance schedule of either the 100,000 mile option or the 50,000 mile certification requirements.

4. Unscheduled Maintenance

The Executive Officer will follow the provisions of section 5.a of these procedures, in evaluating any manufacturer's request for unscheduled maintenance. Manufacturers shall obtain the Executive Officer's approval before performing any unscheduled emission control component/system maintenance. In all cases, the degree of system degradation must not be improved by any inspection or repairs. Emission tests must be performed before and after all unscheduled maintenance and be used in the DF calculation.

5. Evaporative Compliance Criteria

If a manufacturer conducts evaporative emission testing (gasoline- and alcohol-fueled vehicles only) in conjunction with exhaust durability testing, the vehicle manufacturer is required to show compliance with the evaporative emission standard for 50,000 miles. If the manufacturer wishes to conduct testing beyond 50,000 miles, all data must be submitted to the Executive Officer. The Executive Officer will not use

any evaporative emission standard. However, the manufacturer must warrant the evaporative emission control system for 10 years or 100,000 miles.

b. Specific Guidelines for Compliance

Each exhaust emission durability data vehicle shall be driven, with all emission control systems installed and operating, for 100,100,000 miles or such lesser distance as the Executive Officer may agree to as meeting the objectives of this procedure. Emission tests performed on emission-data vehicles and durability-data vehicles (for determination of the deterioration factors) shall be non-regeneration emission tests for diesel passenger cars, light-duty trucks and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems. Compliance with the emission standards shall be established as follows:

1. The linear regression line for all pollutants shall be established by use of all required data from tests of the durability vehicle at every 5,000 mile interval from 5,000 to 100,000 miles. The requirements in subparagraph 86.088- 28(a)(4)(i)(B), 86.090-28(a)(4)(i)(B), and 86.091- 28(a)(4)(i)(B) (durability vehicles must meet emissions standards) refer, for each pollutant, to the California 100,000 mile emission standards.

2. Compliance with the hydrocarbon and carbon monoxide standards shall be determined as follows:

i. For Option 1:

A. The interpolated 4,000 and 50,000 mile points on the linear regression line in section b.1. shall not exceed the appropriate hydrocarbon and carbon monoxide standards, except as in B. below.

B. The linear regression line in section b.1. may exceed the standard provided that no data point exceeds the standard.

C. The hydrocarbon and carbon monoxide data from the 4,000 mile test point of the emission data vehicle shall be multiplied by the deterioration factor computed by dividing the interpolated 50,000 mile point by the interpolated 4,000 mile point, and the appropriate exhaust emission correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). These values shall not exceed the appropriate hydrocarbon and carbon monoxide standards.

ii. For Option 2:

A. The interpolated 4,000 and 100,000 mile points on the linear regression line in section b.1. shall not exceed the appropriate hydrocarbon and carbon monoxide standards, except as in B. below.

B. The linear regression line in section b.1. may exceed the standard provided that no data point exceeds the standard.

C. The hydrocarbon and carbon monoxide data from the 4,000 mile test point of the emission data vehicle shall be multiplied by the deterioration factor computed by dividing the interpolated 100,000 mile point by the interpolated 4,000 mile point, and the appropriate exhaust emission correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). These values shall not exceed the appropriate 100,000 mile hydrocarbon and carbon monoxide standards.

3. Compliance with the oxides of nitrogen standard for Options 1 and 2 shall be determined as follows:

i. the interpolated 4,000 and 100,000 mile points on the linear regression line in section b.1. shall not exceed the appropriate 100,000 mile oxides of nitrogen standard, except as in ii. below.

ii. the linear regression line in section b.1. may exceed the standard provided that no data point exceeds the standard.

iii. the oxides of nitrogen data from the 4,000 mile test point of the emission data vehicle shall be multiplied by the deterioration factor computed by dividing the interpolated 100,000 mile point by the interpolated 4,000 mile point, and the appropriate exhaust emission correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). These values shall not exceed the appropriate 100,000 mile oxides of nitrogen standard.

4. Compliance with the particulate standard for options 1 and 2 shall be determined as follows:

i. the interpolated 4,000 and 50,000 mile points on the linear regression line in section b.1. shall not exceed the appropriate particulate, except as in ii. below.

ii. the linear regression line in section b.1. may exceed the standard provided that no data point exceeds the standard.

iii. the particulate data from the 4,000 mile test point of the emission data vehicle shall be multiplied by the deterioration factor computed by dividing the interpolated 50,000 mile point by the interpolated 4,000 mile point, and the appropriate exhaust emission correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). These values shall not exceed the appropriate particulate standard.

5. All references in these test procedures to "useful life", 5 years, and 50,000 miles shall mean "total life", 10 years, and 100,000 miles, respectively, except in section 10.b.2.

c. Maintenance

Only the following scheduled maintenance shall be allowed under subparagraph 86.085-25 (a)(1)(i).

1. 25(a)(1)(i) Option 1. For 1988 model otto-cycle or diesel vehicles, and 1989 and later model otto-cycle or diesel light- duty trucks and medium-duty vehicles 3751 L.V.W. and greater, and 1993 and subsequent diesel light-duty trucks and medium- duty vehicles 3751 L.V.W. and greater, maintenance shall be restricted to the inspection, replacement, cleaning, adjustment, and/or service of the following items at intervals no more frequent than indicated.

(1) Drive bent tension on engine accessories (30,000 miles).
(2) Valve lash (15,000 miles).
(3) Spark plugs (30,000 miles).
(4) Air filter (30,000 miles).
(5) Exhaust gas sensor (30,000 miles): Provided that:

(a) the manufacturer shall equip the vehicle with a maintenance indicator consisting of a light or flag, which shall be preset to activate automatically by illuminating in the case of a light or by covering the odometer in the case of a flag the first time the minimum maintenance interval established during certification testing is reached and which shall remain activated until reset. After resetting, the maintenance indicator shall activate automatically when the minimum maintenance interval, when added to the vehicle mileage at the time of resetting, is again reached and shall again remain activated until reset. When the maintenance indicator consists of a light, it shall also activate automatically in the engine-run key position before engine cranking to indicate that it is functioning. The maintenance indicator shall be located on the instrument panel and shall, when activated, display the words "oxygen sensor" or may display such other words determined by the Executive Officer to be likely to cause the vehicle owner to seek oxygen sensor replacement. The maintenance indicator

shall be separate from the malfunction indicator light required by Section 1968, Title 13, California Code of Regulations;

(b) the manufacturer shall provide free replacement of the oxygen sensor, including both parts and labor, and shall reset the maintenance indicator without any charge, the first time the maintenance interval established during certification testing is reached for vehicles certified with scheduled sensor maintenance before 50,000 miles. If the oxygen sensor is replaced pursuant to the warranty provisions of Section 2037, Title 13, California Code of Regulations, before the first maintenance interval is reached, the manufacturer shall also replace the oxygen sensor and reset the maintenance indicator at the oxygen sensor and reset the maintenance indicator at the mileage point determined by adding the maintenance interval to the vehicle's mileage at the time of the warranty replacement. If the calculated mileage point for a second oxygen sensor replacement would exceed 50,000 miles, no free second replacement shall be required;

(c) the maintenance indicator shall be resettable. The maintenance instructions required by paragraph 5.b. of these procedures shall provide instructions for the resetting of the maintenance indicator, and shall specify that the maintenance indicator shall be reset each time the oxygen sensor is replaced; and

(d) notwithstanding the provisions of Section 2037(c), Title 13, California Code of Regulations, the oxygen sensor, including any replacement required pursuant to this section, shall be warranted for the applicable warranty period of the vehicle or engine in accordance with Section 2037(a), Title 13, California Code of Regulations. If such oxygen sensor fails during this period, it shall be replaced by the manufacturer in accordance with Section 2037(d), Title 13, California Code of Regulations.

(6) Choke, cleaning or lubrication only (30,000 miles).
(7) Idle speed (30,000 miles).
(8) Fuel Filter (30,000 miles).
(9) Injection timing (30,000 miles).

Option 2. For 1981-1988 and later model otto-cycle vehicles or 1988 and later diesel vehicles, maintenance shall be restricted to the inspection, replacement, cleaning, adjustment, and/or service of the following items at intervals no more frequent than indicated:

(1) Drive belt tension on engine accessories (30,000 miles).
(2) Valve lash (15,000 miles).
(3) Spark plugs (30,000 miles).
(4) Air filter (30,000 miles).

(5) Fuel Filter (30,000 miles).
(6) Idle speed (30,000 miles).
(7) Injection timing (30,000 miles).

2. In addition, adjustment of the engine idle speed (curb idle and fast idle), valve lash, and engine bolt torque may be performed once during the first 5,000 miles of scheduled driving, provided the manufacturer makes a satisfactory showing that the maintenance will be performed on vehicles in use.

d. The manufacturer shall agree to apply to vehicles certified under this paragraph the provision of Section 43204 of the California Health and Safety Code for a period of ten years or 100,000 miles, whichever first occurs.

11. Additional Requirements

a. **Alternative Durability Procedures.** In order to qualify for the alternative durability program, in addition to the requirements of paragraph 86.085-13, the algorithm requirements of Appendix III shall be met and only the first 50,000 miles (or 100,000 miles, as applicable) of data or its equivalent shall be used.

b. **High Altitude Requirements.** For otto-cycle vehicles or hybrid electric vehicles which use otto-cycle engines, evidence shall be supplied showing that the air/fuel metering system or secondary air injection system is capable of providing sufficient oxygen to theoretically allow enough oxidation to attain the CO emission standards at barometric pressures equivalent to those expected at altitudes ranging from sea level to 6000 feet elevations.

A vehicle will be deemed in compliance with the above requirement if the manufacturer demonstrates that the tailpipe air/fuel ratio (TAFR) is, at elevations up to 6000 feet, stoichiometric or leaner in each of several driving modes. However, if a vehicle operates in a given driving mode at sea level with a TAFR richer than stoichiometric, then for that particular driving mode the manufacturer is only required to show that the TAFR is, at elevations up to 6000 feet, no richer than the TAFR at sea level. The driving modes selected for testing shall be representative of the full range of normal driving conditions, and shall include the following three steady-state modes: idle, 30 mph road load cruise, 50 mph road load cruise. Assuming the use of dry air and indolene fuel (hydrogen to carbon atom ratio of 1.85), a TAFR of 14.6 shall be considered a stoichiometric ratio. The vehicle manufacturer may correct this value for different fuels and/or humidity, subject to approval by the Executive Officer.

For fuel injected vehicles or hybrid electric vehicles which use fuel-injected engines, compliance may be demonstrated upon a showing by the manufacturer that the fuel injection system distributes fuel based on air mass flow, rather than volume flow, and is therefore self-compensating. All submitted test proposals will be evaluated on their acceptability by the Executive Officer.

As an alternative to the demonstration described above, a manufacturer may demonstrate compliance by testing California vehicle configurations as part of its federal high altitude certification requirements. Engine families which meet all the applicable California low altitude emission standards when tested at the EPA test elevation are deemed to be in compliance.

Exemptions to the high altitude provisions as allowed by the federal government in 86.087-8, 86.088-9, 86.090-8, 86.090-9, and 86.091-9 shall not be approved.

c. **Highway Fuel Economy Test.** The exhaust emissions shall be measured from all exhaust emission data vehicles tested in accordance with the federal Highway Fuel

Economy Test (HWFET; 40 CFR Part 600, Subpart B). The oxides of nitrogen emissions measured during such tests shall be multiplied by the oxides of nitrogen deterioration factor computed in accordance with paragraph 86.088-28, 86.090-28, and 86.091-28, and then rounded and compared with the standard as set forth in section 3 preceding. All data obtained pursuant to this paragraph shall be reported in accordance with procedures applicable to other exhaust emissions data required pursuant to these procedures. Hybrid electric vehicles shall be tested with the battery state-of- charge set such that one of the following two conditions is satisfied: (1) the state-of-charge is at the lowest level allowed by the control unit of the auxiliary power unit; or (2) the state-of-charge is set such that auxiliary power unit operation will be at its maximum level at the beginning and throughout the emission test.

