

California Environmental Protection Agency
AIR RESOURCES BOARD

**CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR
2001 AND SUBSEQUENT MODEL
PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES**

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NOTE: Amendments to this document that were originally proposed in this rulemaking are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as amended May 28, 2004. Modifications to the originally proposed language made available in connection with this "15-Day Notice" are shown in double underline to indicate additions and ~~double-strikeout~~ to indicate deletions.

NOTE: This document is incorporated by reference in sections 1960.1(k) and 1961(d), title 13, California Code of Regulations (CCR). It contains the majority of the requirements necessary for certification of a passenger car, light-duty truck or medium-duty vehicle for sale in California, in addition to containing the exhaust emission standards and test procedures for these motor vehicles. However, reference is made in these test procedures to other ARB documents that contain additional requirements necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

1. “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes” (incorporated by reference in section 1962, title 13, CCR);
2. “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1976(c), title 13, CCR);
3. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978(b), title 13, CCR);
4. OBD II (section 1968, et seq. title 13, CCR, as applicable);
5. “California Smog Index Label Specifications” (incorporated by reference in section 1965, title 13, CCR);
6. Warranty Requirements (sections 2037 and 2038, title 13, CCR);
7. “Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR);
8. Guidelines for Certification of Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by section 1960.5, title 13, CCR); and
9. “California Non-Methane Organic Gas Test Procedures,” (incorporated by reference in section 1961(d), title 13, CCR).

The section numbering conventions for this document are set forth in Part I, section A.3 on page A-2.

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**CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES
FOR 2001 AND SUBSEQUENT MODEL
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES**

The provisions of Subparts B, C, and S, Part 86, Title 40, Code of Federal Regulations, as adopted or amended on May 4, 1999 or as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, and to the extent they pertain to exhaust emission standards and test procedures, are hereby adopted as the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” with the following exceptions and additions.

**PART I: GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE
VERIFICATION OF EMISSIONS**

A. General Applicability

1. §86.1801 Applicability.

1.1 §86.1801-01. ~~October 6, 2000~~ December 6, 2002. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: Except as otherwise indicated, the provisions of this subpart apply to new 2001 and later model year Otto-cycle and diesel-cycle passenger cars, light-duty trucks and medium-duty vehicles, including alternative fuel and hybrid electric vehicles. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section or paragraph.

1.1.2 Subparagraph (b) *Aftermarket conversions*. [n/a]

1.1.3 Amend subparagraph (c) *Optional Applicability* as follows:

(a) Amend subparagraph (c)(1) as follows: A manufacturer must certify any heavy-duty complete Otto-cycle vehicle of 14,000 pounds Gross Vehicle Weight Rating (GVWR) or less in accordance with the medium-duty chassis-standards of Section E.1. of these test procedures. A manufacturer must certify all heavy-duty diesel engines or vehicles of 14,000 pounds GVWR or less to the medium-duty engine standards in title 13, CCR, section 1956.8(g) or (h). A manufacturer may request to certify heavy-duty complete diesel vehicles to the chassis-standards in Section E.1 of these test procedures. Heavy-duty engine or heavy-duty vehicle provisions of 40 CFR subpart A do not apply to such a vehicle or engine.

(b) Subparagraph (c)(2) [No change.]

(c) Subparagraph (c)(3) [No change.]

(d) Subparagraph (c)(4) [n/a]

(e) Subparagraph (c)(5) [n/a]

1.1.4 Amend subparagraph (d) as follows: Small volume manufacturers. Special certification procedures are available for any manufacturer whose projected or actual combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For manufacturers certifying for the first time in California, model-year production volume shall be based on projected California sales. The small-volume manufacturer's light- and medium-duty vehicle and truck certification procedures are described in 40 CFR §86.1838.

1.1.5 Subparagraph (e). [n/a; NLEVs.]

1.1.6 Subparagraph (f) [n/a; Tier 2 phase-in provisions]

1.1.7 Subparagraph (g) [n/a; Tier 2 phase-in provisions]

1.1.8 Subparagraph (h) [No change.]

2. California Provisions.

2.1 References to "light-duty trucks" in 40 CFR 86 shall apply to both "light-duty trucks" and "medium-duty vehicles" in these procedures. References to "light-duty vehicles" shall apply to "passenger cars" in these procedures. References to dual fuel vehicles shall also mean bi-fuel vehicles.

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

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

2.4 Regulations both herein and in Title 40, CFR Part 86, Subparts B, C, and S, concerning Otto-cycle and diesel-cycle vehicles shall be applicable to ethanol vehicles, including dual fuel, bi-fuel and fuel-flexible vehicles, except where specifically noted otherwise.

2.5 For engines used in medium-duty vehicles that 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.

2.6 Regulations concerning federal OBD system requirements shall mean the California OBD requirements, except where specifically noted otherwise.

3. §86.1802 Section Numbering; Construction.

3.1 §86.1802-01. [No change.]

3.2 The section numbering convention employed in these test procedures, in order of priority, is A.1.1.1. in order to distinguish California procedures and requirements from those of the U.S. EPA. References in these test procedures to specific sections of the Code of Federal Regulations maintain the same numbering system employed in the Code of Federal Regulations.

3.3 In cases where the entire CFR section is incorporated by reference with no modifications, the notation “[No change.]” is used. In cases where there are no changes to the CFR language but there are additional California requirements, the notation “[No change.]” is used and the additional California requirements are then noted in a separate subsection with the numbering convention set forth in subparagraph 3.2, above.

3.4 The notation “[n/a]” indicates that the subject matter of the federal regulation does not apply to California passenger cars, light-duty trucks or medium-duty vehicles. In some cases the subject of the federal regulation is indicated in the bracket for clarity.

B. Definitions, Acronyms and Abbreviations

1. §86.1803 Definitions.

1.1 §86.1803-01. January 18, 2001. [No change, except as otherwise noted below.]

2. California Definitions.

“**AB 965 vehicle**” means a vehicle certified pursuant to section 1960.5, title 13, CCR.

“**A/C Direct Emissions**” means any refrigerant releases from a motor vehicle's air conditioning system.

“**A/C Indirect Emissions**” means any increase in motor vehicle exhaust CO₂ emissions that can be attributed to the operation of the air conditioning system.

“**Administrator**” means the Executive Officer of the Air Resources Board (ARB).

“**Alcohol fuel**” means either methanol or ethanol as those terms are defined in these test procedures.

“**All-Electric Range Test**” means a test sequence used to determine the range of an electric or hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test is described in the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962(e), title 13, CCR.

“**Battery assisted combustion engine vehicle**” means any vehicle that 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.

“**Bi-fuel vehicle**” is any motor vehicle that is engineered and designed to be capable of operating on two fuels wherein the two fuels are stored on board in separate fuel tanks and metered separately, but in operation the two fuels are combusted together.

“**Certificate of Conformity**” means Executive Order certifying vehicles for sale in California.

“**Certification**” means certification as defined in section 39018 of the Health and Safety Code.

“**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 test group. For those test groups that are certified using reactivity adjustment factors developed by the manufacturer pursuant to Part II, Section D of these test procedures, the exhaust NMOG certification level shall include adjustment by the ozone deterioration factor.

“**Conventional gasoline**” means any certification gasoline which meets the specifications of 40 CFR 86.113-94(a), but does not include gasoline that meets the specifications of California reformulated gasoline as set forth in Part II, section A.100.3.1. of these test procedures. For the

purpose of determining the ozone-forming potential of conventional gasoline vehicle exhaust emissions, gasoline meeting the specifications of Part II, Section D of these test procedures shall be used.

“Dedicated Ethanol Vehicle” means any ethanol-fueled motor vehicle that is engineered and designed to be operated solely on ethanol.

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

“Diesel Engine” means any engine powered with diesel fuel, gaseous fuel, or alcohol fuel for which diesel engine speed/torque characteristics and vehicle applications are retained.

“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. In operation, only one fuel is used at a time.

“Ethanol” means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure ethanol (CH₃CH₂OH) and gasoline as specified in Part II, section A.100.3 (Certification 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.

“Ethanol vehicle” means any motor vehicle that is engineered and designed to be operated using ethanol as a fuel.

“Fuel-fired heater” means a fuel burning device that creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

“Fuel-Flexible Vehicle” or **“FFV”** means any motor vehicle engineered and designed to be operated on a petroleum fuel and an alcohol fuel, or any mixture of the two. Alcohol-fueled vehicles that are only marginally functional when using gasoline (e.g., the engine has a drop in rated horsepower of more than 80 percent) are not flexible fuel vehicles.

“GHG Vehicle Test Group” means vehicles that have an identical test group, vehicle make and model, transmission class and driveline, aspiration method (e.g., naturally aspirated, turbocharged), camshaft configuration, valvetrain configuration, and inertia weight class.

“Global Warming Potential” or **“GWP”** means the 100-year global warming potential specified in IPCC (Intergovernmental Panel on Climate Change) 2000: *Emissions Scenarios*. N. Nakicenovic et. al. editors, Special Report of Working Group III of the IPCC, Cambridge University Press, Cambridge UK, ISBN 0-521-80493-0.

“Greenhouse gas” means the following gases: carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons.

“Grid-connected hybrid electric vehicle” means a hybrid electric vehicle that has the capacity for the battery to be recharged from an off-board source of electricity and has some all-electric range.

“Heavy-duty engine” means an engine which is used to propel a heavy-duty vehicle.

“Heavy-duty vehicle” means any motor vehicle having a manufacturer's gross vehicle weight rating greater than 6,000 pounds for vehicles certifying to the standards in Section E.1.1.1 or any motor vehicle having a manufacturer's gross vehicle weight rating greater than 8,500 pounds for vehicles certifying to the standards in Section E.1.1.2, except passenger cars.

“High-priced part” means a part determined to be high-priced in accordance with section 2037(c), title 13, CCR.

“Highway Test Cycle” means the driving schedule as set forth in Part II, section F of these test procedures.

“Highway Test Procedures” means the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86, as modified in Part II of these test procedures, except that emissions shall be measured using the Highway Driving Schedule as set forth in Part II Section F.

“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.”

“Incomplete vehicle” means any vehicle ~~that~~ 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.

“Independent Low Volume Manufacturer” means any manufacturer that meets the “independent low volume manufacturer” definition as set forth in section 1900, title 13, CCR.

“Intermediate Volume Manufacturer” means any 2009 and subsequent model year manufacturer with California sales between 4,501 and 60,000 new light- and medium-duty vehicles based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For a manufacturer certifying for the first time in California, model year sales shall be based on projected California sales. A manufacturer’s California sales shall consist of all vehicles or engines produced by the manufacturer and delivered for sale in California, except that vehicles or engines produced by the manufacturer and marketed in California by another manufacturer under the other manufacturer’s nameplate shall be treated as California sales of the marketing manufacturer.

For purposes of applying the 2009 and subsequent model year Greenhouse Gas requirements for intermediate volume manufacturers, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, each one of which either has a greater than 10% equity ownership in another or is more than 10% owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of greater than 10% in each firm.

“Large volume manufacturer” means a manufacturer that is not a small volume manufacturer, ~~or~~ an independent low volume manufacturer, or an intermediate volume manufacturer.

“LEV I” refers to the low-emission vehicle standards that were initially adopted by the Board on July 12, 1991 and are set forth in Section E.1.1.1 of these test procedures.

“LEV II” refers to the standards that were initially adopted by the Board on August 5, 1999 and are set forth in Section E.1.1.2 of these test procedures.

“Light-duty truck” or “LDT” means any 2000 and subsequent model motor vehicle certified to the standards in Section E.1.1.2 rated at 8,500 pounds gross vehicle weight or less, and any other motor vehicle rated at 6,000 pounds gross vehicle weight or less, that 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.

“LDT1” means a light-duty truck with a loaded vehicle weight of 0-3750 pounds.

“LDT2” means a “LEV II” light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds or a “LEV I” light-duty truck with a loaded vehicle weight of 3751-5750 pounds.

“Low-emission vehicle” or **“LEV”** means any vehicle certified to low-emission standards.

“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 through 2006 model-year heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in Section E.1.1.1, or in title 13, CCR, section 1962, having a manufacturer's gross vehicle weight rating of 14,000 pounds or less; any 1995 through 2002 model year heavy-duty vehicle certified to the Tier 1 standards in Section E.1.1.1 having a manufacturer's gross vehicle weight rating of 14,000 pounds or less; and any 2000 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in Section E.1.1.2, or in title 13, CCR, section 1962, having a manufacturer's gross vehicle weight rating between 8,501 and 14,000 pounds.

“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.

“Methanol” means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH₃OH) and gasoline as specified in Part II, section A.100.3.1 (Certification 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.

“Natural gas vehicle” means any motor vehicle that is engineered and designed to be operated using either compressed natural gas or liquefied natural gas.

“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 incorporated by reference in Part II, section A.100.5.4 of these test procedures.

“Optional GHG Test Vehicle Configuration” means any GHG vehicle configuration that is selected for testing by the manufacturer as allowed by section G.2.3, other than the “worst-case” configuration.

“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.

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

“Parallel hybrid electric vehicle” means any vehicle that allows power to be delivered to the driven wheels by either a combustion engine and/or by a battery powered electric motor.

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

“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.

“Renewable Energy Resource” means a facility that meets all of the criteria set forth in Public Resources Code section 25741(a), except that the facility is not required to be located in California or near the border of California.

“Series hybrid electric vehicle” means any vehicle that ~~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.

“Small volume manufacturer” means any manufacturer whose projected or combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. A manufacturer's California sales shall consist of all vehicles or engines produced by the manufacturer and delivered for sale in California, except that vehicles or engines produced by the manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as California sales of the marketing manufacturer. Beginning with the 2009 model year, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, one of which is 10% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 10% or more in each of the firms; or (3) vehicles produced by two or more firms having a common corporate officer(s) who is (are) responsible for the overall direction of the companies; or (4) vehicles imported or distributed by all firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

“Specific reactivity” is defined as the grams of ozone created per gram of NMOG emitted. This term is also known as ozone-forming potential.

“Super-~~u~~ltra-~~l~~ow-~~e~~mission ~~v~~ehicle” or **“SULEV”** means any vehicle certified to super-ultra-low-emission standards.

“Tier 1 vehicle” means any passenger car and light-duty truck certified to the standards in section 1960.1(f)(2), title 13, CCR, and any medium-duty vehicle certified to the standards in section 1960.1(h)(1), title 13, CCR.

“Transitional low-emission vehicle” or **“TLEV”** means any vehicle certified to transitional low-emission standards.

“Ultra-low-emission vehicle” or **“ULEV”** means any vehicle certified to ultra-low emission standards.

“Unified Cycle” or **“UC”** means the driving schedule as set forth in Part II, section E of these test procedures.

“Variable Displacement Compressor” means a compressor in which the mass flow rate of refrigerant can be adjusted independently of compressor speed by the control system in response to cooling load demand.

“Variable Speed Compressor” means a compressor in which the mass flow rate of refrigerant can be adjusted by control of the compressor input shaft speed, independent of vehicle engine speed. For example, a variable speed compressor can have electric drive, hydraulic drive, or mechanical drive through a variable speed transmission.

“Zero-emission vehicle” or **“ZEV”** means any vehicle certified to the zero-emission standards set forth in the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR.

3. §86.1804 Acronyms and Abbreviations.

3.1 §86.1804.01 October 6, 2000. [No change.]

3.2 California Acronyms and Abbreviations.

“ALVW” means adjusted loaded vehicle weight, which is the average of a vehicle's curb weight and gross vehicle weight.

“CCR” means California Code of Regulations.

“ccs” means cubic centimeters.

“CFR” means Code of Federal Regulations.

“CH₄” means methane.

“GHG” means greenhouse gas.

“GWP” means Global Warming Potential.

“HEV” means hybrid-electric vehicle.

“LDT” means light-duty truck.

“LDT1” means a light-duty truck with a loaded vehicle weight of 0-3750 pounds.

“LDT2” means a “LEV II” light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds or a “LEV I” light-duty truck with a loaded vehicle weight of 3751-5750 pounds.

“LEV” means low-emission vehicle.

“LVW” means loaded vehicle weight.

“MDPV” means medium-duty passenger vehicle.

“MDV” means medium-duty vehicle.

“n/a” means not applicable.

“N₂O” means nitrous oxide.

“Non-Methane Organic Gases” or “NMOG” means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

“OBD” means on-board diagnostic system.

“PC” means passenger car.

“SULEV” means super-ultra-low-emission vehicle.

“TLEV” means transitional low-emission vehicle.

“UC” means Unified Cycle.

“ULEV” means ultra-low-emission vehicle.

C. General Requirements for Certification

1. §86.1805 Useful Life.

1.1 §86.1805-01. October 6, 2000. Amend as follows:

1.1.1 Subparagraph (a). [No change.]

1.1.2 Amend subparagraph (b) to add the following: For vehicles certified to the LEV II emission standards in Section E.1.1.2 of these test procedures, full useful life is as follows:

(a) For passenger cars, light-duty trucks, and medium-duty vehicles (including hybrid electric vehicles), the full useful life shall be 10 years or 120,000 miles, whichever occurs first.

(b) The full useful life of LEV, ULEV and SULEV passenger cars, light-duty trucks and medium-duty vehicles certified to the optional LEV II 150,000 mile standards in section E.1.1.2 shall be 15 years or 150,000 miles, whichever occurs first.

1.2 §86.1805-04. October 6, 2000. Amend as follows:

1.2.1 Subparagraph (a). [No change.]

1.2.2 Amend subparagraph (b) as follows: The full useful life of LEV, ULEV and SULEV passenger cars, light-duty trucks and medium-duty vehicles certified to the optional LEV II 150,000 mile standards in section E.1.1.2 shall be 15 years or 150,000 miles, whichever occurs first.

1.2.3 Subparagraph (c) [No change.]

1.2.4 Subparagraph (d) [No change.]

1.2.5 Subparagraph (e) [n/a]

1.2.6 Subparagraph (f) [n/a]

2. §86.1806 On-Board Diagnostics.

2.1 §86.1806-01; §86.1806-05 Delete.

2.2 California On-Board Diagnostic System Requirements.

All vehicles shall be subject to the provisions of section 1968, et seq., title 13, CCR, as applicable. No vehicle shall be certified unless the Executive Officer finds that the vehicle complies with the requirements of section 1968, et seq., title 13, CCR, as applicable.

3. §86.1807 Vehicle Labeling.

3.1 §86.1807-01. October 6, 2000. Amend as follows:

3.1.1 Subparagraph (a). Add the following sentence to the introductory paragraph: The labeling requirements of this section shall apply to all new motor vehicles, and new motor vehicle engines certified according to the provisions of California Health and Safety Code Section 43100.

3.1.2 Subparagraphs (a)(1) through (c)(1)(i). [No change.]

3.1.3 Subparagraph (c)(1)(ii): Amend as follows: For passenger cars, light-duty trucks, and medium-duty vehicles, the statement: "This vehicle conforms to California regulations applicable to XXX-fueled 20XX model-year new (specify LEV, ULEV, SULEV, or ZEV, as applicable) (specify passenger cars, light-duty trucks, medium-duty vehicles)." For federally certified vehicles certified for sale in California the statement must include the phrase "conforms to U.S. EPA regulations and is certified for sale in California." Such statements shall not be used on labels placed on vehicles or engines which, in fact, do not comply with all applicable California regulations, including assembly-line test requirements, if any.

3.1.4 Subparagraphs (c)(1)(iii) through (c)(3): [No change.]

3.1.5 Subparagraph (d): Delete and replace with: Incomplete medium-duty vehicles shall have the following statement printed prominently on the label required by paragraph (a)(3)(v) of this section: "This vehicle conforms to California regulations applicable to new 20xx model-year (specify LEV, ULEV or SULEV, as applicable) medium-duty vehicles when it does not exceed XXX pounds in curb weight, XXX pounds in gross vehicle weight rating, and XXX square feet in frontal area."

3.1.6 Subparagraph (e): [No change.]

3.1.7 Subparagraph (f): [No change.]

3.1.8. Subparagraph (g): Add the following: The manufacturer shall obtain approval from the Executive Officer for all emission control label formats and locations prior to use. Approval of the specific tune-up settings is not required; however, the format for all such settings and tolerances, if any, is subject to review. If the Executive Officer finds that the information on the label is vague or subject to misinterpretation, or that the location does not comply with these specifications, he or she may require that the label or its location be modified accordingly. Samples of all actual production emission control labels used within a test group shall be submitted to the Executive Officer within thirty days after the start of production. The Executive Officer may approve alternate label locations or may, upon request, waive or modify the label content requirements provided that the intent of these requirements is met. If the Executive Officer finds any motor vehicle or motor vehicle engine manufacturer using emission control labels which are different from those approved or which do not substantially comply with the readability or durability requirements set forth in these labeling requirements, the Executive Officer may invoke §2109, title 13, CCR.

3.2 §86.1807-07. January 18, 2001. [No change, except that the amendments to §86.1807-01 still apply.]

3.3 **California Labeling Requirements.**

3.3.1. In addition to the federal requirements set forth in §86.1807, labeling shall conform with the requirements specified in section 1965, title 13, CCR and the "California Smog Index Label Specifications" as incorporated by reference in section 1965, title 13, CCR. In cases where there is conflict with the federal label specifications, the California requirements shall apply.

3.3.2. For all 2004 and subsequent model-year vehicles (except zero-emission vehicles (ZEVs)), the tune-up label shall also contain the following information lettered in the English language in block letters and numerals which shall be of a color that contrasts with the background of the label:

- (a) "OBD II certified" or "OBD Exempt".
- (b) Identification of the Exhaust Emission Control System, including but not limited to:

| | |
|-----------|--|
| ADSTWC | Adsorbing Three-Way Catalyst |
| AFS | Air-Fuel Ratio Sensor |
| AIR - | Secondary Air Injection (Pump); |
| CAC - | Charge Air Cooler; |
| CFI - | Continuous Fuel Injection; |
| CTOX - | Continuous Trap Oxidizer; |
| DFI - | Direct Fuel Injection; |
| EGR - | Exhaust Gas Recirculation; |
| * EHOC - | Electrically Heated Oxidation Catalyst; |
| * EHTWC - | Electrically Heated Three-Way Catalyst; |
| EM - | Engine Modification; |
| * FFS - | Flexible Fuel Sensor; |
| HO2S - | Heated Oxygen Sensor; |
| IFI - | Indirect Diesel Injection; |
| MFI - | Multiport (Electronic) Fuel Injection, (Central) Multiport Fuel Injection; |
| OC - | Oxidation Catalyst Only; |
| O2S - | Oxygen Sensor; |
| PAIR - | Pulsed Secondary Air Injection; |
| PTOX - | Periodic Trap Oxidizer; |
| SC - | Supercharger; |
| SFI - | Sequential Multipoint (Electronic) Fuel Injection; and |
| SPL - | Smoke Puff Limiter; |
| TBI - | Throttle Body (Electronic) Fuel Injection; |
| TC - | Turbocharger; |
| TWC - | Three-Way Catalyst; |
| TWC+OC - | Three-Way Catalyst + Oxidation Catalyst; |
| WU-TWC - | Warm-Up Catalyst with Three-Way Catalyst; |
| WU-OC - | Warm-Up Catalyst with Oxidation Catalyst; |

* Pending confirmation as SAE protocol

Abbreviations used shall be in accordance with SAE J1930, JUN 1993, including the above nomenclature unless the Executive Officer approves a more current version of SAE J1930. The Executive Officer shall recommend abbreviations for components not listed in SAE J1930, JUN 1993.

3.3.3 Manufacturers may elect to use a supplemental label in addition to the original label if there is not sufficient space to include all the required information. The supplemental label must conform to all specifications as the original label. In the case that a supplemental label is used, the original label shall be numbered "1 of 2" and the supplemental label shall be numbered "2 of 2."

3.3.4 Statements shall not be used on labels placed on vehicles or engines which, in fact, do not comply with all applicable California regulations, including assembly-line test requirements, if any.

4. §86.1808 Maintenance Instructions.

4.1 §86.1808-01. October 6, 2000. [No change.]

4.2 §86.1808-07. January 18, 2001. [No change.]

5. §86.1809 Prohibition of Defeat Devices.

5.1 §86-1809-01. October 6, 2000. [No change except that subparagraph (e) shall apply to vehicles subject to the California TLEV, LEV, ULEV and SULEV standards.]

D. §86.1810 General standards; increase in emissions; unsafe conditions; waivers

1. §86.1810-01. ~~January 18, 2001~~ April 13, 2001. Amend §86.1810-01 as follows:

This section applies to model year 2001 and later light-duty vehicles, light-duty trucks, and medium-duty vehicles fueled by gasoline, diesel, methanol, ethanol, natural gas and liquefied petroleum gas fuels. Multi-fueled vehicles (including bi-fueled, dual-fueled and flexible-fueled vehicles) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible-fueled vehicles). This section also applies to hybrid electric vehicles. The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated.

(a) through (d) [No change.]

(e) On-board diagnostics. Delete and replace with:

All passenger cars, light-duty trucks and medium-duty vehicles are subject to the on-board diagnostic system requirements in section 1968 et seq., title 13, CCR, as applicable.

(f) Altitude Requirements. Delete and replace with:

Altitude Requirements. Except for supplemental exhaust emission standards (which apply only at low altitude conditions), all emission standards apply at low altitude conditions and only CO emission standards apply at high altitude conditions.

(g) [No change.]

(h) [Delete; see D.1.1 below.]

(i) **Supplemental FTP general provisions**. [Delete; see D.2. below]

(j) **Evaporative emissions general provisions**. [Delete. (The provisions of this section are contained the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles.”)]

(k) through (n) [Delete. (The provisions of these sections are contained the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”)]

(o) [Delete. See D.1.1 below]

(p) [No change, except that references to Tier 2 and interim non-Tier 2 vehicles shall mean California LEVs, ULEVs and SULEVs. A manufacturer shall not apply a reactivity adjustment factor to the exhaust NMHC mass emissions for the purpose of determining compliance with the NMOG standard pursuant to this subparagraph.]

1.1 Measurement of Hydrocarbon Emissions.

1.1.1 Except as otherwise indicated in these test procedures, for vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas and certified to the Tier 1 standards, hydrocarbon emissions shall mean non-methane hydrocarbons (NMHC) and shall be measured in accordance with Part B (Determination of NMHC Emissions by Flame Ionization

Detection) of the "California Non-Methane Organic Gas Test Procedures," as incorporated by reference in Part II, section A.100.5.4 of these test procedures. For vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas and certified to the TLEV, LEV, ULEV and SULEV standards, hydrocarbon emissions shall mean non-methane organic gases (NMOG) and shall be measured in accordance with the "California Non-Methane Organic Gas Test Procedures" as incorporated by reference in Part II, section A.100.5.4 of these test procedures.

1.1.2 For diesel vehicles, NMOG shall mean non-methane hydrocarbons and shall be measured in accordance with Part B of the "California Non-Methane Organic Gas Test Procedures," as incorporated by reference in Part II, section A.100.5.4 of these test procedures."

1.1.3 For vehicles certifying to the SFTP standards set forth in Section E.1.2.1 of these test procedures, hydrocarbon emissions shall be measured as follows: for PCs and LDTs certified to the Tier 1 exhaust standards, hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures," as last amended May 15, 1990, which is incorporated herein by reference. For PCs and LDTs certified to the TLEV exhaust standards hydrocarbon emissions shall be measured in accordance with Part B (Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures," as incorporated by reference in Part II, section A.100.5.4 of these test procedures. For alcohol-fueled vehicles certifying to the standards in Section E.1.2.1., "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

2. Supplemental FTP General Provisions for California.

2.1 Amend 40 CFR §86.1810-01(i) as follows:

2.1.1 Delete subparagraphs (1) through (3) [The implementation schedules for SFTP are set forth in Section E.2 of these test procedures.]