In the event that one or more of the manufacturer's emission data vehicles fail the HWFET standard listed in section 3, the manufacturer may submit to the Executive Officer engineering data or other evidence showing that the system is capable of complying with the standard. If the Executive Officer finds, on the basis of an engineering evaluation, that the system can comply with the HWFET standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data.

d. **Labeling Requirements.** Labeling required pursuant to paragraph 86.088-35, 86.090-35, 86.091-35, 86.0894-35, and 86.095-35, and Section 1965, Chapter 3, Title 13 of the California Code of Regulations shall conform with the requirements specified in the "California Motor Vehicle Emission Control and Smog Index Label Specifications."

e. **Driveability and Performance Requirements.** The manufacturer shall submit to the Executive Officer a statement that those vehicles for which certification is requested have driveability and performance characteristics which satisfy that manufacturer's customary driveability and performance requirements for vehicles sold in the United States. This statement shall be based on driveability data and other evidence showing compliance with the manufacturer's performance criteria. This statement shall be supplied with the manufacturer's final application for certification, and with all running changes for which emission testing is required.

If the Executive Officer has evidence to show that in-use vehicles demonstrate poor performance that could result in wide-spread tampering with the emission control systems, he or she may request all driveability data and other evidence used by the manufacturer to justify the performance statement.

f. **Malfunction and Diagnostic System Requirements.** For all vehicles subject to the provisions of Section 1968, or 1968.1, Title 13, California Code of Regulations, the manufacturer shall submit with its application for certification a description of the malfunction and diagnostic system to be installed on the vehicles. (The vehicles shall

not be certified unless the Executive Officer finds that the malfunction and diagnostic system complies with the requirements of Section 1968 or 1968.1).

g. Methanol and Formaldehyde Emission Testing. The provisions of the incorporated federal test procedures which allow manufacturers to omit methanol and formaldehyde emission testing of 1990 through 1994 methanol-fueled vehicles shall not be applicable in California.

h. FFV Emission Testing. The following requirements shall apply to methanol and ethanol fuel-flexible vehicles which are not certified to TLEV, LEV, ~~or~~ ULEV, *or SULEV* emission standards:

The emission testing required under 6.a.4.(D) (Fuel-flexible vehicle special emission testing) shall be made part of the regular certification program and submitted to the Executive Officer for review. Certification for methanol-fueled vehicles shall be denied unless the exhaust emission values resulting from testing with 35-percent methanol and 65-percent certification gasoline, or another approved methanol-gasoline blend, at the required mileage intervals, and with certification gasoline at 5,000 miles, 50,000 miles and the final mileage point, comply with the applicable standards. Certification for ethanol-fueled vehicles shall be denied unless the exhaust emission values resulting from testing with 10-percent ethanol and 90-percent certification gasoline, or another approved ethanol-gasoline blend, at the required mileage intervals, and with certification gasoline at 5,000 miles, 50,000 miles and the final mileage point, comply with the applicable standards.

i. Scope of Certification. Certification, if granted, is effective only for the vehicle/engine family described in the original manufacturer's certification application. Modifications by a secondary manufacturer to vehicles/engines shall be deemed not to increase emissions above the standards under which those vehicles/engines were certified and to be within the original certification if such modifications do not: (1) increase vehicle weight more than 10 percent above the curb weight, increase frontal area more than 10 percent, or result in a combination increase of weight plus frontal area of more than 14 percent; or (2) include changes in axle ratio, tire size, or tire type resulting in changes in the drive train ratio of more than 5 percent; or (3) include any modification to the emission control system. No originally certified vehicle/engine which is modified by a secondary manufacturer in a manner described in items (1) through (3) of the preceding sentence may be sold to an ultimate purchaser, offered or delivered for sale to an ultimate purchaser, or registered in California unless the modified vehicle/engine is certified by the state board in accordance with applicable test procedures to meet emission standards for the model year for which the vehicle/engine was originally certified.

For the purposes of this subsection, "secondary manufacturer" means any person, other than the original manufacturer, who modifies a new motor vehicle prior to sale to the ultimate purchaser.

j. **Statement on Production Vehicles.** A statement must be supplied that the production vehicles shall be in all material respects the same as those for which certification is granted.

k. **50°F Emission Test Requirement.** Following a 12 to 36 hour cold soak at a nominal temperature of 50° F, emissions of CO and NOx measured on the Federal Test Procedure (40 CFR Part 86), conducted at a nominal test temperature of 50° F, shall not exceed the standards for vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68 to 86° F. For all TLEVs, emissions of NMOG and formaldehyde at 50° F shall not exceed the 50,000 mile certification standard multiplied by a factor of 2.00. For all LEVs, emissions of NMOG and formaldehyde at 50° F shall not exceed the 50,000 mile certification standard multiplied by a factor of ~~*1.75*~~ ***2.00***. For all ULEVs, emissions of NMOG and formaldehyde at 50° F shall not exceed the 50,000 mile certification standard multiplied by a factor of ~~*1.0*~~ ***2.00***. Emissions of NMOG shall be multiplied by a reactivity adjustment factor, if any, prior to comparing with the 50,000 certification standard multiplied by the specified factor.

The test vehicles shall not be subject to a diurnal heat build prior to the cold start exhaust test or evaporative emission testing.

i. For the 50° F emission test, the nominal preconditioning, soak, and test temperatures shall be maintained within 3° F of the nominal temperature on an average basis and within 5° F of the nominal temperature on a continuous basis. The temperature shall be sampled at least once every 15 seconds during the preconditioning and test periods and at least once each 5 minutes during the soak period. A continuous strip chart recording of the temperature with these minimum time resolutions is an acceptable alternative to employing a data acquisition system.

ii. The test site temperature shall be measured at the inlet of the vehicle cooling fan used for testing.

iii. The test vehicle may be fueled before the preconditioning procedure in a fueling area maintained within a temperature range of 68 to 86° F. The preconditioning shall be conducted at a nominal temperature of 50° F. The requirement to saturate the evaporative control canister(s) shall not apply.

iv. If a soak area remote from the test site is used, the vehicle may pass through an area maintained within a temperature range of 68 to 86° F during a time interval not to exceed 10 minutes. In such cases, the vehicle shall be restabilized to 50° F by soaking the vehicle in the nominal 50^0 F test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.

v. The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.

Manufacturers shall demonstrate compliance with this requirement each year by testing at least three PC or LDT and three MDV emission data and/or engineering development vehicles (with at least 4000 miles) which are representative of the array of technologies available in that model year. Only TLEVs, LEVs, and ULEVs are to be considered for testing at 50° F. It is not necessary to apply deterioration factors (DFs) to the 50° F test results to comply with this requirement. Testing at 50° F shall not be required for fuel-flexible and dual-fuel vehicles when operating on gasoline. Natural gas, hybrid electric and diesel-fueled vehicles shall also be exempt from 50° F testing.

The following schedule outlines the parameters to be considered for vehicle selection:

1. Fuel control system (e.g., multiport fuel injection, throttle body electronic fuel injection, sequential multiport electronic fuel injection, etc.)
2. Catalyst system (e.g., electrically heated catalyst, close-coupled catalyst, underfloor catalyst, etc.)
3. Control system type (e.g., mass-air flow, speed density, etc.)
4. Vehicle category (e.g., TLEV, LEV, ULEV)
5. Fuel type (e.g., gasoline, methanol, etc.)

The same engine family shall not be selected in the succeeding two years unless the manufacturer produces fewer than three engine families. If the manufacturer produces more than three TLEV, LEV, or ULEV engine families per model year, the Executive Officer may request 50° F testing of specific engine families. If the manufacturer provides a list of the TLEV, LEV, and ULEV engine families that it will certify for a model year and provides a description of the technologies used on each engine family (including the information in items 1 through 5 of the vehicle selection parameters listed above), the Executive Officer shall select the engine families subject to 50° F testing within a 30 day period after receiving such a list and description. The Executive Officer may revise the engine families selected after the 30 day period if the information provided by the manufacturer does not accurately reflect the engine families actually certified by the manufacturer.

1. Emission Control System Continuity at Low Temperature. For each engine family certified to TLEV, LEV, ***or*** ULEV, ***or SULEV*** standards, manufacturers shall submit with the certification application, an engineering evaluation demonstrating that a discontinuity in emissions of non-methane organic gases, carbon monoxide, oxides of nitrogen and formaldehyde measured on the Federal Test Procedure (40 CFR Part 86) does not occur in the temperature range of 20 to 86° F. For diesel vehicles, the engineering evaluation shall also include particulate emissions.

12. Identification of New Clean Fuels to be Used in Certification Testing

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraph 86.113-90 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels." In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel.

13. Reactivity Adjustment Factors

For the purpose of complying with the NMOG exhaust emission standards in Section 1960.1, Title 13, California Code of Regulations, the mass of NMOG emissions from a vehicle certified to operate on a fuel other than conventional gasoline, including fuel-flexible and dual-fuel vehicles when operated on a fuel other than conventional gasoline, shall be multiplied by the reactivity adjustment factor applicable to the vehicle emission control technology category and fuel. The product of the NMOG mass emission value and the reactivity adjustment factor shall be compared to the NMOG exhaust emission standards to determine compliance with the standards. In addition to the above requirements, vehicles operating on natural gas shall add to the product of the NMOG mass emission value and the reactivity adjustment factor, the product of the methane mass emission value and the methane reactivity adjustment factor. This result shall be compared to the NMOG exhaust emission standards to determine compliance with the standards for natural gas-fueled vehicles.

a. The following reactivity adjustment factors have been established pursuant to the criteria in Appendix VIII of these test procedures:

1. **Passenger cars and light-duty trucks 0-5750 lbs. LVW and all medium-duty vehicles 0-14,000 TW**

Vehicle Emission Control Category	Fuel	Reactivity Adjustment Factor
1993 and subsequent model-year TLEVs	85% methanol, 15% gasoline blends	0.41
1993 -2000 model-year LEVs and ULEVs	85% methanol, 15% gasoline blends	0.41
1993 through ~~1997~~ 2000 model-year TLEVs	gasoline meeting the specifications of section 9.a.1.(ii) of these test procedures	0.98
1993 through ~~1997~~ 2000 model-year LEVs and ULEVs	gasoline meeting the specifications of section 9.a.1.(ii) of these test procedures	0.94
1993 through 2000 model-year TLEVs	fuel meeting the specifications of section 9.a.13.(g)(1) of these test procedures (liquefied petroleum gas)	1.00
1993 through 2000	fuel meeting the specifications	0.50

model-year LEVs and ULEVs	of section 9.a.13.(g)(1) of these test procedures (liquefied petroleum gas)	
1993 through 2000 model-year TLEVs	fuel meeting the specifications of section 9.a.13.(g)(2) of these test procedures (natural gas)	1.00
1993 through 2000 model-year LEVs and ULEVs	fuel meeting the specifications of section 9.a.13.(g)(2) of these test procedures (natural gas)	0.43

2. ~~NG~~ Natural gas passenger cars and light-duty trucks 0-5750 lbs. LVW

Vehicle Emission Control Technology Category	Methane Reactivity Adjustment Factor
1993 and subsequent model-year TLEVs	0.0043
1993 and subsequent model-year LEVs and ULEVs	0.0047

3. Natural gas medium-duty vehicles 0-8500 lbs. TW

Vehicle Emission Control Technology Category	Methane Reactivity Adjustment Factor
1995 and subsequent model-year LEVs and ULEVs	0.0047

b. The Executive Officer may establish by executive order new reactivity adjustment factors pursuant to Appendix VIII of these test procedures in addition to those listed in Section 13.a. The Executive Officer shall notify manufacturers in writing of the new reactivity adjustment factors within 30 days of their establishment.

c. The Executive Officer may revise any reactivity adjustment factor listed in Section 13.a. or established by the Executive Officer pursuant to Appendix VIII of these test procedures if he or she determines that the revised reactivity adjustment factor is more representative of the ozone-forming potential of vehicle NMOG emissions based on the best available scientific knowledge and sound engineering judgment. The Executive Officer shall notify manufacturers in writing of any such reactivity adjustment factor at least 3 years prior to January 1 of the calendar year which has the same numerical designation as the model year for which the revised reactivity- adjustment factor first becomes effective. However,manufacturers may use the revised reactivity adjustment factor in certifying any new engine family whose certification application is submitted following such notification, if they so choose.Manufacturers may also continue to use the original reactivity adjustment factor

for any existing engine family previously certified with that reactivity adjustment factor until a new durability-data vehicle is tested for that engine family.