2.1.2 Subparagraph (4) [No change.]

2.1.3 Subparagraph (5) [No change.]

2.1.4 Delete subparagraph (6); replace with: **Air to Fuel Ratio Requirement.**

With the exception of cold-start conditions, warm-up conditions and rapid-throttle motion conditions ("tip-in" or "tip-out" conditions), the air to fuel ratio shall not be richer at any time than, for a given engine operating condition (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters), the leanest air to fuel mixture required to obtain maximum torque (lean best torque) with a tolerance of six percent of the fuel consumption. The Executive Officer may approve a manufacturer's request for approval to use additional enrichment in subsequent testing if the manufacturer demonstrates that additional enrichment is needed to protect the vehicle, occupants, engine, or emission control hardware.

2.1.5 Delete subparagraph (7); replace with: **Single Roll Electric Dynamometer Requirement.** For all vehicles certified to the SFTP standards, a single-roll electric dynamometer or a dynamometer which produces equivalent results, as set forth in 40 CFR §86.108-00, must be used for all types of emission testing to determine compliance with the applicable emission standards.

2.1.6 Delete subparagraph (8); replace with: **Small Volume Provisions.** Small volume manufacturers of PCs, LDTs, and MDVs shall certify 100% of their PC and LDT fleet in 2004 and subsequent model years, and 100% of their MDV fleet in 2005 and subsequent model years under the supplemental FTP requirements.

2.1.7 Subparagraphs (9) through (12) [No change.]

2.1.8 Subparagraph (13) [No change, except that references to Tier 2 and non-Tier 2 vehicles shall mean California LEVs, ULEVs and SULEVs.]

2.1.9 Add the following sentence to subparagraph (14):

The above provisions shall not apply to vehicles powered by “lean-burn” engines or Diesel-cycle engines. A “lean-burn” engine is defined as an Otto-cycle engine designed to run at an air-fuel ratio significantly greater than stoichiometry during the large majority of its operation.

E. California Exhaust Emission Standards.

Delete 40 CFR §§86.1811 through 86.1819.

Introduction. The following Section E. contains the exhaust emission standards, phase-in requirements and reactivity adjustment factors applicable to California passenger cars, light-duty trucks and medium-duty vehicles. A manufacturer must demonstrate compliance with the exhaust standards applicable to specific test groups, and with the composite phase-in requirements applicable to the manufacturer's entire fleet.

A manufacturer has the option of certifying engines used in incomplete and diesel MDVs with a gross vehicle weight rating of greater than 8,500 lbs. to the heavy-duty engine standards and test procedures set forth in sections 1956.8(g) and (h), title 13, CCR, except when the federal vehicle is chassis-certified. If a federal vehicle with a gross vehicle weight rating of greater than 8,500 lbs. is certified to chassis standards, then the equivalent California vehicle must either be certified to the exhaust emission standards applicable to medium-duty vehicles as set forth in section 1961, title 13, CCR or to the federal Tier 2 standards, as per the requirements of section H.1.4 of these test procedures.

The procedures for meeting the ZEV phase-in requirements and for earning ZEV credits are contained in the "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as incorporated by reference in section 1962, title 13, CCR.

1. Exhaust Emission Standards.

1.1 FTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.

The exhaust emission standards set forth in this section refer to the exhaust emitted over the driving schedule set forth in title 40, CFR, Subparts B and C, except as amended in these test procedures.

1.1.1 LEV I and Tier 1 Exhaust Standards. The following standards represent the maximum exhaust emissions for the intermediate and full useful life from new 2001 through 2003 model-year Tier 1 passenger cars, light-duty trucks and medium-duty vehicles, and from new 2001 through 2003 model year "LEV I" TLEV passenger cars and light-duty trucks, 2001 through 2006 model year "LEV I" LEVs and ULEVs in the light- and medium-duty vehicle classes and 2001 through 2006 model year "LEV I" SULEVs in the medium-duty vehicle classes, including bi-fuel, fuel-flexible and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use:

**Exhaust Mass Emission Standards for New 2001 - 2003 Model Year Tier 1 Vehicles and
TLEV Passenger Cars and Light-Duty Trucks; 2001 - 2006 Model Year LEV I
LEV and ULEV Passenger Cars and Light-Duty Trucks;
2001-2003 Model Year Tier 1 Medium-Duty Vehicles; and
2001-2006 Model Year LEV I LEV, ULEV and SULEV Medium-Duty Vehicles**

| Vehicle Type | Durability Vehicle Basis (mi.) | Vehicle Emission Category | NMOG (g/mi) | Carbon Monoxide (g/mi) | Oxides of Nitrogen (g/mi) | Formaldehyde (mg/mi) | Particulate from diesel vehicles** (g/mi) |
|------------------------------------|--------------------------------|---------------------------|-------------|------------------------|---------------------------|----------------------|---|
| All PCs; LDTs (0-3750 lbs. LVW) | 50,000 | Tier 1 | 0.25* | 3.4 | 0.4 | n/a | 0.08 |
| | | TLEV | 0.125 | 3.4 | 0.4 | 15 | n/a |
| | | LEV | 0.075 | 3.4 | 0.2 | 15 | n/a |
| | | ULEV | 0.040 | 1.7 | 0.2 | 8 | n/a |
| | 100,000 | Tier 1 | 0.31 | 4.2 | 0.6 | n/a | n/a |
| | | Tier 1 - diesel option | 0.31 | 4.2 | 1.0 | n/a | n/a |
| | | TLEV | 0.156 | 4.2 | 0.6 | 18 | 0.08 |
| | | LEV | 0.090 | 4.2 | 0.3 | 18 | 0.08 |
| | | ULEV | 0.055 | 2.1 | 0.3 | 11 | 0.04 |
| | | | | | | | |
| LDTs (3751-5750 lbs. LVW) | 50,000 | Tier 1 | 0.32 | 4.4 | 0.7 | n/a | 0.08 |
| | | TLEV | 0.160 | 4.4 | 0.7 | 18 | n/a |
| | | LEV | 0.100 | 4.4 | 0.4 | 18 | n/a |
| | | ULEV | 0.050 | 2.2 | 0.4 | 9 | n/a |
| | 100,000 | Tier 1 | 0.40 | 5.5 | 0.97 | n/a | n/a |
| | | Tier 1 - diesel option | 0.40 | 5.5 | 1.5 | n/a | n/a |
| | | TLEV | 0.200 | 5.5 | 0.9 | 23 | 0.10 |
| | | LEV | 0.130 | 5.5 | 0.5 | 23 | 0.10 |
| | | ULEV | 0.070 | 2.8 | 0.5 | 13 | 0.05 |
| | | | | | | | |
| MDVs (3751-5750 lbs. ALVW) | 50,000 | Tier 1 | 0.32 | 4.4 | 0.7 | 18 | n/a |
| | | LEV | 0.160 | 4.4 | 0.4 | 18 | n/a |
| | | ULEV | 0.100 | 4.4 | 0.4 | 9 | n/a |
| | | SULEV | 0.050 | 2.2 | 0.2 | 4 | n/a |
| | 120,000 | Tier 1 | 0.46 | 6.4 | 0.98 | n/a | 0.10 |
| | | LEV | 0.230 | 6.4 | 0.6 | 27 | 0.10 |
| | | ULEV | 0.143 | 6.4 | 0.6 | 13 | 0.05 |
| | | SULEV | 0.072 | 3.2 | 0.3 | 13 | 0.05 |

| Vehicle Type | Durability Vehicle Basis (mi.) | Vehicle Emission Category | NMOG (g/mi) | Carbon Monoxide (g/mi) | Oxides of Nitrogen (g/mi) | Formaldehyde (mg/mi) | Particulate from diesel vehicles** (g/mi) |
|---------------------------------|--------------------------------|---------------------------|-------------|------------------------|---------------------------|----------------------|---|
| MDVs (5751-8500 lbs. ALVW) | 50,000 | Tier 1 | 0.39 | 5.0 | 1.1 | 22 | n/a |
| | | LEV | 0.195 | 5.0 | 0.6 | 22 | n/a |
| | | ULEV | 0.117 | 5.0 | 0.6 | 11 | n/a |
| | | SULEV | 0.059 | 2.5 | 0.3 | 6 | n/a |
| | 120,000 | Tier 1 | 0.56 | 7.3 | 1.53 | n/a | 0.12 |
| | | LEV | 0.280 | 7.3 | 0.9 | 32 | 0.12 |
| | | ULEV | 0.167 | 7.3 | 0.9 | 16 | 0.06 |
| | | SULEV | 0.084 | 3.7 | 0.45 | 8 | 0.06 |
| MDVs 8501 -10,000 lbs. ALVW | 50,000 | Tier 1 | 0.46 | 5.5 | 1.3 | 28 | n/a |
| | | LEV | 0.230 | 5.5 | 0.7 | 28 | n/a |
| | | ULEV | 0.138 | 5.5 | 0.7 | 14 | n/a |
| | | SULEV | 0.069 | 2.8 | 0.35 | 7 | n/a |
| | 120,000 | Tier 1 | 0.66 | 8.1 | 1.81 | n/a | 0.12 |
| | | LEV | 0.330 | 8.1 | 1.0 | 40 | 0.12 |
| | | ULEV | 0.197 | 8.1 | 1.0 | 21 | 0.06 |
| | | SULEV | 0.100 | 4.1 | 0.5 | 10 | 0.06 |
| MDVs 10,001-14,000 lbs. ALVW | 50,000 | Tier 1 | 0.60 | 7.0 | 2.0 | 36 | n/a |
| | | LEV | 0.300 | 7.0 | 1.0 | 36 | n/a |
| | | ULEV | 0.180 | 7.0 | 1.0 | 18 | n/a |
| | | SULEV | 0.09 | 3.5 | 0.5 | 9 | n/a |
| | 120,000 | Tier 1 | 0.86 | 10.3 | 2.77 | n/a | n/a |
| | | LEV | 0.430 | 10.3 | 1.5 | 52 | 0.12 |
| | | ULEV | 0.257 | 10.3 | 1.5 | 26 | 0.06 |
| | | SULEV | 0.130 | 5.2 | 0.7 | 13 | 0.06 |

* For Tier 1 vehicles, NMOG shall mean NMHC as set forth in Section I.D.1.1 of these test procedures.

** Particulate standards are determined on a 50,000 mile basis for Tier 1 passenger cars and light-duty trucks, on a 100,000 mile basis for all other passenger cars and light-duty trucks and on a 120,000 mile basis for medium-duty vehicles.

1.1.2 **LEV II Exhaust Standards.** The following LEV II standards represent the maximum exhaust emissions for the intermediate and full useful life from new 2004 and subsequent model-year LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use. Prior to the 2004 model year, a manufacturer that produces vehicles meeting these standards has the option of certifying the vehicles to the standards, in which case the vehicles will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

| LEV II Exhaust Mass Emission Standards for New 2004 and Subsequent Model LEVs, ULEVs, and SULEVs in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes | | | | | | | |
|--|---|---------------------------------|----------------|------------------------------|---------------------------------|-------------------------|------------------------|
| Vehicle Type | Durability Vehicle Basis (mi) | Vehicle Emission Category | NMOG (g/mi) | Carbon Monoxide (g/mi) | Oxides of Nitrogen (g/mi) | Formaldehyde (mg/mi) | Particulates (g/mi) |
| All PCs; LDTs 8,500 lbs. GVW or less Vehicles in this category are tested at their loaded vehicle weight. | 50,000 | LEV | 0.075 | 3.4 | 0.05 | 15 | n/a |
| | | LEV, Option 1 | 0.075 | 3.4 | 0.07 | 15 | n/a |
| | | ULEV | 0.040 | 1.7 | 0.05 | 8 | n/a |
| | 120,000 | LEV | 0.090 | 4.2 | 0.07 | 18 | 0.01 |
| | | LEV, Option 1 | 0.090 | 4.2 | 0.10 | 18 | 0.01 |
| | | ULEV | 0.055 | 2.1 | 0.07 | 11 | 0.01 |
| | | SULEV | 0.010 | 1.0 | 0.02 | 4 | 0.01 |
| | 150,000 (optional) | LEV | 0.090 | 4.2 | 0.07 | 18 | 0.01 |
| | | LEV, Option 1 | 0.090 | 4.2 | 0.10 | 18 | 0.01 |
| | | ULEV | 0.055 | 2.1 | 0.07 | 11 | 0.01 |
| | | SULEV | 0.010 | 1.0 | 0.02 | 4 | 0.01 |
| | MDVs 8,501 - 10,000 lbs. GVW Vehicles in this category are tested at their adjusted loaded vehicle weight. | 120,000 | LEV | 0.195 | 6.4 | 0.2 | 32 |
| ULEV | | | 0.143 | 6.4 | 0.2 | 16 | 0.06 |
| SULEV | | | 0.100 | 3.2 | 0.1 | 8 | 0.06 |
| 150,000 (Optional) | | LEV | 0.195 | 6.4 | 0.2 | 32 | 0.12 |
| | | ULEV | 0.143 | 6.4 | 0.2 | 16 | 0.06 |
| | | SULEV | 0.100 | 3.2 | 0.1 | 8 | 0.06 |

| Vehicle Type | Durability Vehicle Basis (mi) | Vehicle Emission Category | NMOG (g/mi) | Carbon Monoxide (g/mi) | Oxides of Nitrogen (g/mi) | Formaldehyde (mg/mi) | Particulates (g/mi) |
|---|-------------------------------|---------------------------|-------------|------------------------|---------------------------|----------------------|---------------------|
| MDVs 10,001-14,000 lbs. GVW Vehicles in this category are tested at their adjusted loaded vehicle weight. | 120,000 | LEV | 0.230 | 7.3 | 0.4 | 40 | 0.12 |
| | | ULEV | 0.167 | 7.3 | 0.4 | 21 | 0.06 |
| | | SULEV | 0.117 | 3.7 | 0.2 | 10 | 0.06 |
| | 150,000 (Optional) | LEV | 0.230 | 7.3 | 0.4 | 40 | 0.12 |
| | | ULEV | 0.167 | 7.3 | 0.4 | 21 | 0.06 |
| | | SULEV | 0.117 | 3.7 | 0.2 | 10 | 0.06 |

1.2 Supplemental Federal Test Procedure (“SFTP”) Exhaust Emission Standards for Light- and Medium-Duty Vehicles.

1.2.1 The following standards represent the maximum SFTP exhaust emissions for the intermediate and full useful life from new 2001 through 2003 model year Tier 1 and TLEV passenger cars and light-duty trucks:

SFTP EXHAUST EMISSION STANDARDS FOR 2001 THROUGH 2003 MODEL-YEAR TIER 1 AND TLEV PASSENGER CARS AND LIGHT-DUTY TRUCKS
(grams per mile)

| Vehicle Type | Loaded Vehicle Weight (lbs.) | Durability Vehicle Basis (mi) | Fuel Type | NMHC + NO _x Composite | CO | | |
|--------------|------------------------------|-------------------------------|-----------|----------------------------------|----------|-----------|------------------|
| | | | | | A/C Test | US06 Test | Composite Option |
| PC | All | 50,000 | Gasoline | 0.65 | 3.0 | 9.0 | 3.4 |
| | | | Diesel | 1.48 | n/a | 9.0 | 3.4 |
| | | 100,000 | Gasoline | 0.91 | 3.7 | 11.1 | 4.2 |
| | | | Diesel | 2.07 | n/a | 11.1 | 4.2 |
| LDT | 0-3750 | 50,000 | Gasoline | 0.65 | 3.0 | 9.0 | 3.4 |
| | | | Diesel | 1.48 | n/a | 9.0 | 3.4 |
| | | 100,000 | Gasoline | 0.91 | 3.7 | 11.1 | 4.2 |
| | | | Diesel | 2.07 | n/a | 11.1 | 4.2 |
| LDT | 3751-5750 | 50,000 | Gasoline | 1.02 | 3.9 | 11.6 | 4.4 |
| | | | Diesel | n/a | n/a | n/a | n/a |
| | | 100,000 | Gasoline | 1.37 | 4.9 | 14.6 | 5.5 |
| | | | Diesel | n/a | n/a | n/a | n/a |

1.2.2 The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for new 2001 and subsequent model LEVs, ULEVs, and SULEVs in the passenger car and light-duty truck class, and new 2003 and subsequent model year LEV, ULEV and SULEV medium-duty vehicles less than 8,500 pounds gross vehicle weight rating:

**SFTP EXHAUST EMISSION STANDARDS
FOR LEVs, ULEVs, AND SULEVs IN THE PASSENGER CAR, LIGHT-DUTY TRUCK,
AND MEDIUM-DUTY VEHICLE CLASSES**
(grams per mile)

| Vehicle Type** | LVW/ALVW (lbs.) | US06 Test* | | A/C Test* | |
|----------------|-----------------------|------------------------|------|------------------------|-----|
| | | NMHC + NO _x | CO | NMHC + NO _x | CO |
| PC | All | 0.14 | 8.0 | 0.20 | 2.7 |
| LDT | 0-3750 lbs.(LVW) | 0.14 | 8.0 | 0.20 | 2.7 |
| LDT | 3751-5750 lbs. (LVW) | 0.25 | 10.5 | 0.27 | 3.5 |
| MDV | 3751-5750 lbs. (ALVW) | 0.40 | 10.5 | 0.31 | 3.5 |
| MDV | 5751-8500 lbs. (ALVW) | 0.60 | 11.8 | 0.44 | 4.0 |

* For certification purposes, testing shall be conducted at 4000 miles ±250 miles or at the mileage determined by the manufacturer for emission-data vehicles.

** The following definitions apply for purposes of this SFTP standards table only:

“LDT” (light-duty truck) is any motor vehicle rated at 6,000 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.

“MDV” (medium-duty truck) is any motor vehicle having a manufacturer's gross vehicle weight rating of greater than 6,000 pounds and less than 14,001 pounds, except passenger cars.

1.3 NMOG Standards for Fuel-Flexible, Bi-Fuel and Dual-Fuel Vehicles Operating on Gasoline.

For fuel-flexible, bi-fuel and dual-fuel PCs, LDTs and MDVs, compliance with the NMOG exhaust mass emission standards shall be based on exhaust emission tests both when the vehicle is operated on the gaseous or alcohol fuel it is designed to use, and when the vehicle is operated on gasoline. A manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG, CO, NO_x and formaldehyde set forth in the tables in Section E.1.1 when certifying the vehicle for operation on the gaseous or alcohol fuel.

If the manufacturer elects to use them, the following standards may represent the maximum NMOG emissions when the vehicle is operating on gasoline. A manufacturer shall not apply a reactivity adjustment factor to the exhaust NMOG mass emission result when operating on gasoline. A manufacturer may measure NMHC in lieu of NMOG when fuel-flexible, bi-fuel and dual-fuel vehicles are operated on gasoline, subject to the requirements of Section D.1., subparagraph (p). Testing at 50°F is not required for fuel-flexible, bi-fuel and dual-fuel vehicles when operating on gasoline. The applicable CO, NO_x and formaldehyde standards are set forth in Section E.1.1 above.

1.3.1 **LEV I Standards for 2001 through 2006 Model Year Bi-Fuel, Fuel-Flexible and Dual Fuel Vehicles Operating on Gasoline.** The applicable exhaust mass emission standards for NMOG when certifying the vehicle for operation on gasoline (as specified in Part II, Section A. paragraph 100.3.1) are:

| LEV I NMOG Standards for Bi-Fuel, Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline | | | |
|---|----------------------|--------------------------|------------|
| (g/mi) | | | |
| Vehicle Type, LVW/ALVW | Emission Category | Durability Vehicle Basis | |
| | | 50,000 mi | 100,000 mi |
| All PCs, LDTs, 0-3750 lbs. LVW (2001 through 2003 model years only, for TLEVs) | TLEV | 0.25 | 0.31 |
| | LEV | 0.125 | 0.156 |
| | ULEV | 0.075 | 0.090 |
| LDTs, 3751-5750 lbs. LVW (2001 through 2003 model years only, for TLEVs) | TLEV | 0.32 | 0.40 |
| | LEV | 0.160 | 0.200 |
| | ULEV | 0.100 | 0.130 |
| MDVs, 3751-5750 lbs. ALVW | LEV | 0.32 | 0.46 |
| | ULEV | 0.160 | 0.230 |
| | SULEV | 0.100 | 0.143 |
| MDVs, 5751-8500 lbs. ALVW | LEV | 0.39 | 0.56 |
| | ULEV | 0.195 | 0.280 |
| | SULEV | 0.117 | 0.167 |
| MDVs, 8501-10,000 lbs. ALVW | LEV | 0.46 | 0.66 |
| | ULEV | 0.230 | 0.330 |
| | SULEV | 0.138 | 0.197 |
| MDVs, 10,001-14,000 lbs. ALVW | LEV | 0.60 | 0.86 |
| | ULEV | 0.300 | 0.430 |
| | SULEV | 0.180 | 0.257 |

1.3.2 **LEV II Standards for 2004 and Subsequent Model Year Bi-fuel, Fuel-Flexible and Dual Fuel Vehicles Operating on Gasoline.** The applicable exhaust mass emission standards for NMOG when certifying the vehicle for operation on gasoline (as specified in Part II, Section A. paragraph 100.3.1) are:

| LEV II NMOG Standards for Bi-Fuel, Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline (g/mi) | | | |
|---|---------------------------|--------------------------|------------|
| Vehicle Type | Vehicle Emission Category | Durability Vehicle Basis | |
| | | 50,000 mi | 120,000 mi |
| All PCs; LDTs, 0-8500 lbs. GVW | LEV | 0.125 | 0.156 |
| | ULEV | 0.075 | 0.090 |
| | SULEV | 0.010 | 0.040 |
| MDVs, 8501-10,000 lbs. GVW | LEV | n/a | 0.230 |
| | ULEV | n/a | 0.167 |
| | SULEV | n/a | 0.117 |
| MDVs, 10,001-14,000 lbs. GVW | LEV | n/a | 0.280 |
| | ULEV | n/a | 0.195 |
| | SULEV | n/a | 0.143 |

1.4 50°F Exhaust Emission Standards.

All light- and medium-duty TLEVs, LEVs, ULEVs and SULEVs must demonstrate compliance with the following exhaust emission standards for NMOG and formaldehyde measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50°F, as modified by Part II, Section C of these test procedures. The NMOG mass emission result shall be multiplied by the applicable reactivity adjustment factor, if any, prior to comparing to the applicable adjusted 50,000 mile certification standards set forth in subparagraphs 1.4.1 and 1.4.2 below. A manufacturer may demonstrate compliance with the NMOG and HCHO certification standards contained in subparagraphs 1.4.1 and 1.4.2 by measuring NMHC exhaust emissions in accordance with Section D.1., subparagraph (p) and Section G.3.1.2, respectively, of these test procedures. Emissions of CO and NO_x measured at 50°F shall not exceed the standards set forth in Section E.1.1 applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86°F. Natural gas and diesel-fueled vehicles are exempt from the 50° F test requirements.

1.4.1 Standards for Vehicles Certified to the LEV I Standards.

| Vehicle Weight Class | Vehicle Emission Category (g/mi) | | | | | | | |
|----------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|
| | TLEV | | LEV | | ULEV | | SULEV | |
| | NMOG | HCHO | NMOG | HCHO | NMOG | HCHO | NMOG | HCHO |
| PCs; LDTs 0-3750 lbs. LVW | 0.250 | 0.030 | 0.150 | 0.030 | 0.080 | 0.016 | n/a | n/a |
| LDTs 3751-5750 lbs. LVW | 0.320 | 0.036 | 0.200 | 0.036 | 0.100 | 0.018 | n/a | n/a |
| MDVs 3751-5750 lbs. TW | n/a | n/a | 0.320 | 0.036 | 0.200 | 0.018 | 0.100 | 0.008 |
| MDVs 5751-8500 lbs. TW | n/a | n/a | 0.390 | 0.044 | 0.234 | 0.022 | 0.118 | 0.012 |
| MDVs 8501-10,000 lbs. TW | n/a | n/a | 0.460 | 0.056 | 0.276 | 0.028 | 0.138 | 0.014 |
| MDVs 10,001-14,000 lbs. TW | n/a | n/a | 0.600 | 0.072 | 0.360 | 0.036 | 0.180 | 0.018 |

1.4.2 Standards for Vehicles Certified to the LEV II Standards

| Vehicle Weight Class | Vehicle Emission Category (g/mi) | | | | | |
|-----------------------------|----------------------------------|-------|-------|-------|-------|-------|
| | LEV | | ULEV | | SULEV | |
| | NMOG | HCHO | NMOG | HCHO | NMOG | HCHO |
| PCs; LDTs 0-8500 lbs. GVW | 0.150 | 0.030 | 0.080 | 0.016 | 0.020 | 0.008 |
| MDVs 8501-10,000 lbs. GVW | 0.390 | 0.064 | 0.286 | 0.032 | 0.200 | 0.016 |
| MDVs 10,001-14,000 lbs. GVW | 0.460 | 0.080 | 0.334 | 0.042 | 0.234 | 0.020 |

1.5 Cold CO Standards.

The following standards represent the 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2001 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles:

**2001 AND SUBSEQUENT MODEL-YEAR COLD TEMPERATURE
CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER
CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES**
(grams per mile)

| Vehicle Type | Carbon Monoxide |
|---|-----------------|
| All PCs, LDTs 0-3750 lbs. LVW | 10.0 |
| LDTs 3751 lbs. LVW - 8500 lbs. GVW LEV I and Tier 1 MDVs 8,500 lbs. GVW and less | 12.5 |

These standards are applicable to vehicles tested in accordance with 40 CFR Part 86 Subpart C, as modified in Part II, Section B of these test procedures at a nominal temperature of 20°F (-7°C). Natural gas vehicles, diesel-fueled vehicles, and medium-duty vehicles with a gross vehicle weight rating greater than 8,500 lbs. are exempt from these standards.

1.6 Highway NOx Standard.

The maximum emissions of oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B, which is incorporated herein by reference) shall not be greater than 1.33 times the applicable PC and LDT standards or 2.0 times the applicable MDV standards set forth in section E.1.1. Both the projected emissions and the HWFET standard shall be rounded in accordance with ASTM E29-67 to the nearest 0.1 g/mi (or 0.01 g/mi for vehicles certified to the 0.05 or 0.02 g/mi NOx standards) before being compared.

1.7 Requirements for Vehicles Certified to the Optional 150,000 Mile Standards.

(a) **Requirement to Generate Additional NMOG Fleet Average Credit.** A vehicle that is certified to the 150,000 mile standards in section E.1.1.2 shall generate additional NMOG fleet average credit as set forth in section E.3.1 or additional vehicle equivalent credits as set forth in E.3.2, provided that the manufacturer extends the warranty on high-priced parts to 8 years or 100,000 miles, whichever occurs first, and agrees to extend the limit on high mileage in-use testing to 112,500 miles.

(b) **Requirement to Generate a Partial ZEV Allowance.** A manufacturer that certifies to the 150,000 mile SULEV standards shall also generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and

Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR.

1.8 Optional LEV NOx Standard.

A manufacturer may certify up to 4% of its light-duty truck fleet from 3751 lbs. LVW - 8500 lbs. GVW with a maximum base payload of 2500 lbs. or more, to the LEV, option 1, standard set forth in Section E.1.1.2 based on projected sales of trucks in this category. Passenger cars and light-duty trucks 0-3750 lbs. LVW are not eligible for this option.

1.9 NMOG Credit for Vehicles with Zero-Evaporative Emissions.

In determining compliance of a vehicle with the applicable exhaust NMOG standard, a gram per mile NMOG factor, to be determined by the Executive Officer based on available data, shall be subtracted from the reactivity-adjusted NMOG exhaust emission results for any vehicle that has been certified to the “zero” evaporative emission standard set forth in title 13, CCR, section 1976(b)(1)(E). This credit shall not apply to a SULEV that generates a partial ZEV allowance.