d. Manufacturers may request the use of a unique reactivity adjustment factor for a specific vehicle emission control technology category and fuel. The Executive Officer shall approve such requests in accordance with the conditions and procedures of Appendix VIII of these test procedures. For the purpose of calculating the reactivity adjustment factor as specified in Appendix VIII, the 'g ozone potential per g NMOG' value for the vehicle emission control technology category and fuel system for which the manufacturer is requesting the use of a unique reactivity adjustment factor shall be divided by the 'g ozone potential per g NMOG' value for a conventional gasoline-fueled vehicle established for the vehicle emission control technology category. The following 'g ozone potential per g NMOG' values for conventional gasoline-fueled vehicle emission control technology categories have been established:

1. **Passenger cars and light-duty trucks 0-5750 lbs. LVW**

Vehicle Emission Control Technology Category	'g ozone potential per g NMOG' for conventional gasoline
All TLEVs	3.42
All 1993 ~~through 1997~~ and subsequent model-year LEVs and ULEVs	3.13

2. **Medium-Duty Vehicles 0-8500 lbs. TW**

All 1993 and subsequent model year LEVs and ULEVs	3.13

14. Cold Temperature Test Procedure

a. General Applicability

In paragraph 86.201-94:

1. Amend subparagraph (a) to read:

(a) This subpart describes procedures for determining the cold temperature carbon monoxide (CO) emissions from 1996 and later model year new passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas vehicles, diesel-fueled vehicles, hybrid electric vehicles, and zero-emission vehicles).

b. Equipment Required; Overview

In paragraph 86.206.94:

1. Amend subparagraph (a) to read:

(a) This subpart contains procedures for exhaust emission tests on passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas vehicles, diesel-fueled vehicles, hybrid electric vehicles, and zero-emission vehicles.) Equipment required and specifications are as follows:

2. Amend subparagraph (a)(1) to read:

(a)(1) Exhaust emission tests. Exhaust from vehicles (excluding natural gas vehicles, diesel-fueled vehicles, hybrid electric vehicles, and zero-emission vehicles) is tested for gaseous emissions using the Constant Volume Sampler (CVS) concept (Section 86.209). Equipment necessary and specifications appear in 40 CFR Part 86, Section 86.208 through 86.214.

3. Amend subparagraph (a)(2) to read:

(a)(2) Fuel, analytical gas, and driving schedule specifications. Fuel specifications for exhaust emission testing for gasoline-fueled vehicles are specified in 40 CFR Part 86, Section 86.213. Fuel specifications for exhaust emission testing for alcohol-fueled vehicles and liquified petroleum gas vehicles are specified in Section 9.a. of these Test Procedures. Analytical gases are specified in 40 CFR Part 86, Section 86.214. The EPA Urban Dynamometer Driving Schedule (UDDS) for use in emission tests is specified in 40 CFR Part 86, Section 86.215 and Appendix I.

APPENDIX I

List of Sections of Subparts A, B, and C, Part 86, Title 40, Code of Federal Regulations, Incorporated by Reference

This Appendix sets forth the sections of Subparts A, B, and C, Part 86, Title 40, Code of Federal Regulations, as adopted or amended by the U.S. Environmental Protection Agency (EPA) on the date listed for each section, which are incorporated by reference in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

86.085-1 General applicability. July 7, 1986.
86.090-1 General applicability. April 11, 1989.
86.082-2 Definitions. November 2, 1982.
86.084-2 Definitions. December 10, 1984.
86.085-2 Definitions. November 26, 1983.
86.088-2 Definitions. March 15, 1985.
86.090-2 Definitions. April 11, 1989.
86.078-3 Abbreviations. January 21, 1980.
86.090-3 Abbreviations. April 11, 1989.
86.084-4 Section numbering; construction. September 25, 1980.
86.084-5 General standards; increase in emissions; unsafe conditions. November 2, 1982.
86.090-5 General standards; increase in emissions; unsafe conditions. April 11, 1989.
86.078-7 Maintenance of records; submitted information; right of entry. November 1, 1982.
86.087-8 Emission standards for 1987 light-duty vehicles. January 24, 1984.
86.090-8 Emission standards for 1990 and later model year light-duty vehicles. April 11, 1989.
86.088-9 Emission standards for 1988 and later model year light-duty trucks. October 31, 1988.
86.080-12 Alternative certification procedures. April 17, 1980.
86.085-13 Alternative durability program. May 19, 1983.
86.084-14 Small-volume manufacturer certification procedures. January 31, 1985.
86.090-14 Small-volume manufacturer certification procedures. April 11, 1989.
86.092-14 Small-volume manufacturer certification procedures. February 28, 1990.
86.095-14 Small-volume manufacturer certification procedures. June 5, 1991.
86.094-16 Prohibition of defeat devices. July 17, 1992.
86.085-20 Incomplete vehicles. January 12, 1983.
86.088-21 Application for certification. March 15, 1985.
86.090-21 Application for certification. April 11, 1989.
86.091-21 Application for certification. April 11, 1989.
86.094-21 Application for certification. July 17, 1992.
86.085-22 Approval of application for certification; test fleet selection, etc. July 7, 1986.

86.090-22 Approval of application for certification; test fleet selection, etc. April 11, 1989.
86.094-22 Approval of application for certification; test fleet selection, etc. July 17, 1992.
86.088-23 Required data. July 19, 1985.
86.090-23 Required data. April 11, 1989.
86.091-23 Required data. July 26, 1990.
86.094-23 Required data. June 5, 1991.
86.085-24 Test vehicles and engines. January 31, 1985.
86.090-24 Test vehicles and engines. April 11, 1989.
86.092-24 Test vehicles and engines. July 26, 1990.
86.094-24 Test vehicles and engines. July 17, 1992.
86.095-24 Test vehicles and engines. July 17, 1992.
86.085-25 Maintenance. July 7, 1986.
86.087-25 Maintenance. July 7, 1986.
86.088-25 Maintenance. July 7, 1986.
86.090-25 Maintenance. April 11, 1989.
86.084-26 Mileage and service accumulation; emission measurements. July 7, 1986.
86.090-26 Mileage and service accumulation; emission requirements. April 11, 1989.
86.085-27 Special test procedures. January 12, 1983.
86.090-27 Special test procedures. April 11, 1989.
86.088-28 Compliance with emission standards. July 7, 1986.
86.090-28 Compliance with emission standards. April 11, 1989.
86.091-28 Compliance with emission standards. July 17, 1992.
86.088-29 Testing by the Administrator. March 15, 1985.
86.090-29 Testing by the Administrator. April 11, 1989.
86.091-29 Testing by the Administrator. April 11, 1989.
86.088-30 Certification. January 24, 1984.
86.090-30 Certification. July 26, 1990.
86.091-30 Certification. July 26, 1990.
86.094-30 Certification. June 5, 1991.
86.095-30 Certification. June 5, 1991.
86.079-31 Separate certification. September 8, 1977.
86.079-32 Addition of a vehicle or engine after certification. September 8, 1977.
86.079-33 Changes to a vehicles or engine covered by certification. September 8, 1977.
86.082-34 Alternative procedures for notification of addition and changes. November 2, 1982.
86.088-35 Labeling. March 15, 1985.
86.090-35 Labeling. April 11, 1989.
86.091-35 Labeling. April 11, 1989.
86.094-35 Labeling. July 17, 1992.
86.095-35 Labeling. July 17, 1992.
86.079-36 Submission of vehicle identification numbers. November 14, 1978.
86.085-37 Production vehicles and engines. January 12, 1983.
86.085-38 Maintenance instructions. November 16, 1983.
86.087-38 Maintenance instructions. July 7, 1986.
86.079-39 Submission of maintenance instructions. September 8, 1977.
86.084-40 Automatic expiration of reporting and record keeping requirements. September 25, 1980.

Subpart B-Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks; Test Procedures.

86.101 General applicability. June 28, 1977.
86.102 Definitions. March 5, 1980.
86.103 Abbreviations. March 5, 1980.
86.104 Section numbering, construction. April 11, 1989.
86.105 Introduction; structure of subpart. April 11, 1989.
86.106-82 Equipment required; overview. March 5, 1980.
86.106-90 Equipment required; overview. April 11, 1989.
86.106-94 Equipment required; overview. June 5, 1991.
86.107-78 Sampling and analytical system, evaporative emissions. June 28, 1977.
86.107-90 Sampling and analytical system, evaporative emissions. April 11, 1989.
86.108-79 Dynamometer. September 12, 1977.
86.109-82 Exhaust gas sampling system; gasoline-fueled vehicles. March 5, 1980.
86.109-90 Exhaust gas sampling system; Otto-cycle vehicles. April 11, 1989.
86.109-94 Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emission measurements. June 5, 1991.
86.110-82 Exhaust gas sampling system; diesel vehicles. October 13, 1981.
86.110-90 Exhaust gas sampling system; diesel vehicles. April 11, 1989.
86.110-94 Exhaust gas sampling system; diesel vehicles. June 5, 1991.
86.111-82 Exhaust gas analytical-system. March 5, 1980.
86.111-90 Exhaust gas analytical-system. April 11, 1989.
86.111-94 Exhaust gas analytical-system. June 5, 1991.
86.112-82 Weighing chamber (or room) and microgram balance specifications. March 5, 1980.
86.112-91 Weighing chamber (or room) and microgram balance specifications. June 5, 1991.
86.113-90 Fuel Specifications. April 11, 1989.
86.113-91 Fuel Specifications. August 21, 1990.
86.113-94 Fuel Specifications. August 21, 1990.
86.114-79 Analytical gases. November 14, 1978.
86.114-94 Analytical gases. June 5, 1991.
86.115-78 EPA urban dynamometer driving schedules. June 28, 1977.
86.116-82 Calibrations, frequency and overview. March 5, 1980.
86.116-90 Calibrations, frequency and overview. April 11, 1989.
86.117-78 Evaporative emission enclosure calibrations. June 28, 1977.
86.117-90 Evaporative emission enclosure calibrations. April 11, 1989.
86.118-78 Dynamometer calibration. June 28, 1977.
86.119-78 CVS calibration. June 28, 1977.
86.119-90 CVS calibration. April 11, 1989.
86.120-82 Gas meter or flow instrumentation calibration, particulate measurement. March 5, 1980.
86.121-82 Hydrocarbon analyzer calibration. March 5, 1980.
86.121-90 Hydrocarbon analyzer calibration. April 11, 1989.
86.122-78 Carbon monoxide analyzer calibration. June 28, 1977.
86.123-78 Oxides of nitrogen analyzer calibration. September 12, 1977.

86.124-78 Carbon dioxide analyzer calibration. June 28, 1977.
86.126-78 Calibration of other equipment. June 28, 1977.
86.126-90 Calibration of other equipment. April 11, 1989.
86.127-82 Test procedures; overview. March 5, 1980.
86.127-90 Test procedures; overview. April 11, 1989.
86.128-79 Transmission. November 14, 1978.
86.129-80 Road load power test weight and inertia weight class determination. November 14, 1978.
86.129-94 Road load power test weight and inertia weight class determination. June 5, 1991.
86.130-78 Test sequence; general requirements. June 28, 1977.
86.131-78 Vehicle preparation. June 28, 1977.
86.131-90 Vehicle preparation. April 11, 1989.
86.132-82 Vehicle preconditioning. March 5, 1980.
86.132-90 Vehicle preconditioning. April 11, 1989.
86.133-78 Diurnal breathing loss test. November 16, 1983.
86.133-90 Diurnal breathing loss test. April 11, 1989.
86.135-82 Dynamometer procedure. December 10, 1984.
86.135-90 Dynamometer procedure. April 11, 1989.
86.136-82 Engine starting and restarting. March 5, 1980.
86.136-90 Engine starting and restarting. April 11, 1989.
86.137-82 Dynamometer test run, gaseous and particulate emissions. March 5, 1980.
86.137-90 Dynamometer test run, gaseous and particulate emissions. April 11, 1989.
86.138-78 Hot soak test. June 28, 1977.
86.138-90 Hot soak test. April 11, 1989.
86.139-82 Diesel particulate filter handling and weighing. March 5, 1980.
86.139-90 Diesel particulate filter handling and weighing. April 11, 1989.
86.140-82 Exhaust sample analysis. March 5, 1980.
86.140-90 Exhaust sample analysis. April 11, 1989.
86.142-82 Records required. March 5, 1980.
86.142-90 Records required. April 11, 1989.
86.143-78 Calculations; evaporative emissions. June 28, 1977.
86.143-90 Calculations; evaporative emissions. April 11, 1989.
86.144-78 Calculations; exhaust emissions. December 10, 1984.
86.144-90 Calculations; exhaust emissions. April 11, 1989.
86.144-94 Calculations; exhaust emissions. July 5, 1991.
86.145-82 Calculations; particulate emissions. October 13, 1981.

Subpart C-Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles and New Light-Duty Trucks; Cold Temperature Test Procedures.

86.201-94 General applicability. July 17, 1992.
86.202-94 Definitions. July 17, 1992.
86.203-94 Abbreviations. July 17, 1992.
86.204-94 Section number construction. July 17, 1992.

86.205-94 Introduction; structure of subpart. July 17, 1992.
86.206-94 Equipment required; overview. July 17, 1992.
86.208-94 Dynamometer. July 17, 1992.
86.209-94 Exhaust gas sampling system; gasoline-fueled vehicles. July 17, 1992.
86.211-94 Exhaust gas analytical system. July 17, 1992.
86.213-94 Fuel specifications. July 17, 1992.
86.214-94 Analytical gases. July 17, 1992.
86.215-94 EPA urban dynamometer driving schedule. July 17, 1992.
86.216-94 Calibrations, frequency and overview. July 17, 1992.
86.218-94 Dynamometer calibration. July 17, 1992.
86.219-94 CVS calibration. July 17, 1992.
86.221-94 Hydrocarbon analyzer calibration. July 17, 1992.
86.222-94 Carbon monoxide analyzer calibration. July 17, 1992.
86.223-94 Oxides of nitrogen analyzer calibration. July 17, 1992.
86.224-94 Carbon dioxide analyzer calibration. July 17, 1992.
86.226-94 Calibration of other equipment. July 17, 1992.
86.227-94 Test procedures; overview. July 17, 1992.
86.228-94 Transmissions. July 17, 1992.
86.229-94 Road load force, test weight, and inertia weight class determination. July 17, 1992.
86.230-94 Test Sequence; general requirements. July 17, 1992.
86.231-94 Vehicle Preparation. July 17, 1992.
86.232-94 Vehicle Preconditioning. July 17, 1992.
86.235-94 Dynamometer procedure. July 17, 1992.
86.236-94 Engine starting and restarting. July 17, 1992.
86.237-94 Dynamometer test run, gaseous emissions. July 17, 1992.
86.240-94 Exhaust sample analysis. July 17, 1992.
86.242-94 Records required. July 17, 1992.
86.244-94 Calculations; exhaust emissions. July 17, 1992.
86.246-94 Intermediate temperature testing. July 17, 1992.

APPENDIX II

Exhaust Emission-Data Vehicle Selection Criteria For Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles

I. Selection of Exhaust Emission-Data Vehicles (see flow diagram on page II-4)

A. Item 1 of the attached emission-data vehicle selection worksheet (page II-5) shall be prepared with the highest projected sales engine displacement-system combination first and the remainder in order of decreasing projected sales volume.

B. For engine families with a single engine displacement-exhaust emission control system combination representing 70 percent or more of the projected sales.

1. The first vehicle selection will be determined as follows:

a. The engine displacement-exhaust emission control system combination shall be the one with the highest projected sales. (Item 1, on worksheet.)

b. Using the data entered in Item 2 of the worksheet and the formula shown below, the equivalent test weight of the vehicle is determined from the calculated sales weighted equivalent test weight for that engine displacement-exhaust emission control system combination.

Sales Weighted Test Weight (SWTW)

Determine the sales weighted test weight as follows:

T_i = Test weight of i'th class
S_i = Sales volume of i'th class
N = Number of test weight classes

$$SWTW = \frac{\sum_{i=1}^{N} S_i T_i}{\sum_{i=1}^{N} S_i}$$

Select the equivalent test weight that includes the calculated SWTW. If the SWTW is exactly between two equivalent test weights, select the higher equivalent test weight. Similarly, if there are no vehicles with the desired displacement-exhaust emission control system combination in the same equivalent test weight that includes the calculated SWTW, the next higher equivalent test weight that contains such a vehicle will be specified.

c. The transmission will be the class with the highest sales for the engine displacement-exhaust emission control system combination (Item 3, worksheet). If the highest sales transmission class is not available in the equivalent test weight determined in (b), above, the next higher equivalent test weight with the highest sales transmission class will be selected. If manual transmissions are the highest selling class, the transmission configuration with the highest sales should generally be selected (Item 4, worksheet). If the manufacturer wishes to test a vehicle with an M-4 transmission both as an M-4 vehicle and an M-3 vehicle, use of the vehicle with an M-4 transmission will be allowed provided the first three gear ratios are identical in both transmissions. Similarly, use of an M-5 will be allowed to represent both an M-5 vehicle and an M-4 vehicle, providing the first four gear ratios are identical in both transmissions.

d. The highest selling engine code within the engine displacement-exhaust emission control system-equivalent test weight-transmission class combination will be specified (Item 5, worksheet).

e. The highest selling body style within the engine displacement-exhaust emission control system-equivalent test weight-transmission class-engine code combination will be specified (Item 6, worksheet.)

f. The N/V ratio will be the standard ratio (standard tire and axle ratio combination) for the vehicle selected (Item 7, worksheet).

g. Standard or optional equipment that can reasonably be expected to influence emissions (Item 8, worksheet) and is expected to be installed on more than 33 percent of the vehicles in the car line within the engine-system combination shall be specified (and the full estimated weight of those items should be included in the curb weight computation) unless an item is not available on the particular vehicle specified. Other standard or optional equipment expected to be installed on more than 33 percent of the vehicles in the car line within the engine-system combination shall have their full estimated weight included in the curb weight computation and be included in the specified vehicle's weight. Overdrive units are considered transmission configurations and not items of optional equipment. The weight of an overdrive unit should be included in the curb weight computation of vehicles with such units. (In other words, the weight of overdrive units should not be disregarded when car line sales of such items are 33 percent or less.)

2. The second vehicle will be determined as follows.

a. The transmission class, from Item 3 of worksheet, with the second highest sales will be specified if this transmission class has projected sales of more than 30 percent of the engine displacement-exhaust emission control system combination. The equivalent test weight, engine code body style, N/V ratio, and optional equipment specified for the second vehicle are determined by criteria in Section 1.

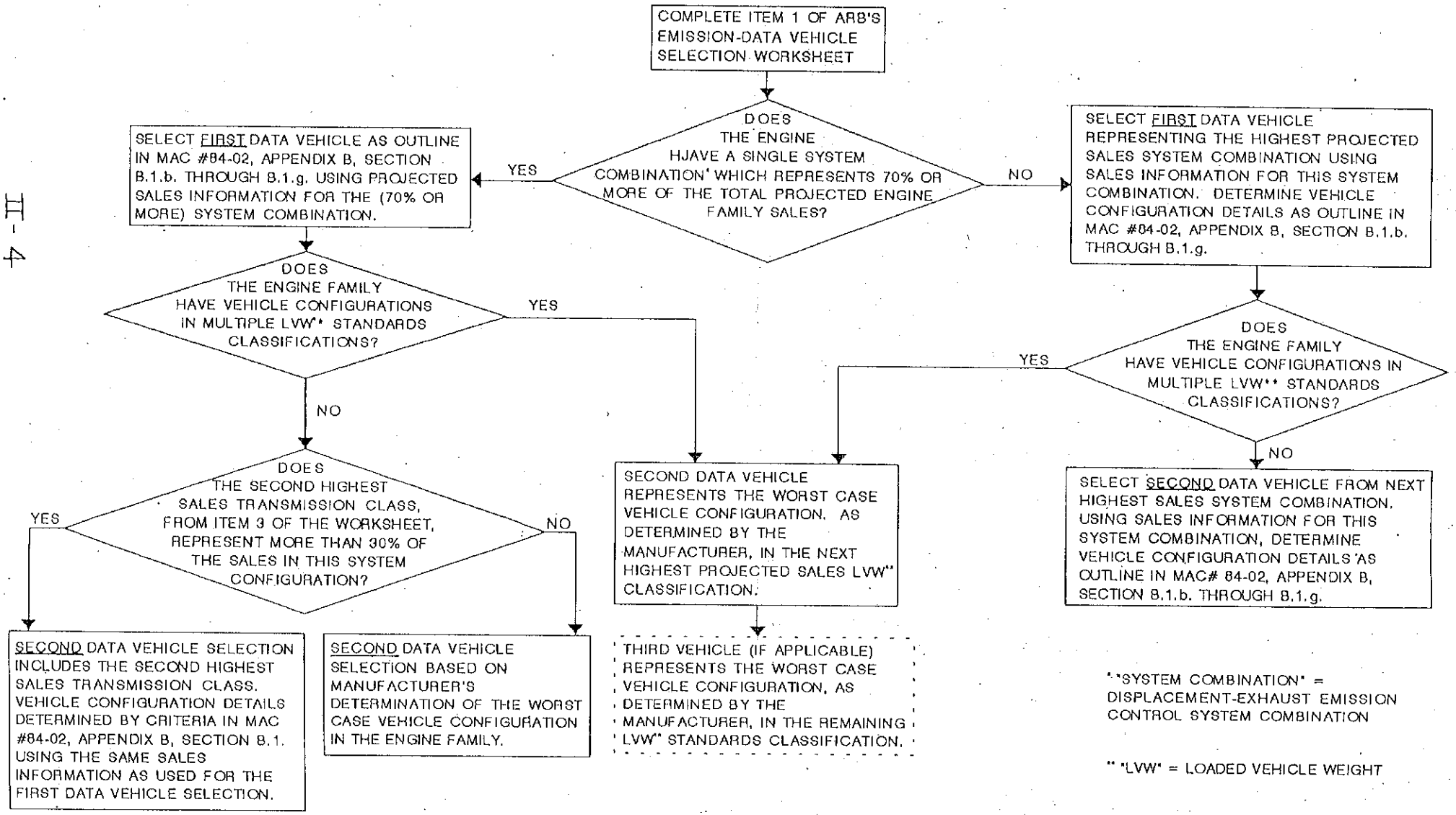
b. If the second transmission class does not meet the criteria of 2.a. above, the second vehicle will be the worst case vehicle selected from the family.

c. For engine families with multiple displacement-emission control system combinations, the first vehicle selection will be highest sales combination, and the second vehicle selection will be second highest sales combination. Other vehicle configuration details will be as in Section B.1.b. through B.1.g.

d. An exception to the two maximum emission-data vehicles may occur for engine families with vehicles in multiple standard classifications, i.e., loaded vehicle weight classifications for light-duty trucks and/or medium-duty vehicles. The first vehicle selection will be determined as above in B.1. in the highest sales loaded vehicle weight classification, and the subsequent vehicle selection(s) will be a worst case vehicle(s) in the other loaded vehicle weight classification(s).

C. For determining cold temperature CO exhaust emission compliance for each engine family, the Executive Officer shall select for testing the vehicle expected to emit the highest emissions from the vehicles selected in accordance with sections I.A. and I.B. of this Appendix. The selected vehicle shall be tested by the manufacturer in accordance with the test procedures in Subpart C, Part 86, Title 40, Code of Federal Regulations or with alternative procedures requested by the manufacturer and approved in advance by the Executive Officer.