1.10 NMOG Credit for Direct Ozone Reduction Technology.

A manufacturer that certifies vehicles equipped with direct ozone reduction technologies shall be eligible to receive NMOG credits that can be applied to the NMOG exhaust emissions of the vehicle when determining compliance with the standard. In order to receive credit, the manufacturer must submit the following information for each vehicle model, including, but not limited to:

- (a) a demonstration of the airflow rate through the direct ozone reduction device and the ozone-reducing efficiency of the device over the range of speeds encountered in the UC as set forth in Part II, section E of these test procedures;
- (b) an evaluation of the durability of the device for the full useful life of the vehicle; and
- (c) a description of the on-board diagnostic strategy for monitoring the performance of the device in-use.

Using the above information, the Executive Officer shall determine the value of the NMOG credit based on the calculated change in the one-hour peak ozone level using an approved airshed model.

1.11 NOx Credits for Pre-2004 MDVs Certified to the LEV I LEV or ULEV Standards.

Prior to the 2004 model year, a manufacturer may earn a 0.02 g/mi per vehicle NOx credit for MDVs between 6,000-8500 lbs. GVW certified to the LEV I LEV or ULEV standards for PCs and LDTs set forth in section E.1.1.1 of these test procedures. The manufacturer may apply the credit on a per vehicle basis to the NOx emissions of LDTs between 6,000-8500 lbs. GVW certified to the PC/LDT LEV or ULEV standards in section E.1.1.2 for the 2004 through 2008 model years.

1.12 When a Federally-Certified Vehicle Model is Required in California.

1.12.1 Basic Requirement. Whenever a manufacturer federally-certifies a 2004 or subsequent model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. The criteria for applying this requirement are set forth in Part I. Section H.1 of these test procedures.

1.12.2 Exception for Clean Fuel Fleet Vehicles. This requirement does not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirements a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

1.12.3 Opt-in for 2003 or Prior Model-Year Vehicles. A manufacturer may certify a passenger car, light-duty truck or medium-duty vehicle to federal exhaust emission standards pursuant to Section E.1.12.1 prior to the 2004 model year.

1.13 Emission Standard for Fuel-Fired Heaters. Whenever a manufacturer elects to utilize an on-board fuel-fired heater on any passenger car, light-duty truck or medium-duty vehicle, the heater must meet the LEV II ULEV standards for passenger cars and light-duty trucks less than 8,500 pounds GVW set forth in Section E.1.1.2 of these test procedures. The exhaust emissions from the fuel-fired heater shall be determined in accordance with the "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes". On-board fuel-fired heaters may not be operable at ambient temperatures above 40°F.

1.14 Greenhouse Gas Emission Requirements. The greenhouse gas emission levels from new 2009 and subsequent model year passenger cars, light-duty trucks, and medium-duty passenger vehicles shall not exceed the requirements set forth in Section E.2.5 of these test procedures. Light-duty trucks from 3751 lbs. LVW – 8500 lbs. GVW that are certified to the ~~Optional~~ Option 1 LEV II NOx Standard in Section E.1.1.2 of these test procedures are exempt from these greenhouse gas emission requirements, however, passenger cars, light-duty trucks 0-3750 lbs. LVW, and medium-duty passenger vehicles are not eligible for this exemption.

2. Emission Standards Phase-In Requirements for Manufacturers

2.1 Fleet Average NMOG Requirements for Passenger Cars and Light-Duty Trucks.

2.1.1 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 each model year by a manufacturer other than a small volume manufacturer or an independent low volume manufacturer shall not exceed:

| FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES (50,000 mile Durability Vehicle Basis) | | |
|---|-------------------------------------|--|
| Model Year | Fleet Average NMOG (g/mi) | |
| | All PCs; LDTs 0-3750 lbs. LVW | LDTs 3751 lbs. LVW - 8500 lbs. GVW |
| 2001 | 0.070 | 0.098 |
| 2002 | 0.068 | 0.095 |
| 2003 | 0.062 | 0.093 |
| 2004 | 0.053 | 0.085 |
| 2005 | 0.049 | 0.076 |
| 2006 | 0.046 | 0.062 |
| 2007 | 0.043 | 0.055 |
| 2008 | 0.040 | 0.050 |
| 2009 | 0.038 | 0.047 |
| 2010+ | 0.035 | 0.043 |

2.1.2 Calculation of Fleet Average NMOG Value.

2.1.2.1 Basic Calculation.

(a) Each manufacturer's PC and LDT1 fleet average NMOG value for the total number of PCs and LDT1s produced and delivered for sale in California shall be calculated as follows:

$$\frac{\sum [\text{Number of vehicles in a test group} \times \text{applicable emission standard}] + \sum [\text{Number of hybrid electric vehicles in a test group} \times \text{HEV NMOG factor}]}{\text{Total number of vehicles}}$$

Total Number of Vehicles Produced, Including ZEVs and HEVs

2.1.2.1 (b) Each manufacturer's LDT2 fleet average NMOG value for the total number of LDT2s produced and delivered for sale in California shall be calculated as follows:

$$\frac{(\sum [\text{Number of vehicles in a test group} \times \text{applicable emission standard}] + \sum [\text{Number of hybrid electric vehicles in a test group} \times \text{HEV NMOG factor}])}{\text{Total Number of Vehicles Produced, Including ZEVs and HEVs}}$$

The applicable emission standards to be used in the above equations are as follows:

| Model Year | Emission Category | Emission Standard Value | |
|---|-------------------|---|---|
| | | All PCs; LDTs 0-3750 lbs. LVW | LDTs 3751-5750 lbs. LVW |
| 2001 and subsequent (AB 965 vehicles only) | All | Federal Emission Standard to which Vehicle is Certified | Federal Emission Standard to which Vehicle is Certified |
| 2001 - 2003 | Tier 1 | 0.25 | 0.32 |
| 2001 - 2006 model year vehicles certified to the "LEV I" standards in E.1.1.1 (For TLEVs, 2001 - 2003 model years only) | TLEVs | 0.125 | 0.160 |
| | LEVs | 0.075 | 0.100 |
| | ULEVs | 0.040 | 0.050 |
| Model Year | Emission Category | All PCs; LDTs 0-3750 lbs. LVW | LDTs 3751 lbs. LVW - 8500 lbs. GVW |
| 2001 and subsequent model year vehicles certified to the "LEV II" standards in E.1.1.2 | LEVs | 0.075 | 0.075 |
| | ULEVs | 0.040 | 0.040 |
| | SULEVs | 0.01 | 0.01 |
| 2001 and subsequent model year vehicles certified to the optional 150,000 mile "LEV II" standards for PCs and LDTs in E.1.1.2 | LEVs | 0.064 | 0.064 |
| | ULEVs | 0.034 | 0.034 |
| | SULEVs | 0.0085 | 0.0085 |

2.1.2.2 **HEV NMOG Factor.** The HEV NMOG factor for light-duty vehicles is calculated as follows:

$$\text{LEV HEV Contribution Factor} = 0.075 - [(\text{Zero-emission VMT Factor}) \times 0.035]$$

$$\text{ULEV HEV Contribution Factor} = 0.040 - [(\text{Zero-emission VMT Factor}) \times 0.030]$$

where Zero-emission VMT Factor for HEVs is determined in accordance with Section C.3 of the "California Exhaust Emission Standards and Test Procedures for

2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR.

2.1.2.3 Federally-Certified Vehicles. A vehicle certified to the standards for a federal exhaust emissions bin in accordance with Section H.1 of these test procedures shall use the corresponding NMOG emission category value set forth in the table in Section E.2.1.2 of these test procedures for the fleet average calculation. If a vehicle is certified to 150,000 mile standards for a federal exhaust emission bin and the corresponding California NMOG emission category is LEV I or LEV II LEV, it may use the emission standard value for the optional 150,000 mile LEV II LEV standards set forth in the Section E.2.1.2 table. If a vehicle is certified to 150,000 mile standards for a federal exhaust emission bin and the corresponding California NMOG emission category is LEV I or LEV II ULEV, it may use the emission standard value for the optional 150,000 mile LEV II ULEV standards set forth in the Section E.2.1.2 table.

2.1.3 Phase-in Requirements for Small Volume Manufacturers.

(a) In 2001 through 2006 model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with subsection E.2.1.2. In 2007 and subsequent model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 for PCs and LDTs from 0-3750 lbs. LVW or 0.075 for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW calculated in accordance with subsection E.2.1.2.

(b) If a manufacturer's average California sales exceeds 4500 units of new PCs, LDTs, MDVs and heavy duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume manufacturer and shall comply with the fleet average requirements applicable to larger manufacturers as specified in section E.2.1.2 beginning with the fourth model year after the last of the three consecutive model years.

(c) If a manufacturer's average California sales falls below 4500 units of new PCs, LDTs, MDVs and heavy duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall be treated as a small volume manufacturer and shall be subject to the requirements for small volume manufacturers beginning with the next model year.

2.1.4 Phase-in Requirements for Independent Low Volume Manufacturers

In 2001 through 2006 model years, an independent low volume manufacturer shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with section E.2.1.2. In 2007 and subsequent model years, an independent low volume manufacturer shall not exceed a fleet average NMOG value of 0.060 for PCs and LDTs from 0-3750 lbs. LVW

or 0.065 g/mi for LDTs from 3751 lbs. LVW - 8500 lbs. GVW calculated in accordance with section E.2.1.2.

2.1.5 Treatment of ZEVs. ZEVs classified as LDTs (>3750 lbs. LVW) that have been counted toward the ZEV requirement for PCs and LDTs (0-3750 lbs. LVW) as specified in Section C of the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR, shall be included in this equation.

2.2 LEV II Phase-In Requirement.

Beginning in the 2004 model year, a manufacturer, except a small volume manufacturer or an independent low volume manufacturer, shall certify a percentage of its PC and LDT fleet to the LEV II standards in section E.1.1.2 according to the following phase-in schedule:

| Model Year | PC/LDT1 (%) | LDT2 (%) |
|-------------------|--------------------|-----------------|
| 2004 | 25 | 25 |
| 2005 | 50 | 50 |
| 2006 | 75 | 75 |
| 2007 | 100 | 100 |

In determining compliance with the phase-in schedule, the fleet shall consist of LEV I and LEV II PCs and LDT1s for the PC/LDT1 calculation, and LEV I and LEV II LDT2s for the LDT2 calculation. LEV I MDVs are not counted in the calculation until they are certified as LEV II LDT2s.

A manufacturer may use an alternative phase-in schedule to comply with these phase-in requirements as long as equivalent NOx emission reductions are achieved by the 2007 model year from each of the two categories – PC/LDT1 or LDT2. Model year emission reductions shall be calculated by multiplying the percent of either PC/LDT1 or LDT2 vehicles meeting the LEV II standards in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2004 model year, 3 for the 2005 model year, 2 for the 2006 model year and 1 for the 2007 model year. The yearly results for PCs/LDT1s shall be summed together to determine a separate cumulative total for PCs/LDT1s and the yearly results for LDT2s shall be summed together to determine a cumulative total for LDT2s. The cumulative total for each category must be equal to or exceed 500 to be considered equivalent. A manufacturer may add vehicles introduced before the 2004 model year (e.g., the percent of vehicles introduced in 2003 would be multiplied by 5) to the cumulative total.

2.3 Medium-Duty Low-Emission Vehicle Phase-In Requirements.

2.3.1 (a) A manufacturer of MDVs, other than a small volume manufacturer, shall certify an equivalent percentage of its MDV fleet according to the following phase-in schedule:

| Model Year | Vehicles Certified to Section E.1.1 (%) | | Vehicles Certified to title 13 CCR Section 1956.8(g) or (h) (%) | | |
|------------|---|------|---|-----|------|
| | LEV | ULEV | Tier 1 | LEV | ULEV |
| 2001 | 80 | 20 | 100 | 0 | 0 |
| 2002 | 70 | 30 | 0 | 100 | 0 |
| 2003 | 60 | 40 | 0 | 100 | 0 |
| 2004 + | 40 | 60 | 0 | 0 | 100 |

(b) **Requirements for Small Volume Manufacturers.** In 2001 through 2003 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV Tier 1 standards in a quantity equivalent to 100% of its MDV fleet. In 2004 through 2006 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV standards in a quantity equivalent to 100% of its MDV fleet. Engines certified to these MDV LEV standards are not eligible for emissions averaging.

(c) **Phase-In Requirements for LEV II MDVs.** For the 2004 through 2006 model years, a manufacturer, other than a small volume manufacturer must phase-in at least one test group per model year to the MDV LEV II standards. All 2007 and subsequent model year MDVs, including those produced by a small volume manufacturer, are subject to the LEV II MDV standards. Beginning in the 2005 model year, all medium-duty engines certified to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), including those produced by a small volume manufacturer, must meet the standard set forth in title 13, CCR §1956.8(c) or (h), as applicable. A manufacturer that elects to certify to the Option 1 or Option 2 federal standards as set forth in 40 CFR §86.005-10(f) is not subject to these phase-in requirements.

2.3.2 Identifying a Manufacturer's MDV Fleet. For the 2001 and subsequent model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturer's total production of California-certified medium-duty vehicles delivered for sale in California. For the 2005 and subsequent model years, a manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR, §1956.8(c), or

(h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subparagraph.

2.4 Implementation Schedules for SFTP Emission Standards

2.4.1 A manufacturer of PCs and of LDTs certified to the Tier 1 and TLEV standards as set forth in Section E.1 of these test procedures, except a small volume manufacturer, shall certify a minimum percentage of its PC and LDT fleet according to the following phase-in schedule.

| Model Year | Percentage of PC and LDT Fleet |
|---------------------|--------------------------------|
| 2001 | 25 |
| 2002 | 50 |
| 2003 | 85 |
| 2004 and subsequent | 100 |

(a) For the purposes of the implementation schedule set forth in this subparagraph 2.4.1, each manufacturer's PC and LDT fleet shall be defined as the total projected number of Tier 1 and TLEV PCs and LDTs from 0-5750 lbs. LVW sold in California. As an option, a manufacturer may elect to have its total PC and LDT fleet defined, for the purposes of this implementation schedule only, as the total projected number of the manufacturer's PCs and LDTs, other than zero-emission vehicles, certified and sold in California.

(b) The phase-in requirements for small volume manufacturers are set forth in Section D.2.1.6 of these test procedures.

2.4.2 (a) A manufacturer of PCs, LDTs, and MDVs certified to the LEV, ULEV and SULEV standards as set forth in Section E.1 of these test procedures, except a small volume manufacturer, shall certify a minimum percentage of its PC and LDT fleet, and a minimum percentage of its MDV fleet, according to the following phase-in schedule.

| Model Year | Percentage | |
|---------------------|------------|-----|
| | PC, LDT | MDV |
| 2001 | 25 | NA |
| 2002 | 50 | NA |
| 2003 | 85 | 25 |
| 2004 | 100 | 50 |
| 2005 and subsequent | 100 | 100 |

(b) A manufacturer may use an “Alternative or Equivalent Phase-in Schedule” to comply with the phase-in requirements. An “Alternative Phase-in” is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The “cumulative total” is the summation of the model-year emission reductions (e.g., a four model-year 25/50/85/100 percent phase-in schedule would be calculated as: $(25\% * 4 \text{ years}) + (50\% * 3 \text{ years}) + (85\% * 2 \text{ years}) + (100\% * 1 \text{ year}) = 520$). Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by the Executive Officer under the following conditions: 1) all vehicles subject to the phase-in shall comply with the respective requirements in the last model year of the required phase-in schedule and 2) if a manufacturer uses the optional phase-in percentage determination in Section 2.4.1(a) above, the cumulative total of model-year emission reductions as determined only for PCs and LDTs certified to this Section 2.4.2. must also be equal to or larger than the required cumulative total by end of the 2004 model year. A manufacturer shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as: $(10\% * 5 \text{ years})$ and added to the cumulative total).

2.4.2.1 For the purposes of the implementation schedule set forth in this subparagraph 2.4.2, each manufacturer's PC and LDT fleet shall be defined as the total projected number of low-emission, ultra-low-emission and super-ultra-low-emission PCs and LDTs from 0-5750 pounds loaded vehicle weight sold in California. Each manufacturer's MDV fleet shall be defined as the total projected number of low-emission, ultra-low-emission, and super-ultra-low-emission MDVs less than 8501 pounds gross vehicle weight rating sold in California.

2.5 Fleet Average Greenhouse Gas Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

2.5.1 The fleet average greenhouse gas exhaust mass emission values from passenger cars, light-duty trucks, and medium-duty passenger vehicles that are produced and delivered for sale in California each model year by a large volume manufacturer shall not exceed:

| FLEET AVERAGE GREENHOUSE GAS EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CAR, LIGHT-DUTY TRUCK, AND MEDIUM-DUTY PASSENGER VEHICLE WEIGHT CLASSES¹ (4,000 mile Durability Vehicle Basis) | | |
|---|--|--|
| Model Year | <i>Fleet Average Greenhouse Gas Emissions (grams per mile CO₂-equivalent)</i> | |
| | <i>All PCs; LDTs 0-3750 lbs. LVW</i> | <i>LDTs 3751 lbs. LVW - 8500 lbs. GVW; MDPVs</i> |
| <u>2009</u> | <u>323</u> | <u>439</u> |
| <u>2010</u> | <u>301</u> | <u>420</u> |
| <u>2011</u> | <u>267</u> | <u>390</u> |
| <u>2012</u> | <u>233</u> | <u>361</u> |
| <u>2013</u> | <u>227</u> | <u>355</u> |
| <u>2014</u> | <u>222</u> | <u>350</u> |
| <u>2015</u> | <u>213</u> | <u>341</u> |
| <u>2016+</u> | <u>205</u> | <u>332</u> |

¹ Each manufacturer shall demonstrate compliance with these values in accordance with Section E.2.5.2.

2.5.2 Calculation of Fleet Average Greenhouse Gas Value.

2.5.2.1 Basic Calculation.

2.5.2.1.1 Each manufacturer shall calculate both a “city” grams per mile average CO₂-equivalent value for each GHG vehicle test group and a “highway” grams per mile average CO₂-equivalent value for each GHG vehicle test group, including AB 965 vehicles and vehicles certified in accordance with Section E.1.12 of these test procedures, using the following formula. Greenhouse Gas emissions used for the “city” CO₂-equivalent value calculation shall be measured using the “FTP” test cycle (40 CFR, Part 86, Subpart B), as modified in Part II of these test procedures. Greenhouse Gas emissions used for the “highway” CO₂-equivalent value calculation shall be based on emissions measured using the Highway Test Procedures.

$$\text{CO}_2\text{-Equivalent Value} = \text{CO}_2 + 296 \times \text{N}_2\text{O} + 23 \times \text{CH}_4 - \text{A/C Direct Emissions Allowance} - \text{A/C Indirect Emissions Allowance}$$

A manufacturer may use $N_2O = 0.006$ grams per mile in lieu of measuring N_2O exhaust emissions.

2.5.2.1.2 **A/C Direct Emissions Allowance.** A manufacturer may use the following A/C Direct Emission Allowances, upon approval of the Executive Officer, if that manufacturer demonstrates that the ~~corresponding~~ following requirements are met. Such demonstration shall include specifications of the components used and an engineering evaluation that verifies the estimated lifetime emissions from the components and the system. A manufacturer shall also provide confirmation that the number of fittings and joints has been minimized and components have been optimized to minimize leakage. No A/C Direct Emissions Allowance is permitted if the following requirements are not met.

(a) A “low-leak air conditioning system” shall be defined as one that meets the following criteria:

- i. All pipe and hose connections are equipped with multiple o-rings, seal washers, or metal gaskets only (e.g., no single o-rings);
- ii. All hoses in contact with the refrigerant must be ultra-low permeability barrier or veneer hose on both the high-pressure and the low-pressure sides of the system (e.g., no rubber hoses); and
- iii. Only multiple-lip compressor shaft seals shall be used (with either body o-rings or gaskets).

(b) For an air conditioning system that uses HFC-134a as the refrigerant:

- i. An A/C Direct Emissions Allowance of 3.0 CO_2 -equivalent grams per mile shall apply if the system meets the criteria for a “low-leak air conditioning system.”
- ii. An A/C Direct Emissions Allowance of 3.0 CO_2 -equivalent grams per mile shall apply if the manufacturer demonstrates alternative technology that achieves equal or lower direct emissions than a “low-leak air conditioning system.”
- iii. An A/C Direct Emissions Allowance greater than 3.0 CO_2 -equivalent grams per mile may apply for an air conditioning system that reduces refrigerant leakage further than would be obtained from a “low-leak air conditioning system.” A maximum A/C Direct Emissions Allowance of 6.0 CO_2 -equivalent grams per mile may be earned for an air conditioning system that has 100 percent containment of refrigerant during normal operation, where “normal operation” means typical everyday use of the A/C system to cool a vehicle. “Normal operation” does not include car accidents, dismantling of an A/C system, or any other non-typical events. To obtain an A/C Direct Emissions Allowance greater than 3.0 CO_2 -equivalent grams per mile, the manufacturer must provide an engineering evaluation that supports the allowance requested.

(c) For an air conditioning system that uses HFC 152a, CO₂ refrigerant, or any refrigerant with a GWP of 150 or less:

An A/C Direct Emissions Allowance shall be calculated using the following formula:

$$\text{A/C Direct Emissions Allowance} = A - (B \times C)$$

where: A = 9 CO₂-equivalent grams per mile (the lifetime vehicle emissions from an air conditioning system that uses refrigerant HFC-134a);

$$B = 9 \text{ CO}_2\text{-equivalent grams per mile} \times \frac{\text{GWP}}{1300}$$

where: B is the lifetime vehicle emissions from an air conditioning system that uses a refrigerant with a GWP of 150 or less and

“GWP” means the GWP of this refrigerant; and

C = 1, except for an air conditioning system that meets the criteria of a “low-leak air conditioning system.”

For an air conditioning system that meets or exceeds the criteria of a “low-leak air conditioning system,” the following formula shall apply:

$$C = 1 - (0.12 \times \text{credit})$$

where: “credit” equals 3.0 CO₂-equivalent grams per mile for a “low-leak air conditioning system” that meets the criteria of Section E.2.5.2.1.2(a) or

“credit” equals a value greater than 3.0 CO₂-equivalent grams per mile for an air conditioning system that reduces refrigerant leakage further than would be obtained from a “low-leak air conditioning system.” A maximum credit of 6.0 CO₂-equivalent grams per mile may be earned for an air conditioning system that has 100 percent containment of refrigerant during normal operation. To obtain a credit greater than 3.0 CO₂-equivalent grams per mile, the manufacturer must provide an engineering evaluation that supports the credit requested.

2.5.2.1.3 A/C Indirect Emissions Allowance. A manufacturer may use the following A/C Indirect Emissions Allowances, upon approval of the Executive Officer, if the manufacturer demonstrates using data or an engineering evaluation that the air conditioning system meets the ~~corresponding~~ following requirements. A manufacturer may use the following A/C Indirect Emissions Allowances for other technologies, upon approval of the Executive Officer, if that manufacturer demonstrates that the air conditioning system achieves equal CO₂-equivalent grams per mile emissions reductions.

~~(a) An allowance of 5.0 CO₂-equivalent grams per mile per 100ccs of compressor displacement shall be given for an air conditioning~~ An "A/C system with reduced indirect emissions" shall be defined as one that meets all of the following criteria:

- i. Has managed outside and recirculated air balance to achieve comfort, demisting, and safety requirements, based on such factors as temperature, humidity, pressure, and level of fresh air in the passenger compartment to minimize compressor usage;
- ii. Is optimized for energy efficiency by utilizing state-of-the-art high efficiency evaporators, condensers, and other components; and
- iii. Has an externally controlled compressor (such as an externally controlled variable displacement or variable speed compressor or an externally controlled fully cycling fixed displacement compressor) that adjusts evaporative temperature to minimize the necessity of reheating cold air to satisfy occupant comfort.

(b) For an A/C system that meets all of the criteria for an "A/C system with reduced indirect emissions," the allowance shall be calculated using the following emission factors, up to a maximum allowance of 9.0 CO₂-equivalent grams per mile for a system that has one evaporator and up to a maximum allowance of 11.0 CO₂-equivalent grams per mile for a system that has two evaporators:

- i. 5.0 CO₂-equivalent grams per mile per 100 cc of maximum compressor displacement for a system that does not use CO₂ as the refrigerant
- ii. 27.5 CO₂-equivalent grams per mile per 100 cc of maximum compressor displacement for a system that uses CO₂ as the refrigerant

~~(c) An allowance of 0.2 CO₂-equivalent grams per mile per 100ccs of compressor displacement shall be given f~~ For an air conditioning system equipped with a refrigerant having a GWP of 150 or less, the allowance shall be calculated using the following emission factors, up to a maximum allowance of 0.5 CO₂-equivalent grams per mile:

- i. 0.2 CO₂-equivalent grams per mile per 100cc of maximum compressor displacement for a system that does not use CO₂ as the refrigerant and
- ii. 1.1 CO₂-equivalent grams per mile per 100cc of maximum compressor displacement for a system that uses CO₂ as the refrigerant.

2.5.2.1.4 Upstream Greenhouse Gas Emission Adjustment Factor for Alternative Fuel Vehicles. A grams per mile average CO₂-equivalent value for each GHG vehicle test group certifying on a fuel other than conventional gasoline, including AB 965 vehicles and vehicles certified in accordance with Section E.1.12 of these test procedures, shall be calculated as follows:

$$\frac{(\text{CO}_2 + \text{A/C Indirect Emissions}) \times (\text{Fuel Adjustment Factor}) + 296 \times \text{N}_2\text{O} + 23 \times \text{CH}_4 + \text{A/C Direct Emissions}}{}$$

where: A/C Indirect Emissions = A-B

where: "A" represents the indirect emissions associated with an A/C system that does not incorporate any of the A/C improvements described in Section E.2.5.2.1.3. "A" is determined by the following emission factors, with a maximum value of 17.0 CO₂-equivalent grams per mile for a system that has one evaporator and a maximum value of 21.0 CO₂-equivalent grams per mile for a system that has two evaporators.

A = 9.6 CO₂-equivalent grams per mile per 100cc of maximum compressor displacement for an A/C system that does not use CO₂ as the refrigerant or

A = 52.8 CO₂-equivalent grams per mile per 100cc of maximum compressor displacement for an A/C system that uses CO₂ as the refrigerant.

B = A/C Indirect Emissions Allowance as calculated per Section E.2.5.2.1.3.

~~A/C Indirect Emissions = 9.0 CO₂-equivalent grams per mile per 100ccs of compressor displacement – A/C Indirect Emissions Allowance as calculated per Section E.2.5.2.1.3.~~

A/C Direct Emissions = 9 CO₂-equivalent grams per mile – A/C Direct Emissions Allowance as calculated per Section E.2.5.2.1.2.

The Fuel Adjustment Factors are:

| <u>Fuel</u> | <u>Fuel Adjustment Factor</u> |
|--------------------|-------------------------------|
| <u>Natural Gas</u> | <u>1.03</u> |
| <u>LPG</u> | <u>0.89</u> |
| <u>E85</u> | <u>0.74</u> |

2.5.2.1.5 Calculation of CO₂-equivalent Emissions for Hydrogen Internal Combustion Engine Vehicles and for Electric and Hydrogen ZEVs. The grams per mile average CO₂-equivalent value for each GHG vehicle test group certifying to ZEV standards, including AB 965 vehicles and vehicles certified in accordance with Section E.1.12 of these test procedures, shall be:

A/C Direct Emissions + Upstream Emissions Factor
~~A/C Direct Emissions + 130 CO₂-equivalent grams per mile for electric ZEVs, A/C Direct Emissions + 290 CO₂-equivalent grams per mile for hydrogen internal combustion engine vehicles, and~~
~~A/C Direct Emissions + 210 CO₂-equivalent grams per mile for hydrogen ZEVs.~~

where: A/C Direct Emissions = 9 CO₂-equivalent grams per mile – A/C Direct Emissions Allowance as calculated per Section E.2.5.2.1.2.