FLOW DIAGRAMS FOR SELECTING ARB PC, LDT, AND MDV EXHAUST EMISSION-DATA VEHICLES



Emission-Data Vehicle Selection Worksheet

Manufacturer _____ Date _____

Engine Family _____

1. **Vehicle Selection**

	Engine Displacement	Emission Control System		Unit	Percent	Cumulative%
a)	_____	_____	____	_____	_____	
b)	_____	_____	____	_____	_____	
c)	_____	_____	____	_____	_____	
d)	_____	_____	____	_____	_____	

2. **Sales Weighted Test Weight**

Total projected sales: _____

	Test Weight - lb.	Sales Volume
a)	_____	_____
b)	_____	_____
c)	_____	_____
d)	_____	_____

Calculated SWTW_____ lbs. Equivalent Test Weight _____ lbs.

3. **Transmission Selection**

	Class	Sales Volumes	Percentage Sales	High Sales
a)	_____	_____	_____	_____
b)	_____	_____	_____	_____

4. **Transmission Configuration**

	Configuration	Sales Volumes	High Sales
a)	_____	_____	_____
b)	_____	_____	_____
c)	_____	_____	_____

5. **Engine Code** (within 1, 2, 3, and 4 above)

	Sales Volumes	High Sales
a)		
b)		
c)		
d)		

6. **Body Style** (within 1, 2, 3, 4, and 5 above)

	Sales Volumes	High Sales
a)		
b)		
c)		
d)		
e)		
f)		

7. **STD Axle**_____ **STD N/V** _____.

8. **Options over 33 percent**

9. **Second and Subsequent Selections Vehicles**

a) Hed Second and Subsequent Selections Vehicles

Disp.	Eng. Code	Evap. Code	Model	Trans.	ETW	Axle	N/V

APPENDIX III

Determination of Acceptable Durability Test Schedule******

A manufacturer may determine mileage test intervals for durability-data vehicles subject to the conditions specified in 40 CFR 86.084-26 or 86.090-26. The following procedure shall be used to determine if the schedule is acceptable to the Executive Officer.

1. Select exhaust system mileage test points and maintenance mileage test points for proposed (prop) schedule.

2. Calculate the sums of the squares corrected to the mean of the system mileages at the proposed test points:

$$A_{prop} = [\Sigma(X_p)^2 - ((\Sigma X_p)^2 / N_p)]_{prop}$$

Where:

X_p = Individual mileages at which the vehicle will be tested.
N_p = Total number of tests (including before and after maintenance tests). (Subscript "p" refers to proposed test schedule).

3. Determine exhaust system mileage test points and maintenance mileage test points based on testing at five thousand mile intervals from 5,000 miles through the final testing point and maintenance mileage test points selected for the proposed schedule in section 1. This schedule will be designated as the standard(std) test schedule.

4. Calculate the sums of squares corrected to the mean of the standard schedule.

$$B_{std} = [\Sigma(X_s)^2 - ((\Sigma X_s)^2 / N)]_{std}$$

Where:

X_s = Individual mileages at which the vehicle will be tested.
N_s = Total number of tests (including before and after maintenance). (Subscript "s" refers to standard test schedule).

****** For diesel vehicles equipped with periodically regenerating trap oxidizer systems (or those with continuously regenerating trap oxidizer systems elected to be certified to the provisions of diesel vehicles with periodically regenerating trap oxidizer systems), additional test schedule requirements for regeneration tests must be met as outlined in subparagraphs 6.a.4.(B) and 6.b.7.(D) in these procedures.

5. Refer to Table I and determine t_p at $(N_p - 2)_{prop}$ degrees of freedom and t_s at $(N_s - 2)_{std}$.

If $(A_{prop})^{½} \geq t_p / t_s \times (B_{std})^{½}$ the proposed plan is acceptable.

Table I

Degrees of freedom N-2	t
1	6.314
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860
9	1.833
10	1.812
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753
16	1.746
17	1.740
18	1.734
19	1.729
20	1.725
21	1.721
22	1.717
23	1.714
24	1.711
25	1.708

APPENDIX IV

Procedure for Determining An Acceptable Exhaust Regeneration Durability-Data Test Schedule for Diesel Cycle Vehicles, Equipped with Periodically Regenerating Traps Oxidizer Systems

1. Select exhaust system mileage test points for proposed (prop) schedule.

2. Calculate the sums of the squares corrected to the mean of the system mileages at the proposed test points:

$$A_{prop} = [\Sigma(X_p)^2 - ((\Sigma X_p)^2 / N_p)]_{prop}$$

Where:

X_p = Individual mileages at which the vehicle will be tested.
N_p = Total number of tests (including before and after maintenance tests).
(Subscript "p" refers to proposed test schedule).

3. The exhaust system mileage tests points at 5,000, 20,000, 35,000 and 50,000 miles will be designated as the standard (std) test schedule.

4. Calculate the sums of square corrected to the mean of the standard tests schedule.

$$B_{std} = [\Sigma(X_s)^2 - ((\Sigma X_s)^2 / N_s)]_{std}$$

Where:

X_s = Individual mileages at which the vehicle will be tested.
N_s = Total number of regeneration emission tests.
(Subscript "s" refers to standard test schedule)

5. Refer to Table I and determine t_p at $(N_p - 2)_{prop}$ degrees of freedom and t_s at $(N_s - 2)_{std}$ degrees of freedom.

If $(A_{prop})^{1/2} \geq t_p / t_s \times (B_{std})^{1/2}$ the proposed plan is acceptable.

Table I

Degrees of freedom N-2	t
1	6.314
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860
9	1.833
10	1.812
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753

APPENDIX V

Pollutant Mass Emissions Calculation Procedure for Gaseous-Fueled Vehicles and for Vehicles Equipped with Periodically Regenerating Trap Oxidizer Systems*

I. Gaseous-Fueled Vehicle Pollutant Mass Emission Calculation Procedure

For 1988 through 1990 model-year gaseous-fueled vehicles. these calculation procedures are to be used in lieu of those in subparagraph 86.144-78, and 86.144-90 Part 86, Title 40, Code of Federal Regulations (CFR) when calculating the mass emissions from vehicles fueled with either liquefied petroleum gas or compressed natural gas. This calculation procedure is based on the "Positive Displacement Pump- Constant Volume Sampler (PDP-CVS)" exhaust sampling system. For 1991 and subsequent model-year gaseous-fueled vehicles, the calculation procedures specified in "California Non-Methane Hydrocarbon Test Procedures" shall apply to all vehicles certified to the emission standards of section 3.b., 3.e, and 3.f. of these test procedures. For all TLEVs, LEVs, and ULEVs, the calculation procedures specified in "California Non-Methane Organic Gas Test Procedures" shall apply.

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

CO_{conc} = Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO_2 extraction in ppm.

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

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

CO_e = Carbon monoxide concentrations of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in ppm. The calculation assumes the carbon to hydrogen ratio of the fuel to be 1:3.802 for natural gas and 1:2.658 for LPG.

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

CO_{mass} = Carbon monoxide emissions, in grams per test phase.

$CO_{2_{conc}}$ = Carbon dioxide concentration of the dilute exhaust sample corrected for background and water vapor, in percent.

CO_{2e} = Carbon dioxide concentration of the dilute exhaust sample, in percent.

$CO_{2\ mass}$ = Carbon dioxide emissions, in grams per test phase.

CO_{dens} = Density of carbon monoxide is 32.97 g/ft^3 at 68° F and 760 mm Hg pressure.

$CO_{2\ dens}$ = Density of carbon dioxide is 51.81 g/ft^3 at 68° F and 760 mm Hg pressure.

HC_{dens} = Density of hydrocarbons is 18.64 g/ft^3 for natural gas and 17.28 g/ft^3 for LPG assuming an average carbon to hydrogen ratio of 1:3.802 for natural gas and 1:2.658 for LPG, at 68° F and 760 mm Hg pressure.

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* These calculation procedures are based on the Federal CVS-1975 Test Procedure.

$NO_{2\,dens}$ = Density of oxides of nitrogen is 54.16 9/ft^3 assuming they are in the form of nitrogen dioxide, at 68° F and 760 mm Hg pressure.

DF = Dilution Factor

H = Absolute humidity in grains of water per pound of dry air.

HC_{conc} = Hydrocarbon concentration for the dilute exhaust sample corrected for background, in ppm carbon equivalent, i.e. equivalent propane X 3.

HC_d = Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent.

HC_e = Hydrocarbon concentration of the dilute exhaust sample, in ppm carbon equivalent.

HC_{mass} = Hydrocarbon emissions, in grams per test phase.

K_H = Humidity correction factor

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

NOx_{conc} = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm.

NOx_d = Oxides of nitrogen concentration of the dilute air as measured, in ppm.

NOx_e = Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.

NOx_{mass} = Oxides of nitrogen emissions, in grams per test phase.

P_B = Barometric pressure, in mm Hg.

P_d = Saturated vapor pressure, in mm. Hg at ambient dry bulb temp.

P_i = Pressure depression below atmospheric measured at the inlet to the positive displacement pump.

T_p = Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected, in degrees Rankine.

R_a = Relative humidity of the ambient air, in percent.

VMIX = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528° R and 760 mm Hg).

V_o = Volume of gas pumped by the positive displacement pump, in cubic feet per revolution. This volume is dependent on the pressure differential across the positive displacement pump.

Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_{ht} = Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.

Y_s = Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams test phase.

Y_{wm} = Weighted mass emissions of each pollutant, i.e., HC, CO, or NOx, in grams per vehicle mile.

D_{ct} = The measured driving distance from the "transient" phase of the cold start test, in miles.

D_{ht} = The measured distance from the "transient" phase of the hot start test, in miles.

D_s = The measured driving distance from the "stabilized" phase of the cold start test, in miles.

For passenger cars, light duty trucks, and medium duty vehicles:

(a) The mass emissions of each pollutant in grams per mile is:

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

(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:

$$HC_{mass} = VMIX \times HC_{dens} \times (HC_{conc} / 1{,}000{,}000)$$

(2) Oxides of nitrogen mass:

$$NOx_{mass} = VMIX \times NO_{2\,dens} \times K_H \times (NOx_{conc} / 1{,}000{,}000)$$

2

K_H = humidity correction factor

(3) Carbon monoxide mass:

$$CO_{mass} = VMIX \times CO_{dens} \times (CO_{conc} / 1{,}000{,}000)$$

(4) Carbon dioxide mass:

$$CO_{2\,mass} = VMIX \times CO_{2\,dens} \times (CO_{2\,conc} / 100)$$

$$VMIX = \frac{V_o \times N \times (P_B - P_i) \times 528}{(760)(T_p)}$$

HC_{conc} = $HC_e - HC_d$ (1-1/DF)

NOx_{conc} = $NOx_e - NOx_d$ (1-1/DF)

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

CO_e = (1-0.02901 $CO_{2\,e}$ - 0.000323 R_a) CO_{em} for natural gas

CO_e = (1-0.02328 CO_{2e} - 0.000323 R_a) CO_{em} for LPG

CO_d = (1-0.000323 R_a) CO_{dm}

K_H = 1 / [1-0.-0047(H-75)]

H = (43.478R)(P_d) / P_B - [(P_d x R_a) / 1]

DF = 9.77 / [$CO_{2\,e}$ + (HC_e + CO_e) x 10-4] for natural gas

DF = 11.7 / [$CO_{2\,e}$ + (HC_e + CO_e) x 10-4] for LPG

II. Pollutant Mass Emissions Calculation Procedure for Vehicles Equipped with Periodically Regenerating Trap Oxidizer Systems

Exhaust Emissions

Amend subparagraph 86.144-88(a) in Part 86, Title 40, Code of Federal Regulations (CFR) to read:

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

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

$$Y_{wm} = 0.43\ ((Yct + Ys)/(Dct + Ds)) + 0.57\ ((Yht + Ys)/(Dht + Ds))$$

For purposes of adjusting emissions for regeneration:

$$Re = ((Yr1 - Yct) + (Yr2 - Ys) + (Yr3 - Yht))/(Dct + Ds + Dht)$$

$$Yr = Ywm^{**} + Re$$

Where:

Ywm**	=	Weighted mass emissions of each pollutant, i.e., HC, CO, NOx or CO , in grams per vehicle mile.
Yct	=	Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.
Yht	=	Mass emissions as calculated from the "transient" phase of the hot start test in grams per test phase.
Ys	=	Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.
Dct	=	The measured driving distance from the "transient" phase of the cold start test, in miles.
Dht	=	The measured distance from the "transient" phase of the hot start test, in miles.
Ds	=	The measured driving distance from the "stabilized" phase of the cold start test, in miles.
Yr	=	Regeneration emission test.
Re	=	Mass emissions of each pollutant attributable to regeneration in grams per mile.
Yr1	=	Mass emissions, during a regeneration emission test, as calculated from the "transient" phase of the cold start test, in grams per test phase.
Yr2	=	Mass emissions, during a regeneration emission test, as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

** Ywm is derived using the emission data from a test with no regeneration.

Yr3 = Mass emissions, during a regeneration emission test, as calculated from the "transient" phase of the hot start test in grams per test phase.

Particulate Emissions

Amend subparagraph 86.145-82(a) in Part 86, Title 40, Code of Federal Regulations (CFR) to read:

(a) The final reported test results for the mass particulate (Mp) in grams/mile shall be computed as follows.

For purposes of adjusting emissions for regeneration:

$$Mp = 0.43(Mp1 + Mp2)/(Dct + Ds) + 0.57 (Mp3 + Mp2/(Dht + Ds)$$

$$Re = ((Mpr1 - Mp1) + (Mpr2 - Mp2) + (Mpr3 - Mp3))/(Dct+Ds+Dht)$$

$$Mpr = Mp^{***} + Re$$

Where:

(1) Mp1 = Mass of particulate determined from the "transient" phase of the cold start test, in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)
(2) Mp2 = Mass of particulate determined from the "stabilized" phase of the cold start test, in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)
(3) Mp3 = Mass of particulate determined from the "transient" phase of the hot start test, in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)
(4) Dct = The measured driving distance from the "transient" phase of the cold start test, in miles.
(5) Ds = The measured driving distance from the "stabilized" phase of the cold start test, in miles.
(6) Dht = The measured driving distance from the "transient" phase of the hot start test, in miles.
(7) Mpr = Regeneration emission test
(8) Re = Mass of particulate attributable to regeneration in grams/mile.
(9) Mpr1 = Mass of particulate determined, during a regeneration emission test, from the "transient" phase of the cold start test in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)
(10) Mpr2 = Mass of particulate determined, during a regeneration emission test, from "stabilized" phase of the cold start test, in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)

*** Mp is derived using the emission data from a test with no regeneration.

(11) Mpr3 = Mass of particulate determined, during a regeneration emission test, from the "transient" phase of the hot start test, in grams per test phase. (See 86.110-82(c)(1) and 86.110-88(d)(1) for determination.)

III. Fuel Economy Calculations for Gaseous Fuels Based on the Cold Start CVS-1975 Federal Test Procedure

Assume the fuel meets HD-5 specifications (95% C_3H_8 , 5% nC_4H_{10} , by volume)

1. Physical constants of Propane and Normal Butane

Component	Mol.Wt.	SP.Gr.	Liquid Density lb/gal @ 60°F		Liquid Density of HD-5 lb/gal @ 60°F
C_3H_8	44.094	0.508	4.235 x (0.95)	=	4.0233
nC_4H_{10}	58.12	0.584	4.868 x (0.95)	=	.2434
					4.2667

2. Density of the HD-5 fuel

(0.95 X 4.235) + (0.05 X 4.868) = 4.267 lb/gal @ 60°F

3. Molecular Weights

Species	Mol. Wt.
C	12.01115
H	1.00797
0	15.9994
CO	28.01055
CO_2	44.00995
$CH_{2.658}$*	14.6903

* Average ratio of Hydrogen to carbon atoms in HD-5 fuel.

C_3H_8	8/3	=	2.666 x 0.95 (% propane)	=	2.533
nC_4H_{10}	10/4	=	2.5 x 0.05 (% Butane)	=	0.125
					2.658

4. Weight of Carbon in:

CO = wt. of CO x (12.01115/28.01055) = wt CO x (0.429)

CO_2 = wt. of CO_2 x (12.01115/44.00995) wt CO_2 x (0.273)

$CH_{2.658}$ = wt. of $CH_{2.658}$ x (12.01115/14.6903) = wt $CH_{2.658}$ x (0.818)

5. Wt. of Carbon per gallon of LPG

wt. of carbon = 4.2667 lbs/gal x 453.59 gms/lb x 0.818
= 1583 grams C/gal HD-5

6. Fuel economy:

$$\frac{\text{grams C/gal}}{\text{grams C in exhaust/mi}} = \text{miles/gal.}$$

$$\text{LPG} = \frac{1583 \text{ gms C/gal}}{0.818)(\text{HC}) + (0.429)(\text{CO}) + (0.273)(\text{CO}_2)}$$

HC = CVS HC in grams/mile
CO = CVS CO in grams/mile
CO_2 = CVS CO_2 in grams/mile

For gasoline: = $2421 / (0.866)(\text{HC}) + (0.429)(\text{CO}) + (0.273)(\text{CO}_2)$
For Natural Gas: = $1535 / (0.759)(\text{HC}) + (0.429)(\text{CO}) + (0.273)(\text{CO}_2)$

APPENDIX VI

Blanket Approval of Running Changes and Field Fixes

Running changes and field fixes meeting the following definitions shall be granted automatic or "blanket" approval by the Executive Officer provided that notification of changes listed in paragraph 1. below are received by the ARB at least five working days before implementation, and notification of changes listed in 2. through 13. below are received by the ARB within two working days after implementation. Such automatic approvals shall be effective when they are approved by EPA.

For passenger cars, light-duty trucks and medium-duty vehicles:

1. The addition of new models to an engine family where the new models differ from previously certified models only in model name and curb weight (same inertia weight class), and where the exhaust, evaporative and fill pipe emission control system specifications do not change.

2. Changes in axle ratio, tire size or tire type, providing that changes to the N/V ratio and/or load horsepower are within 5% of the originally certified values. This includes re-classification of base and optional axle ratios or tires.

3. The deletion of models or vehicle configurations.

4. Changes in fuel tank capacity of less than 10 percent of the originally certified capacity, providing there is no other modification of the evaporative emission control system.

5. Changes to the fuel filler system leaded fuel nozzle restrictor, where EPA preemption is involved.

6. Advance certification of models in the next higher inertia weight class, for use if needed later.

7. Changes in tailpipe length of less than ten inches.

8. The following changes involving spark plugs:

    a. The addition of resistor-type spark plugs if nonresistor spark plugs are standard, or vice-versa, providing the secondary circuit resistance changes less than 5 percent.

    b. The addition of alternate heat ranges within one range of the originally certified spark plugs.

c. The change of spark plug gap within 15 percent of originally certified spark plug gap.

9. Changes to component part numbers when there are no changes in the materials used or to the performance specifications (e.g. distributor advance curves, carburetor flow curves, fuel pump supply pressure, etc.). These changes may be the result of parts consolidation, changes in supplier, addition/deletion of peripheral items such as brackets, and minor dimensional changes where the durability and performance are not affected.

10. Changes in the crankcase emission control system where EPA preemption is involved, excluding revisions that could have an interaction effect on exhaust emissions (e.g., PCV purge flow changes).

11. Changes submitted under the alternate or concurrent notification procedure in 40 CFR 86 which would otherwise qualify for automatic or "blanket" status.

12. Changes in the physical location of a vacuum hose connection with no change in the relationship between vacuum, speed, load, or any other vacuum-related parameter, provided that the changes do not render the vacuum hose routing diagram unrepresentative.

13. Changes in exhaust system cross sectional area, if this area equals or exceeds the minimum area in the system.

Calculation of t-Statistic for Deterioration Data Outlier Test

Residual normal deviates to indicate outliers are used routinely and usefully in analyzing regression data, but suffer theoretical deficiencies if statistical significance tests are required. Consequently, the procedure for testing for outliers outlined by Snedecor and Cochran, 6th ed., Statistical Methods, pp. 157-158, will be used. The method will be described generally, then by appropriate formulae, and finally a numerical example will be given.

Linearity is assumed (as in the rest of the deterioration factor calculation procedure), and each contaminant is treated separately. The procedure is as follows:

Calculate the deterioration factor regression as usual, and determine the largest residual in absolute value. Then recalculate the regression with the suspected outlier omitted. From the new regression line calculate the residual at the deleted point, denoted as $(y_i - y_i')$. Obtain a statistic by dividing $(y_i - y_i')$ by the square root of the estimated variance of $(y_i - y_i')$. Find the tailed probability, p, from the t-distribution corresponding to the quotient (double-tailed), with n-3 degrees of freedom, with n the original sample size.

This probability, p, assumes the suspected outlier is randomly selected, which is not true. Therefore, the outlier will be rejected only if $1 - (1-p)^n \leq .05$.

The procedure will be repeated for each contaminant individually until the above procedure indicates no outliers are present.

When an outlier is found, the vehicle test-log will be examined. If an unusual vehicle malfunction is indicated, data for all contaminants at that test-point will be rejected; otherwise, only the identified outlier will be omitted in calculating the deterioration factor.

Procedure for the calculation of the t-Statistic for Deterioration Data Outlier Test.

Given a set of n points, $(x_1, y_1), (x_2, y_2) \ldots (x_n, y_n)$.

where

x_i is the mileage of the i^{th} data point.
y_i is the emission of the i^{th} data point.

Assume model:

$$y = \alpha + \beta(x - \bar{x}) + \epsilon$$

I.

i) Calculate the regression line,

$$\hat{y} = a + b\,(x - \bar{x})$$

ii) Suppose the absolute value of the i^{th} residual $(y_i - \hat{y}_i)$ is the largest.

II.

i) Calculate the regression line with the i^{th} point deleted.

$$\hat{y}' = a' + b'\,(x - \bar{x})$$

ii) Let $t = (y_i - \hat{y}_i')\Big/\sqrt{\hat{var}\,(y_i - \hat{y}_i')}$

where y_i is the observed suspected outlier.

$\hat{y}_i'$ is the predicted value with the suspected outlier deleted.

$$\hat{var}\,(y_i - \hat{y}_i') = S^2\left(1 + \frac{1}{n-1} + \frac{(x_i - \bar{x})^2}{\sum\limits_{\substack{j=1 \\ j\neq i}} (x_j - \bar{x})^2}\right)$$

(x is calculated without the suspected outlier)

$$S^2 = \sum_{\substack{j=1 \\ j\neq i}}^{n} (y_j - \hat{y}_j')^2 / n-3$$

iii) Find p from the t-statistic table

where

$$p = \text{prob}(\,|t(n-3)| \geq t)$$

t(n-3) is a t-distributed variable with n-3 degrees of freedom.

iv) y_i is an outlier if $1-(1-p)^n < .05$

Example:

	x	y	$\hat{y}$	$y-\hat{y}$
	8	59	56.14	2.86
	6	58	58.17	-0.17
	11	56	53.10	2.90
*	22	53	41.96	11.04
	14	50	50.06	-0.06
	17	45	47.03	-2.03
	18	43	46.01	-3.01
	24	42	39.94	2.06
	19	39	45.00	-6.00
	23	38	40.95	-2.95
	26	30	37.91	-7.91
	40	27	23.73	3.27

Assume model:

$$y = \alpha + \beta(x - \bar{x}) + \epsilon$$

$$\hat{y} = 45 - 1.013\ (x - \bar{x})$$

* Suspected outlier

Suspected point out of regression:

$$\hat{y}' = 44.273 - 1.053\ (x - \bar{x})$$

$$\hat{y}_i' = 44.273 - 1.053\ (22 - 18.727) = 40.827$$

$$y_i - \hat{y}_i' = 12.173$$

$$\hat{var}(y_i - \hat{y}_i') = S^2 \left(1 + \frac{1}{11} + \frac{10.711}{914.182}\right)$$

APPENDIX VIII

Procedure for Determining Vehicle Emission Control Technology Category/Fuel Reactivity Adjustment Factors

The following procedure shall be used by the Executive Officer to establish the reactivity adjustment factor for exhaust emissions of non-methane organic gases (NMOG) and establish the "methane reactivity adjustment factor" for exhaust methane emissions from natural gas vehicles, for the purpose of certifying a vehicle of specific emission control technology category and fuel for sale in California. The NMOG emission results from Transitional Low-Emission Vehicles (TLEVs), Low-Emission Vehicles (LEVs), and Ultra-Low-Emission Vehicles (ULEVs) designed to operate on any available fuel other than conventional gasoline, including fuel-flexible and dual-fuel vehicles when operating on any available fuel other than conventional gasoline, shall be numerically-adjusted to establish a NMOG exhaust mass emission value equivalent, in terms of ozone-forming potential, to the NMOG exhaust mass emissions from conventional gasoline-fueled vehicles of the same vehicle emission control technology category.