The Upstream Emissions Factors are:

| <u>Vehicle Type</u> | <u>Upstream Emissions Factor¹</u> <u>(CO₂-equivalent g/mi)</u> |
|--|---|
| <u>Electric ZEV</u> | <u>130</u> |
| <u>Hydrogen Internal Combustion Engine Vehicle</u> | <u>290</u> |
| <u>Hydrogen ZEV</u> | <u>210</u> |

¹ The Executive Officer may approve use of a lower upstream emissions factor if a manufacturer demonstrates the appropriateness of the lower value by providing information that includes, but is not limited to the percentage of hydrogen fuel or the percentage of electricity produced for sale in California using a “renewable energy resource.”

2.5.2.2 Calculation of Greenhouse Gas Values for Bi-Fuel Vehicles, Fuel-Flexible Vehicles, Dual-Fuel Vehicles, and Grid-connected Hybrid Electric Vehicles.

For bi-fuel, fuel-flexible, dual-fuel, and grid-connected hybrid electric vehicles, a manufacturer shall calculate a grams per mile average CO₂-equivalent value for each GHG vehicle test group, in accordance with Section E.2.5.2.1, of these test procedures, based on exhaust mass emission tests when the vehicle is operating on gasoline.

2.5.2.2.1 Optional Alternative Compliance Mechanisms. Beginning with the 2010 model year, a manufacturer that demonstrates that a bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric GHG vehicle test group will be operated in use in California on the alternative fuel ~~may~~ shall be eligible to certify those vehicles using this optional alternative compliance procedure, upon approval of the Executive Officer.

(a) To demonstrate that bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric vehicles within a GHG vehicle test group will be operated in use in California on the alternative fuel, the manufacturer shall provide data that shows the

previous model year sales of such vehicles to fleets that provide the alternative fuel on-site, or, for grid-connected hybrid electric vehicles, to end users with the capability to recharge the vehicle on-site. This data shall include both the total number of vehicles sales that were made to such fleets or end users with the capability to recharge the vehicle on-site and as the percentage of total GHG vehicle test group sales. The manufacturer shall also provide data demonstrating the percentage of total vehicle miles traveled by the bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric vehicles sold to each fleet or to end users with the capability to recharge the vehicle on-site in the previous model year using the alternative fuel and using gasoline.

(b) For each GHG vehicle test group that receives approval by the Executive Officer under Section E.2.5.2.2.1(a), a grams per mile CO₂-equivalent value shall be calculated as follows:

$$\text{CO}_2\text{-equivalent value} = \frac{[A \times E \times B \times C] + [(1 - (A \times E \times B)) \times D]}{1}$$

where: A = the percentage of previous model year vehicles within a GHG vehicle test group that were operated in use in California on the alternative fuel during the previous calendar year;

B = the percentage of miles traveled by “A” during the previous calendar year;

C = the CO₂-equivalent value for the GHG vehicle test group, as calculated in Section E.2.5.2.1, when tested using the alternative fuel; and

D = the CO₂-equivalent value for the GHG vehicle test group, as calculated in Section E.2.5.2.1, when tested using gasoline; and

E = 0.9 for grid-connected hybrid electric vehicles or

E = 1 for bi-fuel, fuel-flexible, and dual-fuel vehicles.

The Executive Officer may approve use of a higher value for “E” for a grid-connected hybrid electric vehicle GHG vehicle test group if a manufacturer demonstrates that the vehicles can reasonably be expected to maintain more than 90 percent of their original battery capacity over a 200,000 mile vehicle lifetime. The manufacturer may demonstrate the appropriateness of a higher value either by providing data from real world vehicle operation; or by showing that these vehicles are equipped with batteries that do not lose energy storage capacity until after 100,000 miles; or by offering 10 year/150,000 mile warranties on the batteries.

2.5.2.3 Calculation of Fleet Average Greenhouse Values.

2.5.2.3.1. Each manufacturer’s PC and LDT1 fleet average Greenhouse Gas value for the total number of PCs and LDT1s produced and delivered for sale in California, including AB 965 vehicles and vehicles certified in accordance with Section E.1.12 of these test procedures, shall be calculated as follows:

$$\frac{[0.55 \times (\sum \text{City Test Group Greenhouse Gas Values}) + 0.45 \times (\sum \text{Highway Test Group Greenhouse Gas Values})] \div \text{Total Number of PCs and LDT1s Produced, Including ZEVs and HEVs}}$$

where: City Test Group Greenhouse Gas Value = [(Total Number of Vehicles in a Test Group - \sum Number of Vehicles in Optional GHG Test Vehicle Configurations) x “worst-case” calculated CO₂-equivalent value + \sum (Number of vehicles in Optional GHG Test Vehicle Configurations x applicable calculated CO₂-equivalent value)] measured using the FTP test cycle; and

Highway Test Group Greenhouse Gas Value = [(Total Number of Vehicles in a Test Group - \sum Number of Vehicles in Optional GHG Test Vehicle Configurations) x “worst-case” calculated CO₂-equivalent value + \sum (Number of vehicles in Optional GHG Test Vehicle Configurations x applicable calculated CO₂-equivalent value)] measured using the Highway Test Procedures.

2.5.2.3.2. Each manufacturer’s LDT2 and MDPV fleet average Greenhouse Gas value for the total number of LDT2s and MDPVs produced and delivered for sale in California, including AB 965 vehicles and vehicles certified in accordance with Section E.1.12 of these test procedures, shall be calculated as follows:

$$\frac{[0.55 \times (\sum \text{City Test Group Greenhouse Gas Values}) + 0.45 \times (\sum \text{Highway Test Group Greenhouse Gas Values})] \div \text{Total Number of LDT2s and MDPVs Produced, Including ZEVs and HEVs}}$$

where: City Test Group Greenhouse Gas Value = [(Total Number of Vehicles in a Test Group - \sum Number of Vehicles in Optional GHG Test Vehicle Configurations) x “worst-case” calculated CO₂-equivalent value + \sum (Number of vehicles in Optional GHG Test Vehicle Configurations x applicable calculated CO₂-equivalent value)] measured using the FTP test cycle; and

Highway Test Group Greenhouse Gas Value = [(Total Number of Vehicles in a Test Group - \sum Number of Vehicles in Optional GHG Test Vehicle Configurations) x “worst-case” calculated CO₂-equivalent value + \sum (Number of vehicles in Optional GHG Test Vehicle Configurations x applicable calculated CO₂-equivalent value)] measured using the Highway Test Procedures.

2.5.3 Requirements for Intermediate Volume Manufacturers.

2.5.3.1 Before the 2016 model year, compliance with the Greenhouse Gas requirements in section E.2.5 shall be waived for intermediate volume manufacturers.

2.5.3.2 For each intermediate volume manufacturer, the manufacturer's baseline fleet average greenhouse gas value for PCs and LDT1s and baseline fleet average greenhouse gas value for LDT2s and MDPVs shall be calculated in accordance with Section E.2.5.2.1 of these test procedures using its 2002 model year fleet.

2.5.3.3 In the 2016 and subsequent model years, an intermediate volume manufacturer shall either:

(a) not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs, or

(b) not exceed a fleet average greenhouse gas value of 0.75 times the baseline fleet average greenhouse gas value for PCs and LDT1s or 0.82 times the baseline fleet average greenhouse gas value for LDT2s and MDPVs, as calculated in Section E.2.5.3.2.

2.5.3.4 If a manufacturer's average California sales exceed 60,000 units of new PCs, LDTs, MDVs and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall comply with the fleet average requirements applicable to large volume manufacturers as specified in Section E.2.5.1 beginning with the fourth model year after the last of the three consecutive model years.

2.5.3.5 If a manufacturer's average California sales fall below 60,001 units of new PCs, LDTs, MDVs and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall be treated as an intermediate volume manufacturer and shall be subject to the requirements for intermediate volume manufacturers beginning with the next model year.

2.5.4 Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers.

2.5.4.1 Before the 2016 model year, compliance with the Greenhouse Gas requirements in section E.2.5 shall be waived for small volume manufacturers and independent low volume manufacturers.

2.5.4.2 At the beginning of the 2013 model year, each small volume manufacturer and independent low volume manufacturer shall identify all 2012 model year vehicle models, certified by a large volume manufacturer that are comparable to that small volume manufacturer or independent low volume manufacturer's 2016 model year vehicle models, based on horsepower and horsepower to weight ratio. The small volume manufacturer and independent low volume manufacturer shall demonstrate to the Executive Officer the appropriateness of each comparable vehicle model selected. Upon approval of the Executive Officer, s/he shall provide to the small volume manufacturer and to the independent low volume manufacturer the CO₂-equivalent value for each 2012 model year vehicle model that is approved. The small volume manufacturer and independent low volume manufacturer shall calculate an average greenhouse gas emissions value for each its greenhouse gas vehicle test groups based on the CO₂-equivalent values provided by the Executive Officer.

2.5.4.3 In the 2016 and subsequent model years, a small volume manufacturer and an independent low volume manufacturer shall either:

- (a) not exceed the fleet average greenhouse gas emissions value calculated for each GHG vehicle test group for which a comparable vehicle is sold by a large volume manufacturer, in accordance with Section E.2.5.4; or
- (b) not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs; or
- (c) upon approval of the Executive Officer, if a small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system that is identical to a configuration certified for sale in California by a large volume manufacturer, those small volume manufacturer vehicle models are exempt from meeting the requirements in paragraphs E.2.5.4.3(a) and (b) of this Section.

2.5.4.4 If a manufacturer's average California sales exceed 4,500 units of new PCs, LDTs, MDVs and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume manufacturer and shall comply with the fleet average requirements applicable to larger volume manufacturers as specified in Section E.2.5.1 beginning with the fourth model year after the last of the three consecutive model years.

2.5.4.5 If a manufacturer's average California sales exceed 10,000 units of new PCs, LDTs, MDVs and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall no longer be treated as an independent low volume manufacturer and shall comply with the fleet average requirements applicable to larger volume manufacturers as specified in Section E.2.5.1 beginning with the fourth model year after the last of the three consecutive model years.

2.5.4.6 If a manufacturer's average California sales fall below 4,501 units of new PCs, LDTs, MDVs and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall be treated as an small

volume manufacturer and shall be subject to the requirements for small volume manufacturers beginning with the next model year.

3. Calculation of ~~NMOG~~ Credits/Debits

3.1 Calculation of NMOG Credits/Debits

3.1.1 Calculation of NMOG Credits for Passenger Cars and Light-Duty Trucks.

3.1.1.1 In 2001 and subsequent model years, a manufacturer that achieves 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:

$$\begin{aligned} & [(Fleet Average NMOG Requirement) - (Manufacturer's Fleet Average NMOG Value)] \\ & \times \\ & (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs). \end{aligned}$$

A manufacturer with 2001 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 the 2001 through 2006 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. and LDTs 3751 lbs. LVW - 8500 lbs. GVW shall be summed together. For the 2007 and subsequent model years, the total g/mi NMOG credits or debits earned for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVW shall be summed together. The resulting amount shall constitute the g/mi NMOG credits or debits accrued by the manufacturer for the model year.

3.1.2 Calculation of Vehicle Equivalent NMOG Credits for Medium-Duty Vehicles. In 2001 and subsequent model years, a manufacturer that produces and delivers for sale in California MDVs in excess of the equivalent requirements for LEVs, ULEVs and/or SULEVs certified to the exhaust emission standards set forth in section E.1 of these test procedures or to the exhaust emission standards set forth in section 1956.8(h), title 13, CCR 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:

$$\begin{aligned} & \{[(No. of LEVs Produced excluding HEVs) + \\ & (No. of LEV HEVs \times HEV VEC factor for LEVs)] + \\ & (1.20 \times No. of LEVs certified to the 150,000 mile standards)\} - \\ & (Equivalent No. of LEVs Required to be Produced)\} + \end{aligned}$$

$$\{[(1.4) \times (\text{No. of ULEVs Produced excluding HEVs}) + (\text{No. of ULEV HEVs} \times \text{HEV VEC factor for ULEVs})] + (1.50 \times \text{No. of ULEVs certified to the 150,000 mile standards})\} - [(1.4) \times (\text{Equivalent No. of ULEVs Required to be Produced})] +$$

$$\{[(1.7) \times (\text{No. of SULEVs Produced excluding HEVs}) + (\text{No. of SULEV HEVs} \times \text{HEV VEC factor for SULEVs})] + (1.75 \times \text{No. of SULEVs certified to the 150,000 mile standards})\} - [(1.7) \times (\text{Equivalent No. of SULEVs Required to be Produced})] + [(2.0) \times (\text{No. of ZEVs Certified and Produced as MDVs})].$$

MDVs certified prior to the 2004 model year to the LEV I LEV or ULEV standards for PCs and LDTs 0-3750 lbs. LVW set forth in section E.1 of these test procedures shall receive VECs calculated in accordance with the following equation, where the term “produced” means produced and delivered for sale in California:

$$[(1.6) \times (\text{No. of MDVs meeting the LEV I LEV standards for PCs and LDTs 0-3750 lbs. LVW excluding HEVs}) + (\text{No. of HEVs meeting the LEV I LEV standards for PCs and LDTs 0-3750 lbs. LVW} \times \text{HEV VEC factor for MDVs meeting the LEV I LEV standards for PCs and LDTs 0-3750 lbs. LVW})] + [(1.65 \times \text{No. of MDVs certified to the 150,000 mile LEV I LEV standards for PCs and LDTs 0-3750 lbs.})] +$$

$$[(1.8) \times (\text{No. of MDVs meeting the LEV I ULEV standards for PCs and LDTs 0-3750 lbs. LVW excluding HEVs}) + (\text{No. of HEVs meeting the LEV I ULEV standards for PCs and LDTs 0-3750 lbs. LVW} \times \text{HEV VEC factor for MDVs meeting the LEV I ULEV standards for PCs and LDTs 0-3750 lbs. LVW})] + [(1.85 \times \text{No. of MDVs certified to the 150,000 mile LEV I ULEV standards for PCs and LDTs 0-3750 lbs.})].$$

3.1.2.1 The MDV HEV VEC allowance is calculated as follows:

1 + [(LEV standard - ULEV standard) x (Zero-emission VMT Allowance) ÷ LEV standard] for LEVs;
 1 + [(ULEV standard - SULEV standard) x (Zero-emission VMT Allowance) ÷ ULEV standard] for ULEVs;
 1 + [(SULEV standard - ZEV standard) x (Zero-emission VMT Allowance) ÷ SULEV standard] for SULEVs;

where “Zero-emission VMT Allowance” for an HEV is determined in accordance with Section C.3 of the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes, as incorporated in section 1962, title 13, CCR.”

The HEV VEC allowance for MDVs prior to model year 2004 meeting the LEV I LEV and ULEV standards for PCs and LDTs 0-3750 lbs. LVW is calculated as follows:

$1 + \frac{[(\text{MDV SULEV standard} - \text{PC LEV I LEV standard}) \times (\text{Zero-emission VMT Allowance}) \div \text{PC LEV I LEV standard}] \text{ for MDVs meeting the LEV I LEV standards for PCs and LDTs 0-3750 lbs. LVW;}$

$1 + \frac{[(\text{MDV SULEV standard} - \text{PC ULEV standard}) \times (\text{Zero-emission VMT Allowance}) \div \text{PC LEV I ULEV standard}] \text{ for MDVs meeting the ULEV I LEV standards for PCs and LDTs 0-3750 lbs. LVW.}$

3.1.2.2 A manufacturer that fails to produce and deliver for sale in California the equivalent quantity of MDVs certified to LEV, ULEV and/or SULEV exhaust emission standards, shall receive “Vehicle-Equivalent Debits” (or “VEDs”) equal to the amount of negative VECs determined by the aforementioned equation.

3.1.2.3 Only ZEVs certified as MDVs and not used to meet the ZEV requirement shall be included in the calculation of VECs.

3.1.2.4 For a manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), all such 2005 and subsequent model year engines used in MDVs, including those produced by a small volume manufacturer, shall be subject to the emissions averaging provisions applicable to heavy-duty diesel or Otto-cycle engines as set forth in the “California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines,” or the “California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines, incorporated by reference in title 13, CCR, §1956.8(b) or (d), as applicable.

3.1.3 Procedure for Offsetting NMOG Debits.

3.1.3.1 A manufacturer shall equalize emission debits by earning g/mi NMOG emission credits or VECs in an amount equal to the g/mi NMOG debits or VEDs, or by submitting a commensurate amount of g/mi NMOG credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. For 2001 through 2003 and for 2007 and subsequent model years, manufacturers shall equalize emission debits by the end of the following model year. For 2004 through 2006 model years, a manufacturer shall equalize NMOG debits for PCs and LDTs and LEV II MDVs within three model years and prior to the end of the 2007 model year. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code §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 §43211, the number of passenger cars and light-duty trucks 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 and LDTs 3751 lbs. LVW - 8500 lbs. GVW applicable for the model year in which the debits were first incurred and the number of medium-duty vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

3.1.3.2 The emission credits earned in any given model year shall retain full value through the subsequent model year. The 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, shall be 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.

3.2 Calculation of Greenhouse Gas Credits/Debits.

3.2.1 Calculation of Greenhouse Gas Credits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

3.2.1.1 In the 2000 through 2008 model years, a manufacturer that achieves fleet average Greenhouse Gas values lower than the fleet average Greenhouse Gas requirement applicable to the 2012 model year shall receive credits for each model year in units of g/mi Greenhouse Gas determined as:

$$\begin{aligned} & \frac{[(\text{Fleet Average Greenhouse Gas Requirement for the 2012 model year}) \\ & \quad - (\text{Manufacturer's Fleet Average Greenhouse Gas Value})]}{\text{x (Total No. of Vehicles Produced and Delivered for Sale} \\ & \quad \text{in California, Including ZEVs and HEVs).} \end{aligned}$$

3.2.1.2 In 2009 and subsequent model years, a manufacturer that achieves fleet average Greenhouse Gas values lower than the fleet average Greenhouse Gas requirement for the corresponding model year shall receive credits in units of g/mi Greenhouse Gas determined as:

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

3.2.2 A manufacturer with 2009 and subsequent model year fleet average Greenhouse Gas values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi Greenhouse Gas equal to the amount of negative credits determined by the aforementioned equation. For the 2009 and subsequent model years, the total g/mi Greenhouse Gas credits or debits earned for PCs and LDT1s and for LDT2s and MDPVs shall be summed together. The resulting amount shall constitute the g/mi Greenhouse Gas credits or debits accrued by the manufacturer for the model year.

3.2.3 Procedure for Offsetting Greenhouse Gas Debts.

3.2.3.1. A manufacturer shall equalize Greenhouse Gas emission debits by earning g/mi Greenhouse Gas emission credits in an amount equal to the g/mi Greenhouse Gas debits, or by submitting a commensurate amount of g/mi Greenhouse Gas credits to the Executive Officer that were earned previously or acquired from another manufacturer. ~~For 2012 and for 2016 and subsequent model years, manufacturers shall equalize emission debits by the end of the following model year. For the 2009, 2010, and 2011 model years, a manufacturer shall equalize Greenhouse Gas debits for PCs, LDTs, and MDPVs within four model years and prior to the end of the 2013 model year. For the 2013, 2014, and 2015 model years, a~~ A manufacturer shall equalize Greenhouse Gas debits for PCs, LDTs, and MDPVs within ~~four~~ five model years after they are earned ~~and prior to the end of the 2017 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 passenger cars and LDT1s not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year by the g/mi Greenhouse Gas fleet average requirement for PCs and LDTs 0-3750 lbs. LVW applicable for the model year in which the debits were first incurred and the number of LDT2s and MDPVs not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year by the g/mi Greenhouse Gas fleet average requirement for LDTs 3751 lbs. LVW – 8500 lbs. GVW and MDPVs applicable for the model year in which the debits were first occurred.

3.2.3.2 Greenhouse Gas emission credits earned in the 2000 through 2008 2011 model years shall be treated as if they were earned in the 2011 model year and shall retain full value through the 2012 model year. Greenhouse Gas emission credits earned in the 2012 through 2015 model years shall be treated as if they were earned in the 2015 model year and shall retain full value through the 2016 model year. Greenhouse Gas emission credits earned in the 2016 2009 and subsequent model years shall retain full value through the subsequent fifth model year after they are earned. The value of any credits earned in the 2000 through 2008 2011 model years that not used to equalize debits accrued in the 2009 through 2012 model years shall be discounted by 50% at the beginning of the 2013 2014 model year, shall be discounted to 25% of its original value if not used by the beginning of the 2014 2015 model year, and will have no value if not used by the beginning of the 2015 2016 model year. The value of any credits earned in the 2012 through 2015 model years that not used to equalize debits accrued in the 2012 through 2016 model years shall be discounted by 50% at the beginning of the 2018 model year, shall be discounted to 25% of its original value if not used by the beginning of the 2019 model year, and will have no value if not used by the beginning of the 2020 model year. Any credits earned in the 2009 2016 and subsequent model years that are not used to equalize the previous model year's debit by the end of the fifth model year after they are accrued shall be discounted by 50% at the beginning of the sixth second model year after being earned, shall be discounted to 25% of its original value if not used by the beginning of the seventh third model year after being earned, and will have no value if not used by the beginning of the eighth fourth model year after being earned.

4. Intermediate In-Use Compliance Standards.

4.1 LEV I Intermediate In-Use Compliance Standards.

4.1.1 LEV I ULEV Standards. For 2001 and 2002 model year PCs and LDTs certified to the ULEV standards in Section E.1.1.1, including fuel-flexible, and dual-fuel vehicles when operating on an available fuel other than gasoline, the following intermediate in-use standards shall apply:

| Vehicle Type | Durability Vehicle Basis (miles) | Intermediate In-Use Compliance Standards (g/mi) | | |
|---------------------------|----------------------------------|---|-----|-----|
| | | NMOG | CO | NOx |
| PCs, 0-3750 lbs. LVW LDTs | 50,000 | 0.055 | 2.1 | 0.3 |
| | 100,000 | 0.075 | 3.4 | 0.4 |
| 3751-5750 lb. LVW LDTs | 50,000 | 0.070 | 2.8 | 0.5 |
| | 100,000 | 0.100 | 4.4 | 0.7 |

4.1.2 **LEV I Standards for MDVs.** The following intermediate in-use compliance standards for 50,000 miles and 120,000 miles for MDVs from 3751-14,000 lbs. ALVW certified to the LEV I standards in Section E.1.1.1, including fuel-flexible, bi-fuel and dual-fuel vehicles when operating on an available fuel other than gasoline, shall apply for the specified model years only. In-use compliance with standards beyond 50,000 miles shall be waived through the 2001 model year for SULEVs.

| Intermediate In-Use Compliance Standards * | | | | | | | | | | |
|--|--------------|-------------------------------|----------------|-----|------------------|------|------------------|------|--------------------|-----|
| (in grams per mile) | | | | | | | | | | |
| Emission Category | Model Year | Durability Vehicle Basis (mi) | 3751-5750 lbs. | | 5751 - 8500 lbs. | | 8501-10,000 lbs. | | 10,001-14,000 lbs. | |
| | | | NMOG | NOx | NMOG | NOx | NMOG | NOx | NMOG | NOx |
| ULEV | -2002 | 50,000 | 0.128 | -- | 0.156 | -- | 0.184 | -- | 0.240 | -- |
| | -2002 | 120,000 | 0.160 | -- | 0.195 | -- | 0.230 | -- | 0.300 | -- |
| SULEV | through 2002 | 50,000 | 0.072 | 0.3 | 0.084 | 0.45 | 0.100 | 0.5 | 0.130 | 0.7 |
| | 2002 | 120,000 | 0.100 | 0.4 | 0.117 | 0.6 | 0.138 | 0.65 | 0.180 | 1.0 |

* Dashes mean that the standards in Section E.1.1 apply.

4.1.3 **Intermediate In-Use Compliance Standards for Fuel-Flexible, Bi-Fuel and Dual-Fuel Medium-Duty LEV I SULEVs Operating on Gasoline.** For fuel-flexible, bi-fuel and dual-fuel 2001 model year MDV SULEVs operating on gasoline, the following intermediate in-use compliance standards for NMOG emissions at 50,000 miles, apply:

| Fuel-Flexible, Bi-Fuel and Dual-Fuel MDVs Intermediate In-Use Compliance Standards | | |
|---|---------------------------|---------------|
| Test Weight (lbs.) | Vehicle Emission Category | 50,000 (g/mi) |
| 3751-5750 | SULEV | 0.128 |
| 5751-8500 | SULEV | 0.156 |
| 8501-10,000 | SULEV | 0.184 |
| 10,001-14,000 | SULEV | 0.240 |

Compliance with the standards beyond 50,000 miles shall be waived for the 2001 model year for SULEVs.

4.2 Intermediate LEV II In-Use Compliance Standards.

For test groups certified prior to the 2007 model year, the following intermediate in-use compliance standards shall apply for the first two model years the test group is certified to the new standard. For SULEVs certified prior to the 2004 model year, the following intermediate in-use compliance SULEV standards shall apply through the 2006 model year.

| Emission Category | Durability Vehicle Basis | LEV II PCs and LDTs | | LEV II MDVs 8501 - 10,000 lbs. GVW |
|-------------------|--------------------------|---------------------|-----------------|--|
| | | NMOG | NO _x | NO _x |
| LEV/ULEV | 50,000 | n/a | 0.07 | n/a |
| | 120,000 | n/a | 0.10 | 0.3 |
| | 150,000 | n/a | 0.10 | 0.3 |
| LEV, Option 1 | 50,000 | n/a | 0.10 | n/a |
| | 120,000 | n/a | 0.14 | n/a |
| | 150,000 | n/a | 0.14 | n/a |
| SULEV | 120,000 | 0.020 | 0.03 | 0.15 |
| | 150,000 | 0.020 | 0.03 | 0.15 |

5. Reactivity Adjustment Factors.

A reactivity adjustment factor is the ratio of the specific reactivity of a low-emission vehicle designed to operate on a fuel other than conventional gasoline (including a fuel-flexible, bi-fuel or dual-fuel vehicle when operating on any fuel other than conventional gasoline) compared to the NMOG baseline specific reactivity of vehicles in the same vehicle emission category operating on conventional

gasoline. The procedure for determining compliance with the standard is set forth in Section H.1.1 of these test procedures.

5.1 The following specific reactivity values and generic reactivity adjustment factors have been established pursuant to the criteria established in Part II.D. of these test procedures. A manufacturer requesting to certify to existing standards utilizing an adjustment factor unique to its vehicle/fuel system must follow the data requirements described in Part II, Section D of these test procedures.

5.1.1 The following reactivity adjustment factors apply:

| | Passenger Cars and Light-Duty Trucks | | | Medium-Duty Vehicles | |
|--------------------------------------|---|--------|--------|----------------------|--------|
| | TLEV | LEV | ULEV | LEV | ULEV |
| Fuel* | Baseline Specific Reactivity (grams ozone / gram NMOG) | | | | |
| Conventional Gasoline | 3.42 | 3.13 | 3.13 | 3.13 | 3.13 |
| | Reactivity Adjustment Factors | | | | |
| RFG (through the 2003 model year) | 0.98 | 0.94 | 0.94 | 0.94 | 0.94 |
| M85 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| Natural Gas | 1.0 | 0.43 | 0.43 | 0.43 | 0.43 |
| LPG | 1.0 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Methane Reactivity Adjustment Factors | | | | |
| Natural Gas | 0.0043 | 0.0047 | 0.0047 | 0.0047 | 0.0047 |

* The fuel specifications are set forth in Part II. section A.100.3 (reformulated gasoline, M85, CNG and LPG) and Part I.D. (conventional gasoline specification) of these test procedures.

6. Severability. Each provision of these standards and test procedures is severable, and in the event that any provision of these standards and test procedures is held to be invalid, the remainder of the standards and test procedures remains in full force and effect.

F. Requirements and Procedures for Durability Demonstration

1. §86.1820 Durability group determination.

1.1 §86.1820-01 [No change.]

2. §86.1821 Evaporative/refueling emission family determination.

[Delete. (The provisions of this section are set forth in the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles,” and “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”)]

3. §86.1822 Durability data vehicle selection. [No change.]

4. §86.1823 Durability demonstration procedures for exhaust emissions.

4.1 §86.1823-01 October 6, 2000. [No change.]

4.2 **SFTP.** These procedures are not applicable to vehicles certified to the SFTP standards set forth in Section E.1.2.2.

4.3 **HEVs.** A manufacturer shall consider expected customer usage as well as emissions deterioration when developing its durability demonstration for HEVs.

5. §86.1824 Durability demonstration procedures for evaporative emissions.

[Delete. (The provisions of this section are set forth in the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles.”)]

6. §86.1825 Durability demonstration procedures for refueling emissions.

[Delete. (The provisions of this section are set forth in the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”)]

7. §86.1826 Assigned Deterioration Factors for Small Volume Manufacturers and Small Volume Test Groups.

7.1 §86.1826-01. October 6, 2000. [No change.]

G. Procedures for Demonstration of Compliance with Emission Standards

1. §86.1827 Test Group Determination.

1.1 §86.1827-01. October 6, 2000. [No change.]

2. §86.1828 Emission data vehicle selection

2.1 §86.1828-01. [No change.]

2.2 50°F Requirements.

2.2.1 Vehicle Selection. A manufacturer shall select at least three emission data and/or engineering development vehicles each year from PC or LDT test groups and at least three emission data and/or engineering development vehicles from MDV test groups.

2.2.2 The same test group shall not be selected in the succeeding two years unless the manufacturer produces fewer than three test groups. If the manufacturer produces more than three TLEV, LEV, ULEV or SULEV test groups per model year, the Executive Officer may request 50°F testing of specific test groups. If the manufacturer provides a list of the TLEV, LEV, ULEV and SULEV test groups that it will certify for a model year and provides a description of the technologies used on each test group (including the information in Section G.2.1.2(1)), the Executive Officer shall select the test groups subject to 50°F testing within a 30 day period after receiving such a list and description. The Executive Officer may revise the test groups selected after the 30 day period if the information provided by the manufacturer does not accurately reflect the test groups actually certified by the manufacturer.

2.3 Greenhouse Gas Vehicle Test Group.

2.3.1 Within each test group, a manufacturer shall group vehicles into Greenhouse Gas Vehicle Test Groups based on the following criteria being identical.

- (a) Vehicle make and model;
- (b) Transmission class and driveline;
- (c) Aspiration method (e.g., naturally aspirated, turbocharged);
- (d) Camshaft configuration;
- (e) Valvetrain configuration; and
- (f) Inertia weight class.

2.3.2 Greenhouse Gas Emission Test Vehicle Selection. Within each test group, the vehicle configuration shall be selected from the greenhouse gas vehicle test group that is expected to be “worst-case” for greenhouse gas emissions, as calculated in Section E.2.5.2.1, subject to approval by the Executive Officer. A manufacturer may select additional vehicle configurations from greenhouse gas vehicle test groups with lower greenhouse emissions values than the “worst-case” configuration.

3. §86.1829 Durability data and emission data testing requirements; waivers.

3.1 §86.1829-01. July 12, 2001. Amend as follows:

3.1.1 Delete (b)(1)(ii) and replace with: For Otto-cycle vehicles or hybrid vehicles that 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 an elevation of 6000 feet. For fuel injected vehicles or hybrid electric vehicles that use fuel-injected engines, compliance may be demonstrated upon a showing by the manufacturer that the fuel injection system distributes fuel based on mass air 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 that meet all the applicable California low altitude emission standards when tested at the EPA test elevation are deemed to be in compliance. The SFTP standards do not apply to testing at high altitude.

3.1.2 (b)(1)(iii)(E) [No change, except that references to Tier 2 or interim non-Tier 2 vehicles shall mean California LEVs, ULEVs or SULEVs.]

3.1.3 Amend (b)(4)(i) as follows: All 2001 and subsequent model-year emission-data vehicles shall be required to be tail-pipe tested at 4,000 miles or at the mileage at which the vehicle is stabilized as determined in §86.1827-01 and demonstrate compliance with the California Inspection and Maintenance (“I/M”) emission standards as specified in the “Mandatory Exhaust Emissions Inspection Standards and Test Procedures,” title 16, California Code of Regulations, Section 3340.42. A manufacturer shall have the option of using the I/M test procedures in place at the time of certification or, if the I/M test procedures have been amended within two years of the time of certification, a manufacturer may use the preceding procedures. 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 practices, attest that such test vehicles will meet the requirements of this section when preconditioned and tested at ambient temperatures from 35° to 68° F.

3.1.4 Amend (b)(4)(ii) as follows: In lieu of testing vehicles according to the provisions of §86.1829(b)(4)(i), a manufacturer may provide a statement in its application for certification that, based on the manufacturer's engineering evaluation of such I/M testing as the manufacturer deems appropriate, all light-duty vehicles and light-duty trucks comply with the I/M emission standards.

3.1.5 Delete (b)(5). Idle CO Testing.

3.2 50°F Requirements.

A manufacturer shall demonstrate compliance with the 50°F 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) as determined under the provisions of Section G.2.2 of these test procedures. Only

TLEVs, LEVs, ULEVs and SULEVs 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.

3.3 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 40 CFR §86.1823, and then rounded and compared with the standard as set forth in Section E.1.1 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. In the event that one or more of the manufacturer's emission data vehicles fail the HWFET standard listed in Section E of these test procedures, 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.

3.4 Greenhouse Gas Testing Requirements.

A manufacturer shall demonstrate compliance with the greenhouse requirements each year by testing one vehicle per each test group that represents the vehicle configuration that is expected to be “worst-case” for greenhouse gas emissions, as calculated in Section E.2.5.2.1, subject to approval by the Executive Officer. A manufacturer may test additional vehicles within the test group that represent vehicle configuration with lower greenhouse gas emissions values than the “worst-case” configuration. All vehicles shall be tested using both the FTP and Highway Test Procedures as modified in Part II of these test procedures.

4. **§86.1830-01 Acceptance of Vehicles for Testing** [No change.]
5. **§86.1831-01 Mileage accumulation requirements for test vehicles.** [No change.]
6. **§86.1832-01 Optional equipment and air conditioning.** [No change.]
7. **§86.1833-01 Adjustable parameters.** [No change.]
8. **§86.1834 Allowable maintenance.**

8.1 §86.1834-01. October 6, 2000. [No change except that the first allowable maintenance interval under subparagraphs (b)(3)(v) and (b)(4)(ii) shall be at the full useful life of the vehicle.]

8.2 HEVs.

(a) The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light that 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; and (iv) other parameters critical for determining battery condition.

(b) The manufacturer shall equip “off-vehicle charge capable HEVs” with a useful life indicator for the battery system consisting of a light that 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 Urban Driving Schedule portion of the All-Electric Range Test (see the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR).

9. §86.1835-01 Confirmatory certification testing. July 12, 2001. [No change.]

10. §86.1836-01 Manufacturer-supplied production vehicles for testing. [Delete.]

11. §86.1837 Rounding of emission measurements.

11.1 §86.1837-01 February 10, 2000. [No change.]

11.2 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.

12. §86.1838 Small volume manufacturers certification procedures.

12.1 §86.1838-01. ~~February 10, 2000~~ December 6, 2002. [No change, except that the reference to 15,000 units shall mean 4,500 units in California and the reference to 14,999 units shall mean 4,499 units in California.]

13. §86.1839-01 Carryover of certification data. [No change.]

13.1 Greenhouse Gas Requirements.

The provisions of Section E.13 shall apply to greenhouse gas certification data only if the following conditions are met.

(a) To carry over greenhouse gas certification data for a greenhouse gas vehicle group, a manufacturer must demonstrate to the Executive Officer, using good engineering judgement, that design changes to the vehicle from the previous model year do not increase greenhouse gas emissions or

(b) To carry over greenhouse gas certification data for a “worst-case” vehicle configuration, a manufacturer must demonstrate to the Executive Officer, using good engineering judgement, that the previous model-year “worst-case” vehicle configuration still represents the “worst-case” vehicle configuration for the current model-year.

14. §86.1840 Special test procedures.

14.1 §86.1840-01 October 6, 2000. [No change.]

H. Certification, Information and Reporting Requirements.

1. §86.1841 Compliance with emission standards for the purpose of certification

1.1 §86.1841-01. July 12, 2001.

1.1.1 Subparagraph (a) through (d) [No Change.]

1.1.2 Delete subparagraph (e) and replace with: **Reactivity Adjustment Factors.** The NMOG emission results from all TLEVs, LEVs, ULEVs and SULEVs certifying on a fuel other than conventional gasoline, shall be numerically adjusted to establish an NMOG exhaust mass emission value equivalent. A manufacturer shall multiply the NMOG exhaust emission result for each emission-data vehicle by the appropriate reactivity adjustment factor listed in Section E.5. of these test procedures or established by a manufacturer pursuant to Part II, Section D of these test procedures. This product shall be multiplied by, or added to in the case of additive DFs, the applicable deterioration factor to determine compliance with the standard. Reactivity adjustment factors may not be applied to determine compliance with applicable exhaust emission standards for gasoline vehicles certified pursuant to Section D.1.(p) of these test procedures.

1.1.3 For vehicles operating on natural gas, the product of the methane mass emission value and the methane reactivity adjustment factor shall be add to the result of subparagraph 1.1.2. This result shall be compared to the NMOG exhaust emission standards to determine compliance with the standards.

1.2 **Scope of Certification.** Certification, if granted, is effective only for the vehicle/test group 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.

1.3 **SFTP.** For vehicles certified to the SFTP standards in Section E.1.2.2, full and intermediate useful life shall mean 4,000 miles.

1.4 **Certification of a Federal Vehicle in California.** Whenever a manufacturer federally-certifies a 2004 or subsequent model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as

the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. A California vehicle model is to be treated as equivalent to a federal vehicle model if all of the following characteristics are identical:

- (a) Vehicle make and model;
- (b) Cylinder block configuration (e.g., L-6, V-8);
- (c) Displacement;
- (d) Combustion cycle;
- (e) Transmission class;
- (f) Aspiration method (e.g., naturally aspirated, turbocharged); and
- (g) Fuel (e.g., gasoline, natural gas, methanol).

The comparative stringency of the standards for the federal exhaust emissions bin and for the California vehicle emissions category shall be based on a comparison of the sum of the 100,000, 120,000, or 150,000 mile standards for NMOG and NO_x.

1.4.1 If a federally-certified vehicle model is certified in California in accordance with subparagraph 1.4, the model shall be subject to the federal requirements for exhaust emissions, SFTP emissions, cold CO emissions and highway NO_x. The vehicle model shall be subject to all other California requirements including evaporative emissions, OBD II, greenhouse gas emissions, and emissions warranty, except that a 2004 or earlier model-year vehicle in the federal heavy light-duty truck or medium-duty passenger vehicle classes may at the manufacturer's option be subject to the federal requirements for evaporative emissions and OBD II.

1.4.2 Prior to certification of a 2004 or subsequent model-year vehicle, a manufacturer must submit information sufficient to enable the Executive Officer to determine whether there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model based on the criteria listed in subparagraph 1.4.

1.4.3 If the Executive Officer determines that there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model, the following information shall be submitted with the Part I or Part II Application for Certification as set forth below:

- (a) Part I Application for Certification: (i) Evidence of federal certification including, but not limited to, federal certification exhaust emission levels and compliance with federal SFTP, cold CO and highway NO_x emission levels; and (ii) evidence of compliance with California evaporative emission requirements, ~~and~~ California OBD II requirements, and California greenhouse gas requirements or, where permitted under Section 1.4.1 for a 2004 or earlier model-year vehicle, evidence of federal certification evaporative emission levels and compliance with federal OBD II requirements.

(b) Part II Application for Certification: evidence of a warranty on emission-related parts in accordance with sections 2035 et seq., title 13 CCR as they apply to vehicles certified under the primary California standard.

1.4.4 For purposes of meeting the California NMOG fleet average phase-in requirements or for determining vehicle equivalent credits, the applicable California NMOG value for passenger cars and light-duty trucks or vehicle equivalent credits for medium-duty vehicles shall be determined as follows:

(a) The sum of the federal full useful life (100,000, 120,000 or 150,000) NMOG and NO_x value shall be compared with the next less stringent California full useful life NMOG plus NO_x value to determine which emission category (e.g., LEV, ULEV or SULEV) is to be used for the fleet average value or vehicle equivalent credit calculation.

(b) For passenger cars and light-duty trucks, once the equivalent California emission category is determined (e.g., whether the vehicle is considered a LEV, ULEV or SULEV), the applicable NMOG value to be used in the fleet average calculation is set forth in the table in section E.2.1.2 of these test procedures for passenger cars and light-duty trucks. For example, if the full useful life (120,000 miles) NMOG plus NO_x standard to which the federal vehicle is certified is 0.110 grams per mile, that vehicle would be considered a LEV II ULEV for fleet average purposes because the combined LEV full useful life NMOG plus NO_x value is 0.125 and is the next less stringent emission category. The applicable emission standard to be used in the fleet average calculation would therefore be 0.040 grams per mile.

1.4.5 The vehicle shall be subject to the federal in-use requirements and the emission standard applicable for in-use compliance purposes shall be the federal standard to which the vehicle was federally-certified.

1.4.6 The tune up label shall meet the federal requirements applicable to such a vehicle with an additional sentence which reads: "This vehicle conforms to federal regulations and is certified for sale in California." The value used in the smog index label shall be the California emission category to which the vehicle was deemed certified for fleet average NMOG purposes.

1.4.7 The requirements in Section H.1.4 do not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirements a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

1.4.8 A manufacturer may certify a passenger car, light-duty truck or medium-duty vehicle to federal exhaust emission standards pursuant to Section H.1.4 prior to the 2004 model year.

2. §86.1842 Addition of a vehicle after certification; and changes to a vehicle covered by certification.

2.1 §86.1842-01. Amend as follows: Add the following sentence: Changes proposed by a manufacturer in accordance with this section shall be deemed “approved” after 30 days unless the Executive Officer has requested additional information from the manufacturer or has denied the proposed changes.

3. §86.1843 General information requirements

3.1 §86.1843-01 [No change.]

3.2 Alternative Fuel Information.

For TLEVs, LEVs, ULEVs, and SULEVs not certified exclusively on gasoline or diesel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the vehicles are certified.

3.3 Credit Reporting.

In order to verify the status of a manufacturer's compliance with the fleet average, ~~or~~ phase-in requirements, or greenhouse gas requirements for a given model year, and in order to confirm the accrual of 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.

3.4 SFTP.

Prior to 2003 model year, a manufacturer that introduces MDVs certified to the SFTP requirements set forth in E1.2.2 must submit the implementation information required for vehicles produced in subsequent model years.

4. §86.1844 Information Requirements: Application for Certification and Submittal of Information Upon Request.

4.1 §86.1844-01. October 6, 2000. Amend as follows:

4.1.1 All references to “test group” shall mean “test group and greenhouse gas vehicle group.”

4.1.2 Modify §86.1844-01(d) as follows:

(a) Delete §86.1844-01(d)(9).

(b) Add the following requirement: A description of each greenhouse gas test vehicle including the criteria listed in Section G.2.3. and any additional information used by a manufacturer to demonstrate a “worst-case” vehicle configuration used to comply with the requirements of Section G.2.3.

4.1.3~~2~~ Add the following requirements to §86.1844-01(e):

(a) The information required in sections 2037, 2038 and 2039, title 13, CCR.

(b) The NMOG/NMHC and/or formaldehyde to NMHC ratios established according to Section I.1.4 of these test procedures

4.2 OBD Requirements.

For 2001 and subsequent model-year passenger cars, light-duty trucks and medium-duty vehicles, information shall be submitted in the application for certification according to the requirements of section 1968, et seq., title 13, CCR, as applicable.

4.3 **HEVs.**

For HEVs, the information required in the “California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as incorporated by reference in section 1962, title 13, CCR, must be supplied with the Part I application for certification.

4.4 **Fuel-Fired Heaters.**

For vehicles that use fuel-fired heaters, the manufacturer shall provide with the Part I application for certification:

- (a) 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;
- (b) the exhaust emissions value per mile produced by the auxiliary fuel-fired heater operated between 68°F and 86°F; and
- (c) the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

I. In-Use Compliance Requirements and Procedures

1. §86.1845 Manufacturer in-use verification testing requirements.

1.1 §86.1845-01. October 6, 2000. Amend as follows:

1.1.1 Table S01-5 California Small Volume Manufacturers and Small Volume Test Groups

| | | |
|--|-----------|-------------|
| California only test group annual sales ⁽¹⁾ | 1-1,500 | 1,501-4,500 |
| High Mileage | voluntary | 2 |

⁽¹⁾ Total annual production of groups eligible for testing under small volume sampling plan is capped at a maximum of 4,500 California-only production volume per model year, per large volume manufacturer. All other remaining large volume manufacturers small volume test groups shall meet the requirements in Table S01-06 below.

1.1.2 Table S01-6 - California Large Volume Manufacturers

| | | | |
|---|--------------|---------------|---------|
| California only test group - annual sales | 4,500-15,000 | 15,001-25,000 | >25,000 |
| High Mileage | 4 | 5 | 6 |

1.1.3 **High Mileage Testing.** Amend subparagraph (c)(2) of 40 CFR §86.1845-01 to read: All test vehicles must have a minimum odometer mileage of 50,000 miles. At least one vehicle of each test group certified to the emission standards in Section E.1.1.1 must have a minimum age and odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. At least one vehicle of each test group certified to the 120,000-mile and 150,000-mile emission standards in Section E.1.1.2 must have a minimum age and odometer mileage of 90,000 miles and 112,500 miles, respectively. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

1.1.4 **High Altitude Testing.** Amend subparagraph (c)(5)(i) of 40 CFR §86.1845-01 to read: Each test vehicle shall be tested in accordance with the Federal Test Procedure and the US06 portion of the Supplemental Federal Test Procedure (if applicable) as described in subpart B of this part, when such test vehicle is tested for compliance with the applicable exhaust emission standards under this subpart. High altitude testing shall not apply.

1.2 §86.1845-04. July 12, 2001. Amend as follows:

1.2.1 Table S04-5 California Small Volume Manufacturers and Small Volume Test Groups

| California only test group annual sales ⁽¹⁾ | 1-1,500 | 1,501-4,500 |
|--|-----------|-------------|
| Low Mileage | Voluntary | 0 |
| High Mileage | Voluntary | 2 |

⁽¹⁾ Total annual production of groups eligible for testing under small volume sampling plan is capped at a maximum of 4,500 California-only production volume per model year, per large volume manufacturer. All other remaining large volume manufacturers small volume test groups shall meet the requirements in Table S04-06 below.

1.2.2 Table S04-6 - California Large Volume Manufacturers

| California only test groups - annual sales | 4,500-15,000 | 15,001-25,000 | >25,000 |
|--|--------------|---------------|---------|
| Low Mileage | 2 | 3 | 4 |
| High Mileage | 4 | 5 | 6 |

1.2.3 High Mileage Testing. Amend subparagraph (c)(2) of 40 CFR §86.1845-04 to read as follows: All test vehicles must have a minimum odometer mileage of 50,000 miles. At least one vehicle of each test group certified to the emission standards in Part I, Section E.1.1.1 of these procedures must have a minimum age and odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. At least one vehicle of each test group certified to the emission standards in Part I, Section E.1.1.2 of these test procedures must have a minimum age and odometer mileage of 90,000 miles. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

1.3 SFTP.

The manufacturer in-use verification testing requirements shall not apply to vehicles certified to the SFTP standards set forth in Section E.1.2.2 of these test procedures.

1.4 Test Ratios.

(a) As an alternative to measuring the NMOG content, the Executive Officer may approve, upon submission of supporting data by a manufacturer, the use of NMOG to NMHC ratios. To request the use of NMOG to NMHC ratios, a manufacturer shall establish during certification testing the ratio of measured NMOG exhaust emissions to measured NMHC exhaust emissions for each emission data vehicle for the applicable test group. The results shall

be submitted to the Executive Officer in the Part II application for certification. A manufacturer may conduct in-use testing on the test group by measuring NMHC exhaust emissions rather than NMOG exhaust emissions. After approval by the Executive Officer, the measured NMHC exhaust emissions shall be multiplied by the NMOG to NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. The equivalent NMOG exhaust emission value shall be used in place of the measured NMOG exhaust emission value in determining the reactivity adjusted exhaust NMOG results. The equivalent reactivity adjusted NMOG exhaust emission values shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (TLEV, LEV, ULEV or SULEV) in which the test group was certified.

(b) For fuel-flexible vehicles certified to NMOG standards, the manufacturer may request from the Executive Officer the use of a methanol (M85) or ethanol (E85) NMOG exhaust emission to gasoline NMHC exhaust emission ratio which shall be established during certification testing for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. After approval by the Executive Officer, the measured gasoline NMHC exhaust emissions shall be multiplied by the M85 or E85 NMOG to gasoline NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. The equivalent NMOG exhaust emission value shall be used in place of the measured NMOG exhaust emission value in determining the reactivity adjusted exhaust NMOG results. The equivalent reactivity adjusted NMOG exhaust emission values shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (TLEV, LEV, ULEV, or SULEV) in which the test group was certified.

(c) As an alternative to measuring the HCHO content, the Executive Officer may approve, upon submission of supporting data by a manufacturer, the use of HCHO to NMHC ratios. To request the use of HCHO to NMHC ratios, the manufacturer shall establish during certification testing the ratio of measured HCHO exhaust emissions to measured NMHC exhaust emissions for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. Following approval of the application for certification, the manufacturer may conduct in-use testing on the test group by measuring NMHC exhaust emissions rather than HCHO exhaust emissions. The measured NMHC exhaust emissions shall be multiplied by the HCHO to NMHC ratio submitted in the application for certification for the test group to determine the equivalent HCHO exhaust emission values for the test vehicle. The equivalent HCHO exhaust emission values shall be compared to the HCHO exhaust emission standard applicable to the test group.

1.5 Greenhouse Gas Requirements.

The manufacturer in-use verification testing requirements shall not apply to the greenhouse gas emission requirements set forth in Section E.2.5 of these test procedures.

2. §86.1846 Manufacturer in-use confirmatory testing requirements.

2.1 §86.1846-01 July 12, 2001. [No Change.]

2.2 If a gasoline vehicle test group that is certified according to the provisions of Section D.1 (p) fails in-use verification testing, as set forth in Section I, NMOG and formaldehyde exhaust emissions must be measured for that test group in accordance with Section D.1.1 for the purpose of in-use confirmatory testing.

2.3 **SFTP.**

The manufacturer in-use compliance testing requirements shall not apply to vehicles certified to the SFTP standards set forth in Section E.1.2.2 of these test procedures.

2.4 **Greenhouse Gas Requirements.**

The manufacturer in-use compliance testing requirements shall not apply to the greenhouse gas emission requirements set forth in Section E.2.5 of these test procedures.

3. §86.1847 Manufacturer in-use verification and in-use confirmatory testing; submittal of information and maintenance of records. .

3.1 §86.1847-01 Amend as follows:

3.1.1 Amend subparagraph (a)(3) of 40 CFR §86.1847-01 to add: Procurement documentation. A description of the procurement area, a record of the source(s) of any list(s) of vehicles used as a basis for procurement, and a complete record of the number of vehicles rejected after positive vehicle owner response, reason(s) for manufacturer rejection of each rejected vehicles and the method used for random selection of positive owner response vehicles. A complete record of the number of vehicle owners/lessees in which attempt to contact was made and the number of vehicle owners/lessees actually contacted, the number of owners/lessees not contacted and the reasons and number of each for failure to contact, and the number of owners contacted who declined to participate.

3.1.2 Amend subparagraph (b)(1) of 40 CFR §86.1847-01 to read: A complete printout of each and every emission test performed, including, but not limited to, all test results, the date of each test, the full useful life emission standards to which the test group is certified, and the phase mass values for fuel economy, carbon dioxide and each pollutant measured by the Federal Test Procedure and Supplemental Test Procedure as prescribed by subpart B of this part.

3.1.3 Amend subparagraph (f)(1) of 40 CFR §86.1847-01 to read: A complete printout of each and every emission test performed, including, but not limited to, all test results, the date of each test, the full useful life emission standards to which the test group is certified, and the phase mass values for fuel economy, carbon dioxide and each pollutant measured by the Federal Test Procedure and Supplemental Test Procedure as prescribed by subpart B of this part.

Appendices I, II, and III to §86.1845-01 [No change.]

J. Procedural Requirements

1. §86.1848-01 Certification. October 6, 2000. [No change.]
2. §86.1849-01 Right of entry. [No change.]
3. §86.1850-01 Denial, Suspension or Revocation of Certificate of Conformity. [No change.]
4. §86.1851 Application of good engineering judgment to manufacturers' decisions. [No change.]
5. §86.1852 Waivers for good in-use emission performance. [No change.]
6. §86.1853 Certification hearings. [No change.]
7. §§86.1854 - 86.1859. [Reserved]
8. §86.1860-04 How to comply with the Tier 2 and interim Tier 2 fleet average NOx standards. [n/a]
9. §86.1861-04 How do the Tier 2 and interim Tier 2 NOx averaging, banking and trading programs work? [n/a]
10. §86.1862-04 Maintenance of records and submittal of information relevant to compliance with fleet average NOx standards. [n/a]
11. §86.1863-07 Optional Chassis Certification for Diesel Vehicles. January 18, 2001. [No change]

PART II: CALIFORNIA EXHAUST AND PARTICULATE EMISSION TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

This part describes the equipment required and the procedures necessary to perform gaseous and particulate exhaust emission tests (40 CFR Part 86, Subpart B); cold temperature test procedures (40 CFR Part 86, Subpart C); the California 50°F test procedure; the development of reactivity adjustment factors; and the supplemental federal test procedure (40 CFR Part 86, Subpart B) on passenger cars, light-duty trucks and medium-duty vehicles.

A. 40 CFR Part 86, Subpart B - Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks; Test Procedures.

100.1 General applicability.

- 86.101 General applicability. October 6, 2000.
- 86.102 Definitions. March 5, 1980.
- 86.103 Abbreviations. March 5, 1980.
- 86.104 Section numbering, construction. September 21, 1994.
- 86.105 Introduction; structure of subpart. September 21, 1994.

100.2 Equipment and Facility Requirements.

- 86.106-00 Equipment required; overview. October 22, 1996.
- 86.107-98 Sampling and analytical system, evaporative emissions. August 23, 1995.
- 86.108-00 Dynamometer. October 22, 1996.
- 86.109-94 Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emission measurements. June 30, 1995.
- 86.110-94 Exhaust gas sampling system; diesel-cycle vehicles, and Otto-cycle vehicles requiring particulate emissions measurements. June 30, 1995.
- 86.111-94 Exhaust gas analytical-system. September 30, 1994.
- 86.112-91 Weighing chamber (or room) and microgram balance specifications. June 5, 1991.

100.3 Certification Fuel Specifications.

- 86.113-94 Fuel Specifications. February 18, 2000.
- 86.113-04 Fuel Specifications. February 10, 2000.
- 86.113-07 Fuel Specifications. January 18, 2001.

100.3.1 California Certification Gasoline Specification.

Add the following subparagraph which reads: Gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §86.113-94(a)(1) and in §86.113-04(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.

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

100.3.2 Certification Diesel Fuel Specifications.

100.3.2.1 Certification Diesel Fuel Specifications for the 2001-2006 Model Years.

Amend subparagraphs §86.113-94(b)(2) and (b)(3):

(b)(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 40 CFR §86.113-94(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. 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 40 CFR §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.

| California Certification Diesel Fuel Specifications For the 2001-2006 Model Years | | |
|--|---------------------|-----------------------------------|
| Fuel Property | Limit | Test Method ^(a) |
| Natural Cetane Number | 47-55 | D 613-86 |
| Distillation Range | | §2282(g)(3), title 13, CCR |
| IBP | 340-420 °F | |
| 10% point | 400-490 °F | |
| 50% point | 470-560 °F | |
| 90% point | 550-610 °F | |
| EP | 580-660 °F | |
| API Gravity | 33-39° | D 287-82 |
| Total Sulfur | 0.01-0.05 wt. % | §2282(g)(3), title 13, CCR |
| Nitrogen Content | 100-500 ppmw | §2282(g)(3), title 13, CCR |
| Total Aromatic Hydrocarbons | 8-12 vol. % | §2282(g)(3), title 13, CCR |
| Polycyclic Aromatic Hydrocarbons | 1.4 wt. % (max) | §2282(g)(3), title 13, CCR |
| Flashpoint | 130 °F (max) | D 93-80 |
| Viscosity @ 40°F | 2.0-4.1 centistokes | D 445-83 |

^(a) ASTM specifications unless otherwise noted. A reference to a subsection of §2282, title 13, CCR, means the test method identified in that subsection for the particular property. 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 of the specified method.

(b)(3) Diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

100.3.2.2 Certification Diesel Fuel Specifications for the 2007 and Subsequent Model Years. Amend subparagraphs §86.113-07(b)(2) and (b)(3) as follows:

(b)(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 40 CFR §86.113-07(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. 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 40 CFR §86.113-07(b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of 86.113-94(b)(2) and in §86.113-07(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.

| California Certification Diesel Fuel Specifications For the 2007 and Subsequent Model Years | | |
|--|---------------------|-------------------------------|
| Fuel Property | Limit | Test Method ^(a) |
| Natural Cetane Number | 47-55 | D 613-86 |
| Distillation Range | | §2282(g)(3), title 13, CCR |
| IBP | 340-420 °F | |
| 10% point | 400-490 °F | |
| 50% point | 470-560 °F | |
| 90% point | 550-610 °F | |
| EP | 580-660 °F | |
| API Gravity | 33-39° | D 287-82 |
| Total Sulfur | 7-15 ppm | §2282(g)(3), title 13, CCR |
| Nitrogen Content | 100-500 ppmw | §2282(g)(3), title 13, CCR |
| Total Aromatic Hydrocarbons | 8-12 vol. % | §2282(g)(3), title 13, CCR |
| Polycyclic Aromatic Hydrocarbons | 1.4 wt. % (max) | §2282(g)(3), title 13, CCR |
| Flashpoint | 130 °F (max) | D 93-80 |
| Viscosity @ 40°F | 2.0-4.1 centistokes | D 445-83 |

^(a) ASTM specifications unless otherwise noted. A reference to a subsection of §2282, title 13, CCR, means the test method identified in that subsection for the particular property. 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 of the specified method.

(b)(3) Diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

100.3.3 Alcohol Fuels.

Amend §86.113-94(c) as follows:

1. Delete subparagraphs (c)(1) and (c)(2); replace with:

(c)(1) **Emission test fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust and evaporative emission testing shall meet the specifications set forth in section 2292.1, title

13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

| Specification | Limit |
|--|-------------------------|
| M-100 Fuel Methanol | |
| Methanol | 98.0 ± 0.5 vol. percent |
| Ethanol | 1.0 vol. percent max. |
| Petroleum fuel meeting the specifications of section 100.3.1 | 1.0 ± 0.1 vol. percent |
| E-100 Fuel Ethanol | |
| Ethanol | 98.0 ± 0.5 vol. percent |
| Methanol | 1.0 vol. percent max. |
| Petroleum fuel meeting the specifications of section 100.3.1 | 1.0 ± 0.1 vol. percent |

(c)(2) **Mileage accumulation fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for service accumulation shall meet the applicable specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol).

2. Subparagraph (c)(3) [No Change.]

3. Add the following subparagraph. 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.

100.3.4 Mixtures of Petroleum and Alcohol Fuels for Flexible Fuel Vehicles.

Amend §86.113-94(d) as follows:

1. Delete subparagraphs (d)(1) and (d)(2); replace with:

(d)(1) **Exhaust emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) as modified by the following:

| Specification | Limit |
|---|---|
| M-85 Fuel Methanol | |
| Petroleum fuel meeting the specifications of section 100.3.1. | 13-16 vol. percent |
| Reid vapor pressure | 8.0-8.5 psi, using common blending components from the gasoline stream. |
| E-85 Fuel Ethanol | |
| Petroleum fuel meeting the specifications of section 100.3.1. | 15-21 vol. percent |
| Reid vapor pressure | 8.0-8.5 psi, using common blending components from the gasoline stream. |

(d)(2) **Mileage accumulation fuel.** For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel shall meet the applicable specifications in Part II, Sections A.100.3.1 or 100.3.2 and methanol or ethanol fuel shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specification for E-85 Fuel Ethanol). Mileage accumulation procedures shall be subject to the requirements set forth in 40 CFR §86.1831-01(a) and (b) and are subject to the prior approval of the Executive Officer. A manufacturer shall consider expected customer fuel usage as well as emissions deterioration when developing its durability demonstration.

2. Subparagraph (d)(3) [No Change.]

3. Add the following subparagraphs. **Evaporative emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, a blend of methanol or ethanol fuel used for evaporative emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) and gasoline meeting the specifications of Part II section A.100.3.1 of these test procedures such that the final blend is composed of either 35 volume percent methanol (± 1.0 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (± 1.0 volume percent of total blend) for ethanol-fueled vehicles. 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 prior approval of the Executive Officer.

Additive requirements. 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.

100.3.5 Natural Gas Fuels.

Amend §86.113-94(e) as follows:

1. Delete subparagraphs (e)(1), (e)(2) and (e)(3); replace with:

(e)(1) **Exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas) as modified by the following:

| Specification | Limit |
|---|--------------------------|
| Compressed Natural Gas Certification Test Fuel | |
| Methane | 90.0 ± 1.0 mole percent |
| Ethane | 4.0 ± 0.5 mole percent |
| C ₃ and higher hydrocarbon content | 2.0 ± 0.3 mole percent |
| Oxygen | 0.5 mole percent maximum |
| Inert gases (CO ₂ + N ₂) | 3.5 ± 0.5 vol. percent |

(e)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for service accumulation shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas).

100.3.6 Liquefied Petroleum Gas Fuels.

Amend §86.113-94(f) as follows:

1. Delete subparagraphs (f)(1) and (f)(2); replace with:

(f)(1) **Evaporative and exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas) as modified by the following:

| Specification | Limit |
|--|---------------------------|
| Liquefied Petroleum Gas Certification Test Fuel | |
| Propane | 93.5 ± 1.0 volume percent |
| Propene | 3.8 ± 0.5 volume percent |
| Butane and heavier components | 1.9 ± 0.3 volume percent |

(f)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for service accumulation shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas).

2. Subparagraph (f)(3). [No Change.]

100.3.7 §86.113-94(g). [No Change.]

100.3.8 §86.113-07(h). [No Change.]

100.3.9 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 86.113-94 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), NO_x, 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," as adopted September 17, 1993. 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 sold commercially in California.

86.114-94 Analytical gases. June 30, 1995.

86.115-00 EPA urban dynamometer driving schedules. October 22, 1996.

100.4 Calibration methods and frequency.

86.116-94 Calibrations, frequency and overview. June 30, 1995.

86.117-96 Evaporative emission enclosure calibrations. August 23, 1995.

86.118-00 Dynamometer calibrations. October 22, 1996.

86.119-90 CVS calibration. February 18, 2000.

- 86.120-94 Gas meter or flow instrumentation calibration, particulate, methanol and formaldehyde measurement. June 30, 1995.
- 86.121-90 Hydrocarbon analyzer calibration. June 30, 1995.
- 86.122-78 Carbon monoxide analyzer calibration. June 28, 1977.
- 86.123-78 Oxides of nitrogen analyzer calibration. June 30, 1995.
- 86.124-78 Carbon dioxide analyzer calibration. June 28, 1977.
- 86.125-94 Methane analyzer calibration. June 5, 1991.
- 86.126-90 Calibration of other equipment. April 11, 1989.

100.5 Test Procedures and Data Requirements.

- 86.127-00 Test procedures; overview. May 4, 1999.
- 86.128-00 Transmissions. October 22, 1996.
- 86.129-00 Road load power, test weight, inertia weight class determination, and fuel temperature profile. October 6, 2000.

100.5.1 California Road Load Power, Test Weight and Inertia Weight Class Determination.

100.5.1.1 Amend §86.129-00(b) to add the following specifications for medium-duty vehicles:
Power absorption unit adjustment- medium-duty vehicles.

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 miles per hour 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.

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

$$H_p = (0.00182)V((0.015)(W)+(0.0375)(C_d)(A)(V^2)/(32.2\text{ft/s}^2))+P$$

where:

H_p = the dynamometer power absorber setting at 50 mph (horsepower).

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.

C_d = 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 §86.1828-01, the road load power as determined in paragraph (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.

86.130-00 Test sequence; general requirements. October 22, 1996.

100.5.2 California test sequence; general requirements.

100.5.2.1 Delete subparagraph (a) of §86.130-00 and replace with:

For purposes of determining conformity with 50°F test requirements, the procedures set forth in Part II, Section C. For all hybrid electric vehicles and all 2001 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.

100.5.2.2 Add the following:

A manufacturer has the option of simulating air conditioning operation during testing at other ambient test conditions provided it can demonstrate that the vehicle tailpipe exhaust emissions are representative of the emissions that would result from the SC03 cycle test procedure and the ambient conditions of paragraph 86.161-00. The Executive Officer has approved two optional air conditioning test simulation procedures, AC1 and AC2, for the 2001 to 2003 model years only. If a manufacturer desires to conduct an alternative SC03 test simulation other than AC1 and AC2, or the AC1 and AC2 simulations for the 2004 and subsequent model years, the simulation test procedure must be approved in advance by the Executive Officer (see paragraphs 86.162-00 and 86.162-03).

100.5.2.1 Greenhouse Gas Requirements.

For the purpose of determining conformity with greenhouse gas fleet average requirements, the CO₂, CH₄, and N₂O emissions from all passenger cars, light-duty trucks and medium-duty passenger vehicles shall be measured in accordance with the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86, as modified in Part II of these test procedures. Emissions shall be measured using both the EPA Urban Dynamometer Driving Schedule as set forth in Appendix I to Part 86, 40 CFR to

determine “City” emission values and the Highway Driving Schedule as set forth in Part II Section F of these test procedures to determine “Highway” emission values.

86.131-00 Vehicle preparation. October 22, 1996.

86.132-00 Vehicle preconditioning. October 22, 1996.

100.5.3 California Vehicle Preconditioning Requirements.

100.5.3.1 Add the following subparagraph: For all hybrid electric vehicles and all 2000 and subsequent model-year vehicles subject to running loss and useful life evaporative emission standards, the preconditioning sequence for the Federal Test Procedure 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. In addition, the preconditioning sequence for the SFTP described in subparagraphs (n) and (o) of paragraph 86.132-00 shall apply.

100.5.3.2 Add the following subparagraph: The preconditioning sequence described in §86.132-00 shall apply to all vehicles tested for the purpose of demonstrating compliance with greenhouse gas requirements with the following addition. The dynamometer procedure used to precondition a vehicle being tested to measure “highway” emission values shall consist of one cycle of the Highway Driving Schedule followed by 15 seconds of idle prior to initiation of a second Highway Driving Schedule, which is driven to test the vehicle. As an alternative, emission testing may be conducted using the Highway Driving Schedule within three hours following the Federal Test Procedure, if the soak temperature is maintained between 68°F – 86°F, without additional preconditioning required.

86.133-96 Diurnal breathing loss test. August 23, 1995.

86.134-96 Running loss test. August 23, 1995.

86.135-00 Dynamometer procedure. October 22, 1996.

86.136-90 Engine starting and restarting. September 21, 1994.

86.137-96 Dynamometer test run, gaseous and particulate emissions. March 24, 1993.

86.138-96 Hot soak test. August 23, 1995.

86.139-90 Diesel particulate filter handling and weighing. April 11, 1989.

86.140-94 Exhaust sample analysis. June 30, 1995.

86.142-90 Records required. June 30, 1995.

86.143-96 Calculations; evaporative emissions. August 23, 1995.

86.144-94 Calculations; exhaust emissions. September 5, 1997.

100.5.4 Calculations; exhaust emissions.

100.5.4.1 The exhaust emission calculations for California are set forth in the “California Non-Methane Organic Gas Test Procedures,” which is incorporated by reference in section 1961(d), title 13, CCR.

100.5.4.2 Add the following calculation:

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

$$\text{OMNMHCE}_{\text{mass}} = \text{NMHC}_{\text{mass}} + (13.8756/32.042) \times (\text{CH}_3\text{OH})_{\text{mass}} + (13.8756/23.035) \times (\text{CH}_3\text{CH}_2\text{OH})_{\text{mass}} + (13.8756/30.0262) \times (\text{HCHO})_{\text{mass}} + (13.8756/22.027) \times (\text{CH}_3\text{CHO})_{\text{mass}}$$

- 86.145-82 Calculations; particulate emissions. November 2, 1982.
- 86.146-96 to 85.157-98 [n/a; (ORVR)]
- 86.158-00 Supplemental Federal Test Procedures; overview. October 22, 1996.
- 86.159-00 Exhaust emission test procedures for US06 emissions. October 22, 1996.
- 86.160-00 Exhaust emission test procedure for SC03 emissions. October 22, 1996.
- 86.161-00 Air conditioning environmental test facility ambient requirements. October 22, 1996.
- 86.162-00 Approval of alternative air conditioning test simulations and descriptions of AC1 and AC2. October 22, 1996.
- 86.162-03 Approval of alternative air conditioning test simulations. October 22, 1996.
- 86.163-00 Spot check correlation procedures for vehicles tested using a simulation of the environmental test cell for air conditioning emission testing. October 22, 1996.
- 86.164-00 Supplemental federal test procedure calculations. October 22, 1996.

B. 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.

200.1 California applicability.

Amend subparagraph 86.201-94(a) as follows: This subpart describes procedures for determining the cold temperature carbon monoxide (CO) emissions from 2000 and later model year new passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas, diesel-fueled, and zero-emission vehicles).

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.

200.2 California Equipment Required; Overview.

Amend §86.206-94, as follows:

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

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

(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, §86.213. As an option, a manufacturer may utilize the fuel specified in §86.213 with the sulfur content limited to 30-40 ppm by weight. Fuel specifications for exhaust emission testing for alcohol-fueled vehicles and liquefied petroleum gas vehicles are specified in Part II, Section A.100.3 of these test procedures. Analytical gases are specified in 40 CFR Part 86, §86.214. The EPA Urban Dynamometer Driving Schedule (UDDS) for use in emission tests is specified in 40 CFR Part 86, §86.215 and appendix I to this part.

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.

86.213-04 Fuel specifications. February 10, 2000.

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 I to Part 86 -- Urban Dynamometer Schedules. April 29, 1998.

C. 50°F Emission Test Procedure.

The NMOG, CO, NO_x and formaldehyde emissions from all light- and medium-duty TLEVs, LEVs, ULEVs and SULEVs shall be measured according to the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86 at a nominal temperature of 50°F with the following modifications:

(1) Test Procedure.

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

(b) Following a 12 to 36 hour cold soak at a nominal temperature of 50°F, 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.

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

(d) 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 requirement to saturate the evaporative control canister(s) shall not apply.

(e) 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°F test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.

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

D. Procedure for Determining Specific Reactivity.

The following procedure shall be used by the Executive Officer to establish reactivity adjustment factors for exhaust emissions of non-methane organic gases (NMOG) for the purpose of certifying a vehicle of specific emission category and fuel for sale in California.

1. Procedure for Determining Specific Reactivity.

(a) A representative speciated NMOG exhaust emission profile for light- and medium-duty low-emission vehicles shall be established according to the following conditions:

i. Speciated NMOG profiles shall be obtained from a statistically valid number of vehicles in each vehicle emission category and fuel type. The maximum incremental reactivities to be used are provided in the "California Non-Methane Organic Gas Test Procedures," incorporated by reference in Part II, section A.100.5.4 of these test procedures.

ii. The speciated NMOG profiles shall identify and quantify, in units of grams per mile or milligrams per mile, all compounds above the specified laboratory limit of detection as measured in accordance with the procedures specified in the "California Non-Methane Organic Gas Test Procedures."

(b) The "grams ozone per mile" value of each organic compound identified in the speciated profile shall be determined by multiplying the "grams per mile NMOG" emission value of each compound by the applicable maximum incremental reactivity value as specified in the "California Non-Methane Organic Gas Test Procedures."

(c) The "total grams ozone per mile" of NMOG exhaust emissions from each vehicle emission category and fuel type shall be the sum of all the organic compounds values calculated in step (b).

(d) The specific reactivity of each vehicle emission category and fuel type shall be determined by dividing the "total grams ozone per mile" value calculated in step (c) by the "total grams per mile of NMOG emissions."

2. Procedure for Determining Reactivity Adjustment Factors.

(a) The baseline specific reactivity of vehicle emission categories operating on conventional gasoline shall be determined by the Executive Officer in accordance with the procedure outlined in subparagraph 1., above.

i. Gasoline meeting the specifications listed below shall be used to determine the baseline specific reactivity low-emission vehicles operating on conventional gasoline:

| Specifications for Conventional Gasoline | |
|---|--------------------------|
| Fuel Property | Limit |
| Sulfur | 300 ± 50 ppm by weight |
| Benzene | 1.6 ± 0.3 volume percent |
| Reid vapor pressure | 8.7 ± 0.3 psi |
| Distillation, D-86, °F | |
| 10% | 115-135 |
| 50%, maximum | 240 |
| 90%, | 323-333 |
| EP, maximum | 420 |
| Hydrocarbons | |
| Total Aromatics | 32 ± 3.0 volume percent |
| Multi-substituted alkyl aromatics | 21 ± 3.0 volume percent |
| Olefins | 12 ± 3.0 volume percent |
| 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 Part II, Section A.100.3 of these test procedures.)

(b) The generic specific reactivity of vehicle emission categories operating on clean fuels shall also be determined by the Executive Officer according to the procedure outlined in subparagraph 1. above.

(c) The candidate vehicle/fuel “reactivity adjustment factor” shall be determined by dividing the specific reactivity of a candidate fuel and vehicle by the baseline specific reactivity of vehicles in the same vehicle emission category using the procedure outline in subparagraph 1. above.

(d) For a candidate vehicle/fuel system operating on natural gas, a “methane reactivity adjustment factor” shall be calculated by dividing the maximum incremental reactivity value for methane given in the California Non-Methane Organic Gas Test Procedures by the specific reactivity for the vehicle in the same emission control technology category operated on conventional gasoline as listed in subparagraph (a)i. above or established by the Executive Officer pursuant to paragraph 4 and 5 below. The current methane reactivity adjustment factors are listed in Part I.E.4 of these test procedures.

3. Procedures for Establishing Test Group Specific Reactivity Adjustment Factors.

A manufacturer may request the use of a unique specific reactivity for a specific vehicle test group category and fuel only if a baseline specific reactivity factor for the applicable test group class and emission category is provided in section E.5.1.1 of these test procedures. The Executive Officer shall approve such a request provided the criteria outlined below are met.

(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 test group. 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.” 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 specific reactivity for each speciated NMOG exhaust emission profile in accordance with the procedures specified in paragraph 2. above. By using these specific reactivity values, the manufacturer shall calculate a “reactivity adjustment factor” for each test vehicle in accordance with the procedure specified in paragraph 3. above. A “reactivity adjustment factor” for the test group 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:

$$95\% \text{ UCB} = \text{RAF} + 1.96 \times \left[\frac{\sum_{I=1}^n (\text{RAF}_i - \text{RAF}_m)^2}{n-1} \right]^{1/2}$$

where:

RAF_m = mean “reactivity adjustment factor” calculated for the test group

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 test group shall be less than or equal to 115 percent of the test group “reactivity adjustment factor.”

(b) The manufacturer submits an “ozone deterioration factor” for the test group. 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 for calculating mass deterioration factors specified in Part I, Section F.3 (40 CFR §86.1819) of these test procedures. 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.” A mean gram per mile NMOG mass value and a mean specific reactivity 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 grams ozone per mile” value at each mileage interval. A mean “ozone deterioration factor” shall be calculated in accordance with the procedures in Part I Section F.3 (40 CFR §86.1819) of these test procedures except that the mean total “grams ozone 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 4,000 mile test point and the mean “reactivity adjustment factor” for the test group 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 test group, and “ozone deterioration factor” are provided to the Executive Officer with the certification application for the engine family.

(d) The maximum incremental reactivities to be used are provided in the “California Non-Methane Organic Gas Test Procedures.” 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 test group. The Executive Officer may deny such requests if he or she determines that the maximum incremental reactivity value assignments are made incorrectly.

(e) Methanol and LPG Requirements. For a candidate vehicle/fuel system powered by methanol or liquefied petroleum gas, the reactivity adjustment factor determined by the manufacturer shall be multiplied by 1.1. The resulting value shall constitute the “reactivity adjustment factor” for the methanol or liquefied petroleum gas-powered vehicle/fuel system.

4. Procedure for Establishing A New Reactivity Adjustment Factor.

The Executive Officer may establish by executive order new reactivity adjustment factor pursuant to the procedures set forth above. The Executive Officer shall notify manufacturers in writing of a new reactivity adjustment factor within 30 days of their establishment.

5. Procedure for Revising Reactivity Adjustment Factors.

The Executive Officer may revise any reactivity adjustment factor listed in Part I.E.5 of these test procedures or established by the Executive Officer pursuant to the above criteria 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, a manufacturer may use the revised reactivity adjustment factor in certifying any new test group whose certification application is submitted following such notification, if it so chooses. A manufacturer may also continue to use the original reactivity adjustment factor for any existing test group

previously certified with that reactivity adjustment factor until a new durability-data vehicle is tested for that test group.

E. Unified Cycle Driving Schedule.

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Unified Test Cycle
(Speed vs Time Sequence)

| Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 | 0 | 74 | 12.3 | 147 | 20 | 220 | 0 | 293 | 0 | 366 | 45.3 | 439 | 60.3 | 512 | 28 |
| 2 | 0 | 75 | 8.1 | 148 | 23 | 221 | 0 | 294 | 0 | 367 | 46.5 | 440 | 60.3 | 513 | 26.5 |
| 3 | 0 | 76 | 6.1 | 149 | 25.7 | 222 | 0 | 295 | 0 | 368 | 48 | 441 | 60.3 | 514 | 24.2 |
| 4 | 0 | 77 | 9.6 | 150 | 28 | 223 | 0 | 296 | 0 | 369 | 48.8 | 442 | 59.5 | 515 | 22.7 |
| 5 | 0 | 78 | 12.7 | 151 | 30.7 | 224 | 0 | 297 | 0 | 370 | 49.5 | 443 | 58.8 | 516 | 20.4 |
| 6 | 0 | 79 | 15.7 | 152 | 32.6 | 225 | 0 | 298 | 0 | 371 | 49.9 | 444 | 59.1 | 517 | 17.7 |
| 7 | 0 | 80 | 18 | 153 | 34.2 | 226 | 0 | 299 | 0 | 372 | 49.9 | 445 | 58.8 | 518 | 15.7 |
| 8 | 0 | 81 | 20.4 | 154 | 35.3 | 227 | 0 | 300 | 0 | 373 | 49.9 | 446 | 58.8 | 519 | 13.1 |
| 9 | 0 | 82 | 21.9 | 155 | 36.9 | 228 | 0 | 301 | 0 | 374 | 49.5 | 447 | 58.8 | 520 | 10.8 |
| 10 | 0 | 83 | 23.4 | 156 | 36.9 | 229 | 0 | 302 | 0 | 375 | 49.5 | 448 | 58.4 | 521 | 8.4 |
| 11 | 0 | 84 | 23.8 | 157 | 37.2 | 230 | 0 | 303 | 0 | 376 | 48.8 | 449 | 58 | 522 | 7.3 |
| 12 | 0 | 85 | 24.6 | 158 | 37.6 | 231 | 0 | 304 | 0 | 377 | 48.8 | 450 | 58 | 523 | 5 |
| 13 | 0 | 86 | 25 | 159 | 37.6 | 232 | 0 | 305 | 0 | 378 | 48.8 | 451 | 58 | 524 | 3.8 |
| 14 | 0 | 87 | 26.1 | 160 | 37.6 | 233 | 0 | 306 | 0 | 379 | 48.4 | 452 | 58.4 | 525 | 3.5 |
| 15 | 0 | 88 | 26.1 | 161 | 37.2 | 234 | 0 | 307 | 0 | 380 | 48.8 | 453 | 59.1 | 526 | 1.9 |
| 16 | 0 | 89 | 26.9 | 162 | 37.2 | 235 | 0 | 308 | 0 | 381 | 49.5 | 454 | 59.5 | 527 | 0.8 |
| 17 | 0 | 90 | 26.9 | 163 | 36.9 | 236 | 0 | 309 | 0 | 382 | 50.3 | 455 | 59.9 | 528 | 0 |
| 18 | 0 | 91 | 26.9 | 164 | 36.5 | 237 | 0 | 310 | 0 | 383 | 50.7 | 456 | 59.9 | 529 | 0 |
| 19 | 0 | 92 | 26.5 | 165 | 36.5 | 238 | 1.5 | 311 | 0 | 384 | 51.8 | 457 | 60.3 | 530 | 0 |
| 20 | 0 | 93 | 25.7 | 166 | 34.9 | 239 | 5 | 312 | 0 | 385 | 52.6 | 458 | 61.1 | 531 | 0.8 |
| 21 | 1.2 | 94 | 21.9 | 167 | 33.4 | 240 | 8.8 | 313 | 0.4 | 386 | 53.4 | 459 | 61.1 | 532 | 1.9 |
| 22 | 4.2 | 95 | 16.5 | 168 | 31.9 | 241 | 11.5 | 314 | 2.7 | 387 | 54.1 | 460 | 61.1 | 533 | 3.8 |
| 23 | 7.3 | 96 | 10 | 169 | 29.2 | 242 | 14.2 | 315 | 7.3 | 388 | 55.3 | 461 | 61.4 | 534 | 6.9 |
| 24 | 8.8 | 97 | 4.6 | 170 | 25 | 243 | 15.4 | 316 | 11.5 | 389 | 55.3 | 462 | 61.4 | 535 | 9.6 |
| 25 | 10.8 | 98 | 1.5 | 171 | 25 | 244 | 16.1 | 317 | 15.4 | 390 | 56.1 | 463 | 61.1 | 536 | 11.1 |
| 26 | 12.3 | 99 | 0.4 | 172 | 26.1 | 245 | 16.1 | 318 | 18.4 | 391 | 56.4 | 464 | 60.7 | 537 | 11.1 |
| 27 | 13.1 | 100 | 0 | 173 | 27.6 | 246 | 16.9 | 319 | 20.7 | 392 | 56.4 | 465 | 59.9 | 538 | 10.4 |
| 28 | 12.3 | 101 | 0 | 174 | 29.2 | 247 | 16.5 | 320 | 24.2 | 393 | 56.4 | 466 | 59.1 | 539 | 8.8 |
| 29 | 12.3 | 102 | 0 | 175 | 31.1 | 248 | 16.9 | 321 | 26.9 | 394 | 57.2 | 467 | 59.1 | 540 | 9.2 |
| 30 | 11.5 | 103 | 0 | 176 | 32.3 | 249 | 18 | 322 | 29.6 | 395 | 56.8 | 468 | 59.1 | 541 | 10 |
| 31 | 11.5 | 104 | 0 | 177 | 34.2 | 250 | 19.2 | 323 | 31.1 | 396 | 57.6 | 469 | 59.9 | 542 | 10.4 |
| 32 | 11.1 | 105 | 0 | 178 | 34.9 | 251 | 20.4 | 324 | 32.6 | 397 | 57.6 | 470 | 59.5 | 543 | 10.4 |
| 33 | 11.1 | 106 | 0 | 179 | 35.7 | 252 | 20.4 | 325 | 33.8 | 398 | 57.6 | 471 | 59.9 | 544 | 5.4 |
| 34 | 11.1 | 107 | 0 | 180 | 36.5 | 253 | 21.1 | 326 | 34.9 | 399 | 58 | 472 | 58.8 | 545 | 1.9 |
| 35 | 13.1 | 108 | 0.4 | 181 | 36.9 | 254 | 21.1 | 327 | 36.9 | 400 | 58 | 473 | 58 | 546 | 0 |
| 36 | 15 | 109 | 1.2 | 182 | 36.9 | 255 | 22.3 | 328 | 39.2 | 401 | 58.4 | 474 | 57.6 | 547 | 0 |
| 37 | 16.9 | 110 | 1.9 | 183 | 37.2 | 256 | 23 | 329 | 41.1 | 402 | 58.4 | 475 | 56.8 | 548 | 0 |
| 38 | 16.9 | 111 | 3.8 | 184 | 37.6 | 257 | 23.8 | 330 | 43 | 403 | 58.8 | 476 | 56.1 | 549 | 0 |
| 39 | 16.1 | 112 | 7.7 | 185 | 37.2 | 258 | 24.2 | 331 | 43.8 | 404 | 59.1 | 477 | 55.3 | 550 | 0 |
| 40 | 15.7 | 113 | 11.5 | 186 | 37.6 | 259 | 24.6 | 332 | 44.5 | 405 | 58.8 | 478 | 54.1 | 551 | 0 |
| 41 | 15.4 | 114 | 14.6 | 187 | 38 | 260 | 25 | 333 | 45.3 | 406 | 58.8 | 479 | 52.6 | 552 | 0 |
| 42 | 15 | 115 | 18 | 188 | 38.4 | 261 | 25.7 | 334 | 45.3 | 407 | 58 | 480 | 49.2 | 553 | 0 |
| 43 | 13.8 | 116 | 21.5 | 189 | 39.2 | 262 | 25.7 | 335 | 44.9 | 408 | 58 | 481 | 46.1 | 554 | 0 |
| 44 | 10.8 | 117 | 25 | 190 | 39.6 | 263 | 26.5 | 336 | 44.5 | 409 | 57.6 | 482 | 43 | 555 | 0 |
| 45 | 8.4 | 118 | 28.4 | 191 | 39.9 | 264 | 27.6 | 337 | 43.8 | 410 | 57.6 | 483 | 37.2 | 556 | 0 |
| 46 | 6.1 | 119 | 30.7 | 192 | 40.7 | 265 | 28.4 | 338 | 43.4 | 411 | 57.6 | 484 | 29.6 | 557 | 0 |
| 47 | 4.2 | 120 | 31.9 | 193 | 40.3 | 266 | 29.2 | 339 | 42.6 | 412 | 57.6 | 485 | 21.5 | 558 | 0 |
| 48 | 3.5 | 121 | 32.3 | 194 | 41.1 | 267 | 30.3 | 340 | 41.9 | 413 | 57.6 | 486 | 16.5 | 559 | 0 |
| 49 | 3.5 | 122 | 32.3 | 195 | 41.1 | 268 | 31.1 | 341 | 41.5 | 414 | 59.1 | 487 | 15.7 | 560 | 0 |
| 50 | 1.5 | 123 | 31.9 | 196 | 40.7 | 269 | 31.1 | 342 | 40.7 | 415 | 59.5 | 488 | 18.4 | 561 | 0 |
| 51 | 0 | 124 | 30.3 | 197 | 31.9 | 270 | 30.7 | 343 | 40.3 | 416 | 59.9 | 489 | 21.5 | 562 | 0 |
| 52 | 0 | 125 | 28 | 198 | 23.9 | 271 | 31.1 | 344 | 41.1 | 417 | 60.3 | 490 | 25 | 563 | 0 |
| 53 | 0 | 126 | 24.2 | 199 | 15.9 | 272 | 29.6 | 345 | 41.5 | 418 | 60.3 | 491 | 27.3 | 564 | 0 |
| 54 | 0 | 127 | 20 | 200 | 7.9 | 273 | 29.2 | 346 | 42.6 | 419 | 61.1 | 492 | 29.2 | 565 | 0 |
| 55 | 0 | 128 | 16.1 | 201 | 2.7 | 274 | 29.2 | 347 | 43.4 | 420 | 60.3 | 493 | 30.7 | 566 | 0 |
| 56 | 0 | 129 | 11.5 | 202 | 0.4 | 275 | 28.8 | 348 | 44.2 | 421 | 59.9 | 494 | 31.5 | 567 | 0 |
| 57 | 0 | 130 | 8.1 | 203 | 0.4 | 276 | 28 | 349 | 44.9 | 422 | 59.5 | 495 | 31.1 | 568 | 0 |
| 58 | 0 | 131 | 5 | 204 | 2.7 | 277 | 23 | 350 | 45.7 | 423 | 59.1 | 496 | 31.1 | 569 | 0 |
| 59 | 0 | 132 | 3.5 | 205 | 3.8 | 278 | 21.1 | 351 | 46.5 | 424 | 59.1 | 497 | 30.3 | 570 | 0 |
| 60 | 0 | 133 | 1.9 | 206 | 3.8 | 279 | 21.5 | 352 | 46.8 | 425 | 59.5 | 498 | 30 | 571 | 0 |
| 61 | 0 | 134 | 0 | 207 | 1.5 | 280 | 20.7 | 353 | 47.2 | 426 | 59.5 | 499 | 30 | 572 | 0.4 |
| 62 | 0 | 135 | 0 | 208 | 0 | 281 | 20.7 | 354 | 48 | 427 | 59.5 | 500 | 29.6 | 573 | 1.5 |
| 63 | 1.2 | 136 | 0 | 209 | 0 | 282 | 19.6 | 355 | 47.6 | 428 | 59.9 | 501 | 30 | 574 | 3.5 |
| 64 | 3.5 | 137 | 0 | 210 | 0 | 283 | 16.5 | 356 | 48.4 | 429 | 60.3 | 502 | 28.8 | 575 | 6.1 |
| 65 | 7.7 | 138 | 0 | 211 | 0 | 284 | 13.1 | 357 | 48 | 430 | 60.7 | 503 | 28.8 | 576 | 10.4 |

| | | | | | | | | | | | | | | | |
|----|------|-----|------|-----|---|-----|-----|-----|------|-----|------|-----|------|-----|------|
| 66 | 11.1 | 139 | 0 | 212 | 0 | 285 | 9.6 | 358 | 47.2 | 431 | 60.7 | 504 | 28 | 577 | 14.2 |
| 67 | 13.8 | 140 | 0 | 213 | 0 | 286 | 7.3 | 359 | 46.1 | 432 | 61.4 | 505 | 28.4 | 578 | 16.9 |
| 68 | 16.5 | 141 | 0 | 214 | 0 | 287 | 3.8 | 360 | 45.7 | 433 | 61.8 | 506 | 28 | 579 | 19.2 |
| 69 | 18.4 | 142 | 0 | 215 | 0 | 288 | 0.8 | 361 | 44.9 | 434 | 61.8 | 507 | 28.4 | 580 | 20 |
| 70 | 20.4 | 143 | 1.5 | 216 | 0 | 289 | 0 | 362 | 44.2 | 435 | 61.8 | 508 | 28.4 | 581 | 21.5 |
| 71 | 20.7 | 144 | 6.9 | 217 | 0 | 290 | 0 | 363 | 43.8 | 436 | 61.8 | 509 | 28.8 | 582 | 23.4 |
| 72 | 19.6 | 145 | 12.7 | 218 | 0 | 291 | 0 | 364 | 44.5 | 437 | 61.1 | 510 | 28.4 | 583 | 24.6 |
| 73 | 17.3 | 146 | 16.5 | 219 | 0 | 292 | 0 | 365 | 44.9 | 438 | 60.7 | 511 | 28.4 | 584 | 24.2 |

**Unified Test Cycle
(Speed vs Time Sequence)**

| Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 585 | 20 | 658 | 33 | 731 | 4.2 | 804 | 20.4 | 877 | 62.2 | 950 | 16.5 | 1023 | 0.4 | 1096 | 9.6 |
| 586 | 16.9 | 659 | 34.2 | 732 | 1.2 | 805 | 18.8 | 878 | 62.2 | 951 | 15 | 1024 | 2.7 | 1097 | 8.8 |
| 587 | 13.4 | 660 | 34.6 | 733 | 0 | 806 | 17.3 | 879 | 62.6 | 952 | 11.9 | 1025 | 6.1 | 1098 | 10.8 |
| 588 | 13.4 | 661 | 35.3 | 734 | 0 | 807 | 15 | 880 | 63.7 | 953 | 9.6 | 1026 | 9.2 | 1099 | 12.7 |
| 589 | 15.7 | 662 | 36.1 | 735 | 0 | 808 | 13.1 | 881 | 64.5 | 954 | 8.4 | 1027 | 11.5 | 1100 | 14.2 |
| 590 | 18.4 | 663 | 36.1 | 736 | 0 | 809 | 9.2 | 882 | 64.9 | 955 | 5.8 | 1028 | 14.2 | 1101 | 14.6 |
| 591 | 21.1 | 664 | 36.9 | 737 | 0 | 810 | 6.9 | 883 | 66 | 956 | 1.2 | 1029 | 16.1 | 1102 | 13.1 |
| 592 | 23.4 | 665 | 36.9 | 738 | 0 | 811 | 4.6 | 884 | 66 | 957 | 0 | 1030 | 18 | 1103 | 11.1 |
| 593 | 25.3 | 666 | 37.6 | 739 | 0 | 812 | 4.6 | 885 | 66.8 | 958 | 0 | 1031 | 20 | 1104 | 11.1 |
| 594 | 27.6 | 667 | 37.6 | 740 | 0 | 813 | 4.6 | 886 | 66.4 | 959 | 0 | 1032 | 21.5 | 1105 | 11.1 |
| 595 | 28.8 | 668 | 38.4 | 741 | 0 | 814 | 4.2 | 887 | 66.8 | 960 | 1.2 | 1033 | 23 | 1106 | 13.1 |
| 596 | 30.3 | 669 | 38 | 742 | 0 | 815 | 5.4 | 888 | 67.2 | 961 | 3.1 | 1034 | 24.2 | 1107 | 15.7 |
| 597 | 30.7 | 670 | 37.6 | 743 | 0 | 816 | 4.6 | 889 | 66.4 | 962 | 5 | 1035 | 25 | 1108 | 18.4 |
| 598 | 31.5 | 671 | 37.6 | 744 | 0 | 817 | 3.5 | 890 | 66.4 | 963 | 8.4 | 1036 | 25.7 | 1109 | 20.7 |
| 599 | 31.1 | 672 | 37.2 | 745 | 0 | 818 | 2.3 | 891 | 66 | 964 | 11.5 | 1037 | 26.9 | 1110 | 23.8 |
| 600 | 31.1 | 673 | 36.9 | 746 | 0 | 819 | 2.3 | 892 | 65.7 | 965 | 14.6 | 1038 | 27.6 | 1111 | 25.7 |
| 601 | 30.3 | 674 | 36.1 | 747 | 0 | 820 | 1.9 | 893 | 65.7 | 966 | 16.9 | 1039 | 27.6 | 1112 | 28 |
| 602 | 30.3 | 675 | 35.7 | 748 | 0 | 821 | 3.1 | 894 | 66.4 | 967 | 18.8 | 1040 | 28.4 | 1113 | 30 |
| 603 | 30.3 | 676 | 36.1 | 749 | 0 | 822 | 6.1 | 895 | 66 | 968 | 21.1 | 1041 | 29.2 | 1114 | 31.1 |
| 604 | 30.7 | 677 | 35.7 | 750 | 0 | 823 | 4.6 | 896 | 65.7 | 969 | 23.8 | 1042 | 29.2 | 1115 | 32.3 |
| 605 | 31.1 | 678 | 35.7 | 751 | 0 | 824 | 2.7 | 897 | 65.3 | 970 | 26.5 | 1043 | 30 | 1116 | 34.2 |
| 606 | 32.3 | 679 | 35.7 | 752 | 0 | 825 | 2.3 | 898 | 65.3 | 971 | 28 | 1044 | 29.6 | 1117 | 35.7 |
| 607 | 32.6 | 680 | 36.1 | 753 | 0 | 826 | 2.3 | 899 | 64.5 | 972 | 29.6 | 1045 | 29.6 | 1118 | 36.9 |
| 608 | 32.6 | 681 | 36.1 | 754 | 0 | 827 | 3.1 | 900 | 64.5 | 973 | 30.7 | 1046 | 28.8 | 1119 | 38.8 |
| 609 | 32.6 | 682 | 35.7 | 755 | 0 | 828 | 4.2 | 901 | 64.1 | 974 | 32.6 | 1047 | 28 | 1120 | 40.3 |
| 610 | 31.1 | 683 | 35.7 | 756 | 0 | 829 | 3.5 | 902 | 63.7 | 975 | 34.2 | 1048 | 23.8 | 1121 | 41.5 |
| 611 | 26.9 | 684 | 34.9 | 757 | 0 | 830 | 3.8 | 903 | 63.7 | 976 | 35.3 | 1049 | 18.8 | 1122 | 42.2 |
| 612 | 22.3 | 685 | 34.6 | 758 | 0 | 831 | 4.2 | 904 | 63.7 | 977 | 36.1 | 1050 | 11.9 | 1123 | 43 |
| 613 | 18 | 686 | 34.2 | 759 | 0 | 832 | 3.5 | 905 | 64.5 | 978 | 36.9 | 1051 | 6.1 | 1124 | 43.8 |
| 614 | 13.8 | 687 | 33.8 | 760 | 0 | 833 | 3.5 | 906 | 64.5 | 979 | 38 | 1052 | 1.5 | 1125 | 43.8 |
| 615 | 9.6 | 688 | 33.4 | 761 | 0 | 834 | 3.5 | 907 | 64.9 | 980 | 38 | 1053 | 1.5 | 1126 | 43.4 |
| 616 | 4.6 | 689 | 33 | 762 | 0 | 835 | 4.6 | 908 | 64.5 | 981 | 38 | 1054 | 4.2 | 1127 | 43 |
| 617 | 6.1 | 690 | 30.3 | 763 | 1.5 | 836 | 5.8 | 909 | 64.1 | 982 | 38 | 1055 | 8.1 | 1128 | 42.2 |
| 618 | 10 | 691 | 29.2 | 764 | 5.4 | 837 | 3.5 | 910 | 64.9 | 983 | 38 | 1056 | 10.4 | 1129 | 41.9 |
| 619 | 14.2 | 692 | 28.4 | 765 | 9.2 | 838 | 0.8 | 911 | 65.3 | 984 | 37.2 | 1057 | 13.1 | 1130 | 41.5 |
| 620 | 17.3 | 693 | 25 | 766 | 11.5 | 839 | 3.5 | 912 | 65.3 | 985 | 36.9 | 1058 | 15.4 | 1131 | 41.9 |
| 621 | 20 | 694 | 21.1 | 767 | 14.6 | 840 | 3.8 | 913 | 65.3 | 986 | 36.1 | 1059 | 18 | 1132 | 41.9 |
| 622 | 21.5 | 695 | 16.9 | 768 | 17.3 | 841 | 2.3 | 914 | 64.1 | 987 | 35.7 | 1060 | 20.4 | 1133 | 41.9 |
| 623 | 22.3 | 696 | 13.4 | 769 | 19.2 | 842 | 0 | 915 | 63.4 | 988 | 34.9 | 1061 | 23 | 1134 | 42.2 |
| 624 | 22.3 | 697 | 13.1 | 770 | 21.1 | 843 | 1.2 | 916 | 63 | 989 | 34.9 | 1062 | 25.3 | 1135 | 42.6 |
| 625 | 22.3 | 698 | 12.3 | 771 | 20.7 | 844 | 6.9 | 917 | 63.4 | 990 | 33.8 | 1063 | 27.3 | 1136 | 42.6 |
| 626 | 22.3 | 699 | 12.7 | 772 | 20.7 | 845 | 13.8 | 918 | 64.1 | 991 | 31.5 | 1064 | 28.8 | 1137 | 42.6 |
| 627 | 23 | 700 | 15.7 | 773 | 19.6 | 846 | 18.8 | 919 | 64.9 | 992 | 28.8 | 1065 | 30.3 | 1138 | 42.6 |
| 628 | 23 | 701 | 19.2 | 774 | 18.4 | 847 | 23.8 | 920 | 65.3 | 993 | 25.7 | 1066 | 31.1 | 1139 | 42.6 |
| 629 | 22.7 | 702 | 22.3 | 775 | 16.9 | 848 | 27.3 | 921 | 64.5 | 994 | 24.6 | 1067 | 32.3 | 1140 | 42.6 |
| 630 | 22.3 | 703 | 24.6 | 776 | 16.9 | 849 | 30.7 | 922 | 64.1 | 995 | 23.4 | 1068 | 31.9 | 1141 | 42.6 |
| 631 | 21.9 | 704 | 25.7 | 777 | 16.5 | 850 | 33.8 | 923 | 63.4 | 996 | 22.3 | 1069 | 32.3 | 1142 | 42.2 |
| 632 | 22.7 | 705 | 26.5 | 778 | 16.9 | 851 | 37.6 | 924 | 63.7 | 997 | 21.5 | 1070 | 31.9 | 1143 | 43 |
| 633 | 23.8 | 706 | 26.5 | 779 | 16.9 | 852 | 40.7 | 925 | 63.4 | 998 | 20 | 1071 | 31.1 | 1144 | 43.4 |
| 634 | 25 | 707 | 26.9 | 780 | 16.9 | 853 | 43.8 | 926 | 63.4 | 999 | 20 | 1072 | 28.8 | 1145 | 43 |
| 635 | 25.3 | 708 | 27.3 | 781 | 17.3 | 854 | 46.1 | 927 | 63.4 | 1000 | 19.2 | 1073 | 25 | 1146 | 42.6 |
| 636 | 25.7 | 709 | 27.3 | 782 | 19.2 | 855 | 48 | 928 | 63.4 | 1001 | 19.2 | 1074 | 22.7 | 1147 | 41.9 |
| 637 | 26.5 | 710 | 27.6 | 783 | 20.4 | 856 | 49.5 | 929 | 63.7 | 1002 | 18 | 1075 | 18.8 | 1148 | 40.7 |
| 638 | 26.9 | 711 | 28.4 | 784 | 21.1 | 857 | 51.5 | 930 | 64.5 | 1003 | 11.9 | 1076 | 15.4 | 1149 | 36.9 |
| 639 | 27.3 | 712 | 28.8 | 785 | 22.3 | 858 | 53 | 931 | 65.3 | 1004 | 6.9 | 1077 | 13.4 | 1150 | 32.6 |

| | | | | | | | | | | | | | | | |
|-----|------|-----|------|-----|------|-----|------|-----|------|------|-----|------|------|------|------|
| 640 | 28 | 713 | 28.8 | 786 | 22.3 | 859 | 54.5 | 932 | 64.9 | 1005 | 2.7 | 1078 | 11.9 | 1151 | 28 |
| 641 | 29.2 | 714 | 29.2 | 787 | 22.7 | 860 | 55.7 | 933 | 63.7 | 1006 | 0.8 | 1079 | 8.8 | 1152 | 23.4 |
| 642 | 30 | 715 | 28.8 | 788 | 22.3 | 861 | 56.8 | 934 | 63 | 1007 | 0.4 | 1080 | 5 | 1153 | 18.4 |
| 643 | 30 | 716 | 28.8 | 789 | 22.7 | 862 | 58 | 935 | 59.9 | 1008 | 0 | 1081 | 1.9 | 1154 | 14.6 |
| 644 | 29.6 | 717 | 28 | 790 | 22.3 | 863 | 59.1 | 936 | 55.3 | 1009 | 0 | 1082 | 2.3 | 1155 | 12.3 |
| 645 | 29.6 | 718 | 28 | 791 | 23.8 | 864 | 60.3 | 937 | 50.7 | 1010 | 0 | 1083 | 2.7 | 1156 | 9.2 |
| 646 | 28.8 | 719 | 27.6 | 792 | 25.7 | 865 | 61.1 | 938 | 49.2 | 1011 | 0 | 1084 | 3.5 | 1157 | 5.8 |
| 647 | 28.4 | 720 | 26.5 | 793 | 27.6 | 866 | 61.8 | 939 | 48 | 1012 | 0 | 1085 | 6.5 | 1158 | 1.9 |
| 648 | 28 | 721 | 24.6 | 794 | 29.6 | 867 | 61.8 | 940 | 46.1 | 1013 | 0 | 1086 | 10.8 | 1159 | 0.4 |
| 649 | 27.3 | 722 | 20.7 | 795 | 30 | 868 | 61.8 | 941 | 44.2 | 1014 | 0 | 1087 | 13.8 | 1160 | 0 |
| 650 | 25.7 | 723 | 16.5 | 796 | 29.2 | 869 | 61.8 | 942 | 41.1 | 1015 | 0 | 1088 | 16.1 | 1161 | 0 |
| 651 | 24.6 | 724 | 15 | 797 | 27.6 | 870 | 62.6 | 943 | 39.9 | 1016 | 0 | 1089 | 18.4 | 1162 | 0 |
| 652 | 25 | 725 | 14.2 | 798 | 25 | 871 | 63.4 | 944 | 36.1 | 1017 | 0 | 1090 | 20.4 | 1163 | 0 |
| 653 | 26.5 | 726 | 14.2 | 799 | 23.8 | 872 | 63 | 945 | 32.6 | 1018 | 0 | 1091 | 21.9 | 1164 | 0 |
| 654 | 28 | 727 | 13.8 | 800 | 23.4 | 873 | 63 | 946 | 29.2 | 1019 | 0 | 1092 | 21.9 | 1165 | 0.4 |
| 655 | 29.6 | 728 | 13.8 | 801 | 24.2 | 874 | 62.6 | 947 | 24.6 | 1020 | 0 | 1093 | 20.7 | 1166 | 4.2 |
| 656 | 30.7 | 729 | 11.9 | 802 | 23.4 | 875 | 61.8 | 948 | 20.7 | 1021 | 0 | 1094 | 17.3 | 1167 | 9.2 |
| 657 | 32.3 | 730 | 8.4 | 803 | 23 | 876 | 61.8 | 949 | 19.2 | 1022 | 0 | 1095 | 13.1 | 1168 | 11.9 |

**Unified Test Cycle
(Speed vs Time Sequence)**

| Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1169 | 14.2 | 1240 | 3.5 | 1311 | 40.7 | 1382 | 2.7 | 1453 | 0 | 1524 | 26.9 | 1595 | 37.6 | 1666 | 0 |
| 1170 | 15.7 | 1241 | 10.4 | 1312 | 40.3 | 1383 | 2.3 | 1454 | 0 | 1525 | 26.9 | 1596 | 37.2 | 1667 | 0 |
| 1171 | 15 | 1242 | 15.4 | 1313 | 39.6 | 1384 | 1.5 | 1455 | 0 | 1526 | 26.9 | 1597 | 37.2 | 1668 | 0 |
| 1172 | 14.2 | 1243 | 17.3 | 1314 | 39.2 | 1385 | 1.2 | 1456 | 1.2 | 1527 | 26.5 | 1598 | 36.9 | 1669 | 0 |
| 1173 | 13.4 | 1244 | 17.3 | 1315 | 38.8 | 1386 | 0 | 1457 | 4.2 | 1528 | 25.7 | 1599 | 36.5 | 1670 | 0 |
| 1174 | 13.8 | 1245 | 18.4 | 1316 | 38 | 1387 | 1.2 | 1458 | 7.3 | 1529 | 21.9 | 1600 | 36.5 | 1671 | 0 |
| 1175 | 14.6 | 1246 | 21.5 | 1317 | 37.6 | 1388 | 4.2 | 1459 | 8.8 | 1530 | 16.5 | 1601 | 34.9 | 1672 | 0 |
| 1176 | 14.6 | 1247 | 24.6 | 1318 | 37.2 | 1389 | 7.3 | 1460 | 10.8 | 1531 | 10 | 1602 | 33.4 | 1673 | 1.5 |
| 1177 | 14.2 | 1248 | 27.3 | 1319 | 36.5 | 1390 | 8.8 | 1461 | 12.3 | 1532 | 4.6 | 1603 | 31.9 | 1674 | 5 |
| 1178 | 16.1 | 1249 | 30 | 1320 | 34.6 | 1391 | 10.8 | 1462 | 13.1 | 1533 | 1.5 | 1604 | 29.2 | 1675 | 8.8 |
| 1179 | 15.7 | 1250 | 31.5 | 1321 | 31.5 | 1392 | 12.3 | 1463 | 12.3 | 1534 | 0.4 | 1605 | 25 | 1676 | 11.5 |
| 1180 | 15.7 | 1251 | 31.9 | 1322 | 29.6 | 1393 | 13.1 | 1464 | 12.3 | 1535 | 0 | 1606 | 25 | 1677 | 14.2 |
| 1181 | 14.6 | 1252 | 32.6 | 1323 | 29.2 | 1394 | 12.3 | 1465 | 11.5 | 1536 | 0 | 1607 | 26.1 | 1678 | 15.4 |
| 1182 | 13.1 | 1253 | 33.4 | 1324 | 28.8 | 1395 | 12.3 | 1466 | 11.5 | 1537 | 0 | 1608 | 27.6 | 1679 | 16.1 |
| 1183 | 10 | 1254 | 34.9 | 1325 | 28.8 | 1396 | 11.5 | 1467 | 11.1 | 1538 | 0 | 1609 | 29.2 | 1680 | 16.1 |
| 1184 | 7.3 | 1255 | 36.5 | 1326 | 28 | 1397 | 11.5 | 1468 | 11.1 | 1539 | 0 | 1610 | 31.1 | 1681 | 16.9 |
| 1185 | 3.5 | 1256 | 37.6 | 1327 | 28 | 1398 | 11.1 | 1469 | 11.1 | 1540 | 0 | 1611 | 32.3 | 1682 | 16.5 |
| 1186 | 0.8 | 1257 | 39.2 | 1328 | 28.4 | 1399 | 11.1 | 1470 | 13.1 | 1541 | 0 | 1612 | 34.2 | 1683 | 16.9 |
| 1187 | 0 | 1258 | 40.3 | 1329 | 29.6 | 1400 | 11.1 | 1471 | 15 | 1542 | 0 | 1613 | 34.9 | 1684 | 18 |
| 1188 | 0 | 1259 | 40.7 | 1330 | 30 | 1401 | 13.1 | 1472 | 16.9 | 1543 | 0.4 | 1614 | 35.7 | 1685 | 19.2 |
| 1189 | 0 | 1260 | 41.1 | 1331 | 30.3 | 1402 | 15 | 1473 | 16.9 | 1544 | 1.2 | 1615 | 36.5 | 1686 | 20.4 |
| 1190 | 0 | 1261 | 40.7 | 1332 | 29.2 | 1403 | 16.9 | 1474 | 16.1 | 1545 | 1.9 | 1616 | 36.9 | 1687 | 20.4 |
| 1191 | 0.4 | 1262 | 40.7 | 1333 | 26.5 | 1404 | 16.9 | 1475 | 15.7 | 1546 | 3.8 | 1617 | 36.9 | 1688 | 21.1 |
| 1192 | 2.7 | 1263 | 40.7 | 1334 | 25.3 | 1405 | 16.1 | 1476 | 15.4 | 1547 | 7.7 | 1618 | 37.2 | 1689 | 21.1 |
| 1193 | 7.3 | 1264 | 41.5 | 1335 | 25 | 1406 | 15.7 | 1477 | 15 | 1548 | 11.5 | 1619 | 37.6 | 1690 | 22.3 |
| 1194 | 11.5 | 1265 | 42.6 | 1336 | 24.6 | 1407 | 15.4 | 1478 | 13.8 | 1549 | 14.6 | 1620 | 37.2 | 1691 | 23 |
| 1195 | 15.4 | 1266 | 43 | 1337 | 24.6 | 1408 | 15 | 1479 | 10.8 | 1550 | 18 | 1621 | 37.6 | 1692 | 23.8 |
| 1196 | 19.2 | 1267 | 44.5 | 1338 | 25.3 | 1409 | 13.8 | 1480 | 8.4 | 1551 | 21.5 | 1622 | 38 | 1693 | 24.2 |
| 1197 | 21.9 | 1268 | 45.3 | 1339 | 26.1 | 1410 | 10.8 | 1481 | 6.1 | 1552 | 25 | 1623 | 38.4 | 1694 | 24.6 |
| 1198 | 23.8 | 1269 | 45.3 | 1340 | 27.3 | 1411 | 8.4 | 1482 | 4.2 | 1553 | 28.4 | 1624 | 39.2 | 1695 | 25 |
| 1199 | 25 | 1270 | 44.9 | 1341 | 28.4 | 1412 | 6.1 | 1483 | 3.5 | 1554 | 30.7 | 1625 | 39.6 | 1696 | 25.7 |
| 1200 | 26.1 | 1271 | 43.4 | 1342 | 29.2 | 1413 | 4.2 | 1484 | 3.5 | 1555 | 31.9 | 1626 | 39.9 | 1697 | 25.7 |
| 1201 | 27.3 | 1272 | 40.3 | 1343 | 29.2 | 1414 | 3.5 | 1485 | 1.5 | 1556 | 32.3 | 1627 | 40.7 | 1698 | 26.5 |
| 1202 | 28.8 | 1273 | 38 | 1344 | 29.6 | 1415 | 3.5 | 1486 | 0 | 1557 | 32.3 | 1628 | 40.3 | 1699 | 27.6 |
| 1203 | 30 | 1274 | 36.1 | 1345 | 30 | 1416 | 1.5 | 1487 | 0 | 1558 | 31.9 | 1629 | 41.1 | 1700 | 28.4 |
| 1204 | 29.6 | 1275 | 36.5 | 1346 | 31.1 | 1417 | 0 | 1488 | 0 | 1559 | 30.3 | 1630 | 41.1 | 1701 | 29.2 |
| 1205 | 29.6 | 1276 | 38 | 1347 | 32.6 | 1418 | 0 | 1489 | 0 | 1560 | 28 | 1631 | 40.7 | 1702 | 30.3 |
| 1206 | 28.8 | 1277 | 39.2 | 1348 | 33.8 | 1419 | 0 | 1490 | 0 | 1561 | 24.2 | 1632 | 31.9 | 1703 | 31.1 |
| 1207 | 26.1 | 1278 | 40.7 | 1349 | 34.6 | 1420 | 0 | 1491 | 0 | 1562 | 20 | 1633 | 23.9 | 1704 | 31.1 |
| 1208 | 22.3 | 1279 | 42.2 | 1350 | 34.9 | 1421 | 0 | 1492 | 0 | 1563 | 16.1 | 1634 | 15.9 | 1705 | 30.7 |
| 1209 | 19.2 | 1280 | 43.4 | 1351 | 34.6 | 1422 | 0 | 1493 | 0 | 1564 | 11.5 | 1635 | 7.9 | 1706 | 31.1 |
| 1210 | 16.5 | 1281 | 44.9 | 1352 | 34.9 | 1423 | 0 | 1494 | 0 | 1565 | 8.1 | 1636 | 2.7 | 1707 | 29.6 |
| 1211 | 12.7 | 1282 | 45.7 | 1353 | 34.6 | 1424 | 0 | 1495 | 0 | 1566 | 5 | 1637 | 0.4 | 1708 | 29.2 |
| 1212 | 9.6 | 1283 | 46.1 | 1354 | 34.9 | 1425 | 0 | 1496 | 0 | 1567 | 3.5 | 1638 | 0.4 | 1709 | 29.2 |
| 1213 | 6.9 | 1284 | 46.8 | 1355 | 34.9 | 1426 | 0 | 1497 | 0 | 1568 | 1.9 | 1639 | 2.7 | 1710 | 28.8 |
| 1214 | 4.2 | 1285 | 46.5 | 1356 | 34.9 | 1427 | 0 | 1498 | 1.2 | 1569 | 0 | 1640 | 3.8 | 1711 | 28 |
| 1215 | 2.3 | 1286 | 46.5 | 1357 | 34.2 | 1428 | 0 | 1499 | 3.5 | 1570 | 0 | 1641 | 3.8 | 1712 | 23 |
| 1216 | 0.8 | 1287 | 46.5 | 1358 | 33.8 | 1429 | 0 | 1500 | 7.7 | 1571 | 0 | 1642 | 1.5 | 1713 | 21.1 |
| 1217 | 0 | 1288 | 46.1 | 1359 | 32.6 | 1430 | 0 | 1501 | 11.1 | 1572 | 0 | 1643 | 0 | 1714 | 21.5 |
| 1218 | 0 | 1289 | 46.1 | 1360 | 31.5 | 1431 | 0 | 1502 | 13.8 | 1573 | 0 | 1644 | 0 | 1715 | 20.7 |
| 1219 | 0 | 1290 | 46.1 | 1361 | 30 | 1432 | 0 | 1503 | 16.5 | 1574 | 0 | 1645 | 0 | 1716 | 20.7 |
| 1220 | 0 | 1291 | 46.8 | 1362 | 28.8 | 1433 | 0 | 1504 | 18.4 | 1575 | 0 | 1646 | 0 | 1717 | 19.6 |
| 1221 | 0 | 1292 | 47.6 | 1363 | 27.3 | 1434 | 0 | 1505 | 20.4 | 1576 | 0 | 1647 | 0 | 1718 | 16.5 |
| 1222 | 0 | 1293 | 48 | 1364 | 23.8 | 1435 | 0 | 1506 | 20.7 | 1577 | 0 | 1648 | 0 | 1719 | 13.1 |
| 1223 | 0 | 1294 | 48.4 | 1365 | 23 | 1436 | 0 | 1507 | 19.6 | 1578 | 1.5 | 1649 | 0 | 1720 | 9.6 |
| 1224 | 0 | 1295 | 48 | 1366 | 23 | 1437 | 0 | 1508 | 17.3 | 1579 | 6.9 | 1650 | 0 | 1721 | 7.3 |
| 1225 | 0 | 1296 | 48 | 1367 | 22.3 | 1438 | 0 | 1509 | 12.3 | 1580 | 12.7 | 1651 | 0 | 1722 | 3.8 |
| 1226 | 0 | 1297 | 47.2 | 1368 | 20.4 | 1439 | 0 | 1510 | 8.1 | 1581 | 16.5 | 1652 | 0 | 1723 | 0.8 |
| 1227 | 0 | 1298 | 46.5 | 1369 | 18.8 | 1440 | 0 | 1511 | 6.1 | 1582 | 20 | 1653 | 0 | 1724 | 0 |
| 1228 | 0 | 1299 | 46.8 | 1370 | 17.7 | 1441 | 0 | 1512 | 9.6 | 1583 | 23 | 1654 | 0 | 1725 | 0 |
| 1229 | 0 | 1300 | 47.2 | 1371 | 16.1 | 1442 | 0 | 1513 | 12.7 | 1584 | 25.7 | 1655 | 0 | 1726 | 0 |
| 1230 | 0 | 1301 | 48.4 | 1372 | 14.6 | 1443 | 0 | 1514 | 15.7 | 1585 | 28 | 1656 | 0 | 1727 | 0 |
| 1231 | 0 | 1302 | 48.4 | 1373 | 12.7 | 1444 | 0 | 1515 | 18 | 1586 | 30.7 | 1657 | 0 | 1728 | 0 |
| 1232 | 0 | 1303 | 48.8 | 1374 | 11.1 | 1445 | 0 | 1516 | 20.4 | 1587 | 32.6 | 1658 | 0 | 1729 | 0 |

| | | | | | | | | | | | | | | | |
|------|---|------|------|------|-----|------|---|------|------|------|------|------|---|------|---|
| 1233 | 0 | 1304 | 48.4 | 1375 | 9.2 | 1446 | 0 | 1517 | 21.9 | 1588 | 34.2 | 1659 | 0 | 1730 | 0 |
| 1234 | 0 | 1305 | 47.6 | 1376 | 8.8 | 1447 | 0 | 1518 | 23.4 | 1589 | 35.3 | 1660 | 0 | 1731 | 0 |
| 1235 | 0 | 1306 | 46.5 | 1377 | 7.3 | 1448 | 0 | 1519 | 23.8 | 1590 | 36.9 | 1661 | 0 | 1732 | 0 |
| 1236 | 0 | 1307 | 44.2 | 1378 | 6.1 | 1449 | 0 | 1520 | 24.6 | 1591 | 36.9 | 1662 | 0 | 1733 | 0 |
| 1237 | 0 | 1308 | 42.2 | 1379 | 5 | 1450 | 0 | 1521 | 25 | 1592 | 37.2 | 1663 | 0 | 1734 | 0 |
| 1238 | 0 | 1309 | 41.5 | 1380 | 4.2 | 1451 | 0 | 1522 | 26.1 | 1593 | 37.6 | 1664 | 0 | 1735 | 0 |
| 1239 | 0 | 1310 | 41.1 | 1381 | 3.5 | 1452 | 0 | 1523 | 26.1 | 1594 | 37.6 | 1665 | 0 | | |

F. Highway Driving Schedule.

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Highway Test Cycle
(Speed vs Time Sequence)

| Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 | 0 | 74 | 47.2 | 147 | 42 | 220 | 43.1 | 293 | 30.6 | 366 | 56.9 | 439 | 58 | 512 | 54 |
| 2 | 0 | 75 | 47.3 | 148 | 43.1 | 221 | 43.2 | 294 | 29.6 | 367 | 56.9 | 440 | 57.9 | 513 | 54 |
| 3 | 2.0 | 76 | 47.2 | 149 | 43.7 | 222 | 43.4 | 295 | 28.8 | 368 | 57 | 441 | 57.9 | 514 | 54 |
| 4 | 4.9 | 77 | 47.1 | 150 | 44.1 | 223 | 43.9 | 296 | 28.4 | 369 | 57 | 442 | 57.9 | 515 | 54 |
| 5 | 8.1 | 78 | 47 | 151 | 44.3 | 224 | 44.3 | 297 | 28.6 | 370 | 57 | 443 | 57.9 | 516 | 54 |
| 6 | 11.3 | 79 | 46.9 | 152 | 44.4 | 225 | 44.7 | 298 | 29.5 | 371 | 57 | 444 | 57.9 | 517 | 54.1 |
| 7 | 14.5 | 80 | 46.9 | 153 | 44.6 | 226 | 45.1 | 299 | 31.4 | 372 | 57 | 445 | 58 | 518 | 54.2 |
| 8 | 17.3 | 81 | 46.9 | 154 | 44.7 | 227 | 45.4 | 300 | 33.4 | 373 | 57 | 446 | 58.1 | 519 | 54.5 |
| 9 | 19.6 | 82 | 47 | 155 | 44.9 | 228 | 45.8 | 301 | 35.6 | 374 | 57 | 447 | 58.1 | 520 | 54.8 |
| 10 | 21.8 | 83 | 47.1 | 156 | 45.2 | 229 | 46.5 | 302 | 37.5 | 375 | 57 | 448 | 58.2 | 521 | 54.9 |
| 11 | 24 | 84 | 47.1 | 157 | 45.7 | 230 | 46.9 | 303 | 39.1 | 376 | 57 | 449 | 58.2 | 522 | 55 |
| 12 | 25.8 | 85 | 47.2 | 158 | 45.9 | 231 | 47.2 | 304 | 40.2 | 377 | 56.9 | 450 | 58.2 | 523 | 55.1 |
| 13 | 27.1 | 86 | 47.1 | 159 | 46.3 | 232 | 47.4 | 305 | 41.1 | 378 | 56.8 | 451 | 58.1 | 524 | 55.2 |
| 14 | 28 | 87 | 47 | 160 | 46.8 | 233 | 47.3 | 306 | 41.8 | 379 | 56.5 | 452 | 58 | 525 | 55.2 |
| 15 | 29 | 88 | 46.9 | 161 | 46.9 | 234 | 47.3 | 307 | 42.4 | 380 | 56.2 | 453 | 58 | 526 | 55.3 |
| 16 | 30 | 89 | 46.5 | 162 | 47 | 235 | 47.2 | 308 | 42.8 | 381 | 56 | 454 | 58 | 527 | 55.4 |
| 17 | 30.7 | 90 | 46.3 | 163 | 47.1 | 236 | 47.2 | 309 | 43.3 | 382 | 56 | 455 | 58 | 528 | 55.5 |
| 18 | 31.5 | 91 | 46.2 | 164 | 47.6 | 237 | 47.2 | 310 | 43.8 | 383 | 56 | 456 | 58 | 529 | 55.6 |
| 19 | 32.2 | 92 | 46.3 | 165 | 47.9 | 238 | 47.1 | 311 | 44.3 | 384 | 56.1 | 457 | 58 | 530 | 55.7 |
| 20 | 32.9 | 93 | 46.5 | 166 | 48 | 239 | 47 | 312 | 44.7 | 385 | 56.4 | 458 | 57.9 | 531 | 55.8 |
| 21 | 33.5 | 94 | 46.9 | 167 | 48 | 240 | 47 | 313 | 45 | 386 | 56.7 | 459 | 57.9 | 532 | 55.9 |
| 22 | 34.1 | 95 | 47.1 | 168 | 47.9 | 241 | 46.9 | 314 | 45.2 | 387 | 56.9 | 460 | 58 | 533 | 56 |
| 23 | 34.6 | 96 | 47.4 | 169 | 47.8 | 242 | 46.8 | 315 | 45.4 | 388 | 57.1 | 461 | 58.1 | 534 | 56 |
| 24 | 34.9 | 97 | 47.7 | 170 | 47.3 | 243 | 46.9 | 316 | 45.5 | 389 | 57.3 | 462 | 58.1 | 535 | 56 |
| 25 | 35.1 | 98 | 48 | 171 | 46.7 | 244 | 47 | 317 | 45.8 | 390 | 57.4 | 463 | 58.2 | 536 | 56 |
| 26 | 35.7 | 99 | 48.2 | 172 | 46.2 | 245 | 47.2 | 318 | 46 | 391 | 57.4 | 464 | 58.3 | 537 | 56 |
| 27 | 35.9 | 100 | 48.5 | 173 | 45.9 | 246 | 47.5 | 319 | 46.1 | 392 | 57.2 | 465 | 58.3 | 538 | 56 |
| 28 | 35.8 | 101 | 48.8 | 174 | 45.7 | 247 | 47.9 | 320 | 46.5 | 393 | 57 | 466 | 58.3 | 539 | 56 |
| 29 | 35.3 | 102 | 49.1 | 175 | 45.5 | 248 | 48 | 321 | 46.8 | 394 | 56.9 | 467 | 58.2 | 540 | 56 |
| 30 | 34.9 | 103 | 49.2 | 176 | 45.4 | 249 | 48 | 322 | 47.1 | 395 | 56.6 | 468 | 58.1 | 541 | 56 |
| 31 | 34.5 | 104 | 49.1 | 177 | 45.3 | 250 | 48 | 323 | 47.7 | 396 | 56.3 | 469 | 58 | 542 | 56 |
| 32 | 34.6 | 105 | 49.1 | 178 | 45 | 251 | 48 | 324 | 48.3 | 397 | 56.1 | 470 | 57.8 | 543 | 56 |
| 33 | 34.8 | 106 | 49 | 179 | 44 | 252 | 48 | 325 | 49 | 398 | 56.4 | 471 | 57.5 | 544 | 56 |
| 34 | 35.1 | 107 | 49 | 180 | 43.1 | 253 | 48.1 | 326 | 49.7 | 399 | 56.7 | 472 | 57.1 | 545 | 56 |
| 35 | 35.7 | 108 | 49.1 | 181 | 42.2 | 254 | 48.2 | 327 | 50.3 | 400 | 57.1 | 473 | 57 | 546 | 56 |
| 36 | 36.1 | 109 | 49.2 | 182 | 41.5 | 255 | 48.2 | 328 | 51 | 401 | 57.5 | 474 | 56.6 | 547 | 55.9 |
| 37 | 36.2 | 110 | 49.3 | 183 | 41.5 | 256 | 48.1 | 329 | 51.7 | 402 | 57.8 | 475 | 56.1 | 548 | 55.9 |
| 38 | 36.5 | 111 | 49.4 | 184 | 42.1 | 257 | 48.6 | 330 | 52.4 | 403 | 58 | 476 | 56 | 549 | 55.9 |
| 39 | 36.7 | 112 | 49.5 | 185 | 42.9 | 258 | 48.9 | 331 | 53.1 | 404 | 58 | 477 | 55.8 | 550 | 55.8 |
| 40 | 36.9 | 113 | 49.5 | 186 | 43.5 | 259 | 49.1 | 332 | 53.8 | 405 | 58 | 478 | 55.5 | 551 | 55.6 |
| 41 | 37 | 114 | 49.5 | 187 | 43.9 | 260 | 49.1 | 333 | 54.5 | 406 | 58 | 479 | 55.2 | 552 | 55.4 |
| 42 | 37 | 115 | 49.4 | 188 | 43.6 | 261 | 49.1 | 334 | 55.2 | 407 | 58 | 480 | 55.1 | 553 | 55.2 |
| 43 | 37 | 116 | 49.1 | 189 | 43.3 | 262 | 49.1 | 335 | 55.8 | 408 | 58 | 481 | 55 | 554 | 55.1 |
| 44 | 37 | 117 | 48.9 | 190 | 43 | 263 | 49.1 | 336 | 56.4 | 409 | 57.9 | 482 | 54.9 | 555 | 55 |
| 45 | 37 | 118 | 48.6 | 191 | 43.1 | 264 | 49 | 337 | 56.9 | 410 | 57.8 | 483 | 54.9 | 556 | 54.9 |
| 46 | 37 | 119 | 48.4 | 192 | 43.4 | 265 | 48.9 | 338 | 57 | 411 | 57.7 | 484 | 54.9 | 557 | 54.6 |
| 47 | 37.1 | 120 | 48.1 | 193 | 43.9 | 266 | 48.2 | 339 | 57.1 | 412 | 57.7 | 485 | 54.9 | 558 | 54.4 |
| 48 | 37.3 | 121 | 47.7 | 194 | 44.3 | 267 | 47.7 | 340 | 57.3 | 413 | 57.8 | 486 | 54.9 | 559 | 54.2 |
| 49 | 37.8 | 122 | 47.4 | 195 | 44.6 | 268 | 47.5 | 341 | 57.6 | 414 | 57.9 | 487 | 54.9 | 560 | 54.1 |
| 50 | 38.6 | 123 | 47.3 | 196 | 44.9 | 269 | 47.2 | 342 | 57.8 | 415 | 58 | 488 | 55 | 561 | 53.8 |
| 51 | 39.3 | 124 | 47.5 | 197 | 44.8 | 270 | 46.7 | 343 | 58 | 416 | 58.1 | 489 | 55 | 562 | 53.4 |
| 52 | 40 | 125 | 47.8 | 198 | 44.4 | 271 | 46.2 | 344 | 58.1 | 417 | 58.4 | 490 | 55 | 563 | 53.3 |
| 53 | 40.7 | 126 | 47.9 | 199 | 43.9 | 272 | 46 | 345 | 58.4 | 418 | 58.9 | 491 | 55 | 564 | 53.1 |
| 54 | 41.4 | 127 | 48 | 200 | 43.4 | 273 | 45.8 | 346 | 58.7 | 419 | 59.1 | 492 | 55 | 565 | 52.9 |
| 55 | 42.2 | 128 | 47.9 | 201 | 43.2 | 274 | 45.6 | 347 | 58.8 | 420 | 59.4 | 493 | 55 | 566 | 52.6 |
| 56 | 42.9 | 129 | 47.9 | 202 | 43.2 | 275 | 45.4 | 348 | 58.9 | 421 | 59.8 | 494 | 55.1 | 567 | 52.4 |
| 57 | 43.5 | 130 | 47.9 | 203 | 43.1 | 276 | 45.2 | 349 | 59 | 422 | 59.9 | 495 | 55.1 | 568 | 52.2 |
| 58 | 44 | 131 | 48 | 204 | 43 | 277 | 45 | 350 | 59 | 423 | 59.9 | 496 | 55 | 569 | 52.1 |
| 59 | 44.3 | 132 | 48 | 205 | 43 | 278 | 44.7 | 351 | 58.9 | 424 | 59.8 | 497 | 54.9 | 570 | 52 |
| 60 | 44.5 | 133 | 48 | 206 | 43.1 | 279 | 44.5 | 352 | 58.8 | 425 | 59.6 | 498 | 54.9 | 571 | 52 |
| 61 | 44.8 | 134 | 47.9 | 207 | 43.4 | 280 | 44.2 | 353 | 58.6 | 426 | 59.4 | 499 | 54.8 | 572 | 52 |
| 62 | 44.9 | 135 | 47.3 | 208 | 43.9 | 281 | 43.5 | 354 | 58.4 | 427 | 59.2 | 500 | 54.7 | 573 | 52 |
| 63 | 45 | 136 | 46 | 209 | 44 | 282 | 42.8 | 355 | 58.2 | 428 | 59.1 | 501 | 54.6 | 574 | 52.1 |
| 64 | 45.1 | 137 | 43.3 | 210 | 43.5 | 283 | 42 | 356 | 58.1 | 429 | 59 | 502 | 54.4 | 575 | 52 |

| | | | | | | | | | | | | | | | |
|----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|
| 65 | 45.4 | 138 | 41.2 | 211 | 42.6 | 284 | 40.1 | 357 | 58 | 430 | 58.9 | 503 | 54.3 | 576 | 52 |
| 66 | 45.7 | 139 | 39.5 | 212 | 41.5 | 285 | 38.6 | 358 | 57.9 | 431 | 58.7 | 504 | 54.3 | 577 | 51.9 |
| 67 | 46 | 140 | 39.2 | 213 | 40.7 | 286 | 37.5 | 359 | 57.6 | 432 | 58.6 | 505 | 54.2 | 578 | 51.6 |
| 68 | 46.3 | 141 | 39 | 214 | 40 | 287 | 35.8 | 360 | 57.4 | 433 | 58.5 | 506 | 54.1 | 579 | 51.4 |
| 69 | 46.5 | 142 | 39 | 215 | 40 | 288 | 34.7 | 361 | 57.2 | 434 | 58.4 | 507 | 54.1 | 580 | 51.1 |
| 70 | 46.8 | 143 | 39.1 | 216 | 40.3 | 289 | 34 | 362 | 57.1 | 435 | 58.4 | 508 | 54.1 | 581 | 50.7 |
| 71 | 46.9 | 144 | 39.5 | 217 | 41 | 290 | 33.3 | 363 | 57 | 436 | 58.3 | 509 | 54 | 582 | 50.3 |
| 72 | 47 | 145 | 40.1 | 218 | 42 | 291 | 32.5 | 364 | 57 | 437 | 58.2 | 510 | 54 | 583 | 49.8 |
| 73 | 47.1 | 146 | 41 | 219 | 42.7 | 292 | 31.7 | 365 | 56.9 | 438 | 58.1 | 511 | 54 | 584 | 49.3 |

**Highway Test Cycle
(Speed vs Time Sequence)**

| Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) | Time (sec.) | Speed (mph) |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 585 | 48.7 | 608 | 49.1 | 631 | 55.1 | 654 | 52.2 | 677 | 52.1 | 700 | 54.2 | 723 | 57.7 | 746 | 39.2 |
| 586 | 48.2 | 609 | 49 | 632 | 55.4 | 655 | 52.5 | 678 | 51.7 | 701 | 54.5 | 724 | 57.3 | 747 | 35.9 |
| 587 | 48.1 | 610 | 48.9 | 633 | 55.4 | 656 | 52.1 | 679 | 51.1 | 702 | 54.8 | 725 | 57.1 | 748 | 32.6 |
| 588 | 48 | 611 | 48 | 634 | 55 | 657 | 51.6 | 680 | 50.5 | 703 | 55 | 726 | 56.8 | 749 | 29.3 |
| 589 | 48 | 612 | 47.1 | 635 | 54.5 | 658 | 51.1 | 681 | 50.1 | 704 | 55.5 | 727 | 56.5 | 750 | 26.8 |
| 590 | 48.1 | 613 | 46.2 | 636 | 53.6 | 659 | 51 | 682 | 49.8 | 705 | 55.9 | 728 | 56.2 | 751 | 24.5 |
| 591 | 48.4 | 614 | 46.1 | 637 | 52.5 | 660 | 51 | 683 | 49.7 | 706 | 56.1 | 729 | 55.5 | 752 | 21.5 |
| 592 | 48.9 | 615 | 46.1 | 638 | 50.2 | 661 | 51.1 | 684 | 49.6 | 707 | 56.3 | 730 | 54.6 | 753 | 19.5 |
| 593 | 49 | 616 | 46.2 | 639 | 48.2 | 662 | 51.4 | 685 | 49.5 | 708 | 56.4 | 731 | 54.1 | 754 | 17.4 |
| 594 | 49.1 | 617 | 46.9 | 640 | 46.5 | 663 | 51.7 | 686 | 49.5 | 709 | 56.5 | 732 | 53.7 | 755 | 15.1 |
| 595 | 49.1 | 618 | 47.8 | 641 | 46.2 | 664 | 52 | 687 | 49.7 | 710 | 56.7 | 733 | 53.2 | 756 | 12.4 |
| 596 | 49 | 619 | 49 | 642 | 46 | 665 | 52.2 | 688 | 50 | 711 | 56.9 | 734 | 52.9 | 757 | 9.7 |
| 597 | 49 | 620 | 49.7 | 643 | 46 | 666 | 52.5 | 689 | 50.2 | 712 | 57 | 735 | 52.5 | 758 | 7 |
| 598 | 48.9 | 621 | 50.6 | 644 | 46.3 | 667 | 52.8 | 690 | 50.6 | 713 | 57.3 | 736 | 52 | 759 | 5 |
| 599 | 48.6 | 622 | 51.5 | 645 | 46.8 | 668 | 52.7 | 691 | 51.1 | 714 | 57.7 | 737 | 51.3 | 760 | 3.3 |
| 600 | 48.3 | 623 | 52.2 | 646 | 47.5 | 669 | 52.6 | 692 | 51.6 | 715 | 58.2 | 738 | 50.5 | 761 | 2 |
| 601 | 48 | 624 | 52.7 | 647 | 48.2 | 670 | 52.3 | 693 | 51.9 | 716 | 58.8 | 739 | 49.5 | 762 | 0.7 |
| 602 | 47.9 | 625 | 53 | 648 | 48.8 | 671 | 52.3 | 694 | 52 | 717 | 59.1 | 740 | 48.5 | 763 | 0 |
| 603 | 47.8 | 626 | 53.6 | 649 | 49.5 | 672 | 52.4 | 695 | 52.1 | 718 | 59.2 | 741 | 47.6 | 764 | 0 |
| 604 | 47.7 | 627 | 54 | 650 | 50.2 | 673 | 52.5 | 696 | 52.4 | 719 | 59.1 | 