(1) The Executive Officer shall determine representative speciated NMOG exhaust emission profiles for light- and medium-duty conventional gasoline-fueled TLEVs, LEVs, and ULEVs according to the following conditions.

a. All testing will be conducted using a specified gasoline blend representative of commercial gasoline and having the specifications listed in (9).

b. Speciated NMOG profiles shall be obtained from a statistically valid number of TLEVs, LEVs, and ULEVs.

c. The speciated NMOG profiles shall identify and quantify, in units of g/mile or mg/mile, as many constituents as possible in accordance with the procedures specified in "California Non-Methane Organic Gas Test Procedures."

(2) The "g ozone potential per mile" of each NMOG identified in the speciated profile shall be determined by multiplying the "g/mile NMOG" emission value of the constituent NMOG by its maximum incremental reactivity given in (10).

(3) The "total g ozone potential per mile" of NMOG exhaust emissions from the vehicle/fuel system shall be the sum of all the constituent NMOG "g ozone potential per mile" values calculated in step (2).

(4) The "g ozone potential per g NMOG" for the vehicle/fuel system shall be determined by dividing the "total g ozone potential per mile" value calculated in step (3) by the "total g/mile of NMOG emissions".

(5) For light- and medium-duty candidate vehicle/fuel systems not powered by conventional gasoline, the Executive Officer shall establish "reactivity adjustment factors" calculated from exhaust emission profiles derived according to the same conditions specified in parts b and c of step (1).

(6) The "g ozone potential per g NMOG" for candidate vehicle/fuel systems not powered by conventional gasoline shall be determined according to steps (2), (3), and (4).

(7) a. The candidate vehicle/fuel "reactivity adjustment factor" shall be determined by dividing the "g ozone potential per g NMOG" calculated in step (6) by the "g ozone potential per g NMOG" value for the vehicle in the same emission control technology category operated on conventional gasoline. The "g ozone potential per g NMOG" values for conventional gasoline vehicles are listed in Section 13.d. of these test procedures or shall be established by the Executive Officer pursuant to Appendix VIII of these test procedures. For candidate vehicle/fuel systems powered by methanol or liquified petroleum gas, the quotient calculated above shall be multiplied by 1.1. The resulting value shall constitute the "reactivity adjustment factor" for the methanol or liquified petroleum gas-powered vehicle/fuel system.

b. For candidate vehicle/fuel systems operating on natural gas, a "methane reactivity adjustment factor" shall be calculated by dividing the maximum incremental reactivity value for methane given in (10) by the "g ozone potential per g NMOG" value for the vehicle in the same emission control technology category operated on conventional gasoline as listed in Section 13.d. of these test procedures or established by the Executive Officer pursuant to Appendix VIII of these test procedures.

(8) The Executive Officer shall assign a reactivity adjustment factor unique to a specific engine family at the request of a vehicle manufacturer provided that each of the following occurs:

a. The manufacturer submits speciated NMOG exhaust emission profiles to the Executive Officer obtained from emission testing a minimum of four different vehicles representative of vehicles that will be certified in the engine family. The test vehicles shall include the official emission-data vehicle(s) for the engine family, and the mileage accumulation of each vehicle shall be at or greater than 4000 miles. One speciated profile shall be submitted for each test vehicle. Emission levels of each constituent NMOG shall be measured according to the "California Non-Methane Organic Gas Test Procedures," ~~as adopted July 12, 1991~~. For the emission-data vehicle(s), the speciated profile(s) shall be obtained from the same test used to obtain the official exhaust emission test results for the emission-data vehicle at the 4,000 mile test point. The manufacturer shall calculate "g ozone potential per g NMOG" values for each speciated NMOG exhaust emission profile in accordance with the procedures specified in steps (2), (3), and (4) above. By using these "g ozone potential per g NMOG" values, the manufacturer shall calculate a "reactivity adjustment factor" for each test vehicle in accordance with the procedure specified in step (7) above. A "reactivity adjustment

factor" for the engine family shall be calculated by taking the arithmetic mean of the "reactivity adjustment factor"' obtained for each test vehicle. The 95 percent upper confidence bound (95% UCB) shall be calculated according to the equation:

$$95\%\ UCB = RAF + 1.96 \times \left[\sum_{i=1}^{n} (RAF_i - RAF_m)^2 / (n-1) \right]^{1/2}$$

where:

RAF_m = mean "reactivity adjustment factor" calculated for the engine family
RAF_i = "reactivity adjustment factor" calculated for the i'th test vehicle
n = number of test vehicles

The 95 percent upper confidence bound of the "reactivity adjustment factor" for the engine family shall be less than or equal to 115 percent of the engine family "reactivity adjustment factor."

b. The manufacturer submits an "ozone deterioration factor" for the engine family. To determine the "ozone deterioration factor," the manufacturer shall perform two tests at each mileage interval for one or more durability vehicle(s) tested in accordance with the procedures and conditions specified in Sections 6 and 10 of these California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles for calculating mass deterioration factors. The Executive Officer shall approve the use of other mileage intervals and procedures if the manufacturer can demonstrate that equivalently representative "ozone deterioration factors" are obtained. One speciated profile shall be submitted for each test.Emission levels of each constituent NMOG shall be measured according to the "California Non-Methane Organic Gas Test Procedures. ~~as adopted July 12, 1991~~ A mean g/mi NMOG mass value and a mean "g ozone per g NMOG" value shall be calculated by taking the arithmetic mean of each measurement from the speciated profiles. These results shall be multiplied together to obtain a mean "total g ozone potential per mile" value at each mileage interval. A mean "ozone deterioration factor" shall be calculated in accordance with the procedures in Sections 6, 10, and Appendix VIII of these California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles except that the mean total "g ozone potential per mile" value determined at each mileage interval shall be used in place of measured mass emissions. If the "ozone deterioration factor" is determined to be less than 1.00, the "ozone deterioration factor" shall be assigned a value of 1.00.The "ozone deterioration factor" shall be multiplied by the product of the official exhaust NMOG mass emission results at the 4000 mile test point and the mean "reactivity adjustment factor" for the engine family to obtain the NMOG certification levels used to determine compliance with the NMOG emission standards.

c. The speciated profiles, mean "reactivity adjustment factor" for the engine family, and "ozone deterioration factor" are provided to the Executive Officer with the certification application for the engine family.

(9) Gasoline meeting the specifications listed below shall be used to determine the "g ozone potential per g NMOG" of conventional gasoline:

Fuel Property	Limit
Sulfur, ppm by weight	300 ± 50
Benzene, volume percent	1.6 ± 0.3
Reid vapor pressure, psi	8.7 ± 0.3
Distillation, D-86 degrees F	
10%	115-135
50%, maximum	240
90%	323-333
EP, maximum	420
Hydrocarbon Type, volume percent	
Total Aromatics	32 ± 3.0
Multi-substituted alkyl aromatics	21 ± 3.0
Olefins	12 ± 3.0
Saturates	remainder

(The test methods used for each fuel property shall be the same as the test method for the identical fuel property listed in section 9.a.(1) of these test procedures.)

(10) The maximum incremental reactivities to be used in step (2) are provided in the table below. Any manufacturer which intends to use the table shall submit to the Executive Officer a list which provides the specific organic gases measured by the manufacturer and the maximum incremental reactivity value assigned to each organic gas prior to or with the submittal of a request for the use of a reactivity adjustment factor unique to a specific engine family. The Executive Officer may deny such requests if he or she determines that the maximum incremental reactivity value assignments are made incorrectly.

Maximum Incremental Reactivity (MIR) Values
(Units: grams ozone/gram organic gas)

Organic Gas Name	MIR
Methane	0.0148
Ethane	0.25
Propane	0.48
n-Butane	1.02
n-Pentane	1.04
n-Hexane	0.98
n-Heptane	0.81
n-Octane	0.61
n-Nonane	0.54
n-Decane	0.47
n-Undecane	0.42
n-Dodecane	0.38
n-Tridecane	0.35
n-Tetradecane	0.32
n-Pentadecane	0.29
2-Methylpropane	1.21
2-Methylbutane	1.38
2,2-Dimethylpropane	0.37
Branched C5 Alkanes	1.38
2-Methylpentane	1.53
3-Methylpentane	1.52
2,2-Dimethylbutane	0.82
2,3-Dimethylbutane	1.07
Branched C6 Alkanes	1.53
2-Methylhexane	1.08
3-Methylhexane	1.40
2,3-Dimethylpentane	1.51
2,4-Dimethylpentane	1.78
3,3-Dimethylpentane	0.71
2,2,3-Trimethylbutane	1.32
Branched C7 Alkanes	1.40
2-Methylheptane	0.96
3-Methylheptane	0.99
4-Methylheptane	1.20
2,3-Dimethylhexane	1.32
2,4-Dimethylhexane	1.50
2,5-Dimethylhexane	1.63
2,2,4-Trimethylpentane	0.93
2,3,4-Trimethylpentane	1.60

Branched C8 Alkanes	1.20
4-Ethylheptane	1.14
2,4-Dimethylheptane	1.34
2,2,5-Trimethylhexane	0.97
Branched C9 Alkanes	1.14
4-Propylheptane	1.01
Branched C10 Alkanes	1.01
Branched C11 Alkanes	1.17
Branched C12 Alkanes	1.23
Branched C13 Alkanes	0.96
Branched C14 Alkanes	0.76
Branched C15 Alkanes	0.70
Cyclopentane	2.38
Cyclohexane	1.28
Methylcyclopentane	2.82
C6 Cycloalkanes	1.28
Methylcyclohexane	1.85
Ethylcyclopentane	2.31
1,3-Dimethylcyclopentane	2.55
C7 Cycloalkanes	1.85
Ethylcyclohexane	1.94
C8 Cycloalkanes	1.94
C9 Cycloalkanes	2.30
C10 Cycloalkanes	1.78
C11 Cycloalkanes	1.91
C12 Cycloalkanes	1.68
C13 Cycloalkanes	1.42
C14 Cycloalkanes	1.22
C15 Cycloalkanes	1.07
Ethene	7.29
Propene	9.40
1-Butene	8.91
2-Methylpropene	5.31
1-Pentene	6.22
2-Methyl-1-Butene	4.90
3-Methyl-1-Butene	6.22
1-Hexene	4.42
C6 Terminal Alkenes	4.42
C7 Terminal Alkenes	3.48
C8 Terminal Alkenes	2.69
C9 Terminal Alkenes	2.23
C10 Terminal Alkenes	1.91
C11 Terminal Alkenes	1.67
C12 Terminal Alkenes	1.52
C13 Terminal Alkenes	1.36

cis-2-Butene	9.94
trans-2-Butene	9.94
2-Methyl-2-Butene	6.41
C5 Internal Alkenes	8.80
C6 Internal Alkenes	6.69
C7 Internal Alkenes	5.53
C8 Internal Alkenes	5.29
C9 Internal Alkenes	4.58
C10 Internal Alkenes	4.05
C11 Internal Alkenes	3.63
C12 Internal Alkenes	3.32
C13 Internal Alkenes	3.03
1,3-Butadiene	10.89
2-Methyl-1,3-Butadiene	9.08
Cyclopentene	7.66
Cyclohexene	5.67
a-Pinene	3.28
b-Pinene	4.41
Ethyne	0.50
Propyne	4.10
1-Butyne	9.24
Benzene	0.42
Toluene	2.73
Ethylbenzene	2.70
n-Propylbenzene	2.12
Isopropylbenzene	2.24
s-Butylbenzene	1.89
C10 Monoalkyl Benzenes	1.87
C11 Monoalkyl Benzenes	1.70
C12 Monoalkyl Benzenes	1.55
m-Xylene	8.16
o-Xylene	6.46
p-Xylene	6.60
C9 Dialkyl Benzenes	7.20
C10 Dialkyl Benzenes	6.45
C11 Dialkyl Benzenes	5.84
C12 Dialkyl Benzenes	5.34
1,2,3-Trimethylbenzene	8.85
1,2,4-Trimethylbenzene	8.83
1,3,5-Trimethylbenzene	10.12
C10 Trialkyl Benzenes	9.07
C11 Trialkyl Benzenes	8.21
C12 Trialkyl Benzenes	7.50
C10 Tetraalkyl Benzenes	9.07
Styrene	2.22

	~~Indan~~	~~1.06~~
	~~Tetralin~~	~~0.95~~
	~~Naphthalene~~	~~1.18~~
	~~Methyl Naphthalenes~~	~~3.27~~
	~~2,3-Dimethylnaphthalene~~	~~5.13~~
	~~Phenol~~	~~1.13~~
	~~Cresols~~	~~2.31~~
	~~Methanol~~	~~0.56~~
	~~Ethanol~~	~~1.34~~
	~~n-Propyl Alcohol~~	~~2.26~~
	~~Isopropyl Alcohol~~	~~0.54~~
	~~n-Butyl Alcohol~~	~~2.69~~
	~~Isobutyl Alcohol~~	~~1.92~~
	~~t-Butyl Alcohol~~	~~0.42~~
	~~Formaldehyde~~	~~7.15~~
	~~Acetaldehyde~~	~~5.52~~
	~~Propionaldehyde~~	~~6.53~~
	~~C4 Aldehydes~~	~~5.26~~
	~~C5 Aldehydes~~	~~4.41~~
	~~C6 Aldehydes~~	~~3.79~~
	~~C7 Aldehydes~~	~~3.32~~
	~~Crotonaldehyde~~	~~5.42~~
	~~Benzaldehyde~~	~~-0.55~~
	~~Methyl t-Butyl Ether~~	~~0.62~~
	~~Ethyl t-Butyl Ether~~	~~1.98~~
	~~Acetone~~	~~0.56~~
	~~C4 Ketones~~	~~1.18~~
	~~Acrolein~~	~~6.77~~

CAS #	COMPOUND	MIR
	Alcohols	
00067-56-1	methanol	0.56
00064-17-5	ethanol	1.34
	Light End and Mid-Range Hydrocarbons (Listed in approximate elution order)	
	methane	0.0148
00074-85-1	ethene	7.29
00074-86-2	ethyne	0.50
00074-84-0	ethane	0.25
00115-07-1	propene	9.40
00074-98-6	propane	0.48
00463-49-0	1,2-propadiene	10.89

CAS #	COMPOUND	MIR
00074-99-7	1-propyne	4.10
00075-28-5	methylpropane	1.21
00115-11-7	2-methylpropene	5.31
00106-98-9	1-butene	8.91
00106-99-0	1,3-butadiene	10.89
00106-97-8	n-butane	1.02
00624-64-6	trans-2-butene	9.94
00463-82-1	2,2-dimethylpropane	0.37
00107-00-6	1-butyne	9.24
00590-18-1	cis-2-butene	9.94
00563-45-1	3-methyl-1-butene	6.22
00078-78-4	2-methylbutane	1.38
00503-17-3	2-butyne	9.24
00109-67-1	1-pentene	6.22
00563-46-2	2-methyl-1-butene	4.90
00109-66-0	n-pentane	1.04
00078-79-5	2-methyl-1,3-butadiene	9.08
00646-04-8	trans-2-pentene	8.80
00558-37-2	3,3-dimethyl-1-butene	4.42
00627-20-3	cis-2-pentene	8.80
00689-97-4	1-buten-3-yne	9.24
00513-35-9	2-methyl-2-butene	6.41
00542-92-7	1,3-cyclopentadiene	7.66
00075-83-2	2,2-dimethylbutane	0.82
00142-29-0	cyclopentene	7.66
00691-37-2	4-methyl-1-pentene	4.42
00760-20-3	3-methyl-1-pentene	4.42
00287-92-3	cyclopentane	2.38
00079-29-8	2,3-dimethylbutane	1.07
01634-04-4	1-methyl-tert-butyl-ether	0.62
00691-38-3	4-methyl-cis-2-pentene	6.69
00107-83-5	2-methylpentane	1.53
00674-76-0	4-methyl-trans-2-pentene	6.69
00096-14-0	3-methylpentane	1.52
00763-29-1	2-methyl-1-pentene	4.42
00592-41-6	1-hexene	4.42
00110-54-3	n-hexane	0.98
13269-52-8	trans-3-hexene	6.69
07642-09-3	cis-3-hexene	6.69
04050-45-7	trans-2-hexene	6.69
00616-12-6	3-methyl-trans-2-pentene	6.69
00625-27-4	2-methyl-2-pentene	6.69
01120-62-3	3-methylcyclopentene	5.65

CAS #	COMPOUND	MIR
07688-21-3	cis-2-hexene	6.69
00637-92-3	1-ethyl-tert-butyl-ether	1.98
00922-62-3	3-methyl-cis-2-pentene	6.69
00590-35-2	2,2-dimethylpentane	1.40
00096-37-7	methylcyclopentane	2.82
00108-08-7	2,4-dimethylpentane	1.78
00464-06-2	2,2,3-trimethylbutane	1.32
07385-78-6	3,4-dimethyl-1-pentene	3.48
00693-89-0	1-methylcyclopentene	7.66
00071-43-2	benzene	0.42
03404-61-3	3-methyl-1-hexene	3.48
00562-49-2	3,3-dimethylpentane	0.71
00110-82-7	cyclohexane	1.28
00591-76-4	2-methylhexane	1.08
00565-59-3	2,3-dimethylpentane	1.51
00110-83-8	cyclohexene	5.67
00589-34-4	3-methylhexane	1.40
02532-58-3	cis-1,3-dimethylcyclopentane	2.55
00617-78-7	3-ethylpentane	1.40
00822-50-4	trans-1,2-dimethylcyclopentane	1.85
00592-76-7	1-heptene	3.48
00540-84-1	2,2,4-trimethylpentane	0.93
14686-14-7	trans-3-heptene	5.53
00142-82-5	n-heptane	0.81
02738-19-4	2-methyl-2-hexene	5.53
03899-36-3	3-methyl-trans-3-hexene	5.53
14686-13-6	trans-2-heptene	5.53
00816-79-5	3-ethyl-2-pentene	5.53
00107-39-1	2,4,4-trimethyl-1-pentene	2.69
10574-37-5	2,3-dimethyl-2-pentene	5.53
06443-92-1	cis-2-heptene	5.53
00108-87-2	methylcyclohexane	1.85
00590-73-8	2,2-dimethylhexane	1.20
00107-40-4	2,4,4-trimethyl-2-pentene	5.29
01640-89-7	ethylcyclopentane	2.31
00592-13-2	2,5-dimethylhexane	1.63
00589-43-5	2,4-dimethylhexane	1.50
00563-16-6	3,3-dimethylhexane	1.20
00565-75-3	2,3,4-trimethylpentane	1.60
00560-21-4	2,3,3-trimethylpentane	1.20
00108-88-3	toluene	2.73

CAS #	COMPOUND	MIR
00584-94-1	2,3-dimethylhexane	1.32
00592-27-8	2-methylheptane	0.96
00589-53-7	4-methylheptane	1.20
00589-81-1	3-methylheptane	0.99
15890-40-1	(1a,2a,3b)-1,2,3-trimethylcyclopentane	1.94
00638-04-0	cis-1,3-dimethylcyclohexane	1.94
02207-04-7	trans-1,4-dimethylcyclohexane	1.94
03522-94-9	2,2,5-trimethylhexane	0.97
00111-66-0	1-octene	2.69
14850-23-8	trans-4-octene	5.29
00111-65-9	n-octane	0.61
13389-42-9	trans-2-octene	5.29
02207-03-6	trans-1,3-dimethylcyclohexane	1.94
07642-04-8	cis-2-octene	5.29
01069-53-0	2,3,5-trimethylhexane	1.14
02213-23-2	2,4-dimethylheptane	1.34
02207-01-4	cis-1,2-dimethylcyclohexane	1.94
01678-91-7	ethylcyclohexane	1.94
00926-82-9	3,5-dimethylheptane	1.14
00100-41-4	ethylbenzene	2.70
03074-71-32	2,3-dimethylheptane	1.14
00108-38-3	m-&p-xylene	7.64
`02216-34-4	4-methyloctane	1.14
03221-61-2	2-methyloctane	1.14
02216-33-3	3-methyloctane	1.14
00100-42-5	styrene(ethenylbenzene)	2.22
00095-47-6	o-xylene	6.46
00124-11-8	1-nonene	2.23
00111-84-2	n-nonane	0.54
00098-82-8	(1-methylethyl)benzene	2.24
15869-87-1	2,2-dimethyloctane	1.01
04032-94-4	2,4-dimethyloctane	1.01
00103-65-1	n-propylbenzene	2.12
00620-14-4	1-methyl-3-ethylbenzene	7.20
00622-96-8	1-methyl-4-ethylbenzene	7.20
00108-67-8	1,3,5-trimethylbenzene	10.12
00611-14-3	1-methyl-2-ethylbenzene	7.20
00095-63-6	1,2,4-trimethylbenzene	8.83
00124-18-5	n-decane	0.47
00538-93-2	(2-methylpropyl)benzene	1.87
00135-98-8	(1-methylpropyl)benzene	1.89

CAS #	COMPOUND	MIR
00535-77-3	1-methyl-3-(1-methylethyl)benzene	6.45
00526-73-8	1,2,3-trimethylbenzene	8.85
00099-87-6	1-methyl-4-(1-methylethyl)benzene	6.45
00496-11-7	2,3-dihydroindene(indan)	1.06
00527-84-4	1-methyl-2-(1-methylethyl)benzene	6.45
00141-93-5	1,3-diethylbenzene	6.45
00105-05-5	1,4-diethylbenzene	6.45
01074-43-7	1-methyl-3-n-propylbenzene	6.45
01074-55-1	1-methyl-4-n-propylbenzene	6.45
00135-01-3	1,2-diethylbenzene	6.45
01074-17-5	1-methyl-2-n-propylbenzene	6.45
01758-88-9	1,4-dimethyl-2-ethylbenzene	9.07
00874-41-9	1,3-dimethyl-4-ethylbenzene	9.07
00934-80-5	1,2-dimethyl-4-ethylbenzene	9.07
02870-04-4	1,3-dimethyl-2-ethylbenzene	9.07
01120-21-4	n-undecane(hendecane)	0.42
00933-98-2	1,2-dimethyl-3-ethylbenzene	9.07
00095-93-2	1,2,4,5-tetramethylbenzene	9.07
03968-85-2	(2-methylbutyl)benzene	1.07
00527-53-7	1,2,3,5-tetramethylbenzene	9.07
01074-92-6	1-(1,1-dimethylethyl)-2-methylbenzene	5.84
00488-23-3	1,2,3,4-tetramethylbenzene	9.07
00538-68-1	n-pentylbenzene	1.70
00098-19-1	1-(1,1-dimethylethyl)-3,5-DMbenzene	7.50
00091-20-3	naphthalene	1.18
00112-40-3	n-dodecane	0.38

CAS #	COMPOUND	MIR
	Carbonyl Compounds	
00050-00-0	formaldehyde	7.15
00075-07-0	acetaldehyde	5.52
00107-02-8	acrolein	6.77
00067-64-1	acetone	0.56
00123-33-6	propionaldehyde	6.53
00123-72-8	butyraldehyde	5.26
00066-25-1	hexanaldehyde	3.79
00100-52-7	benzaldehyde	-0.55
00078-93-3	methyl ethyl ketone (2-butanone)	1.18
00078-85-3	methacrolein	6.77
04170-30-3	crotonaldehyde	5.42
00110-62-3	valeraldehyde	4.41
00620-23-5	m-tolualdehyde	-0.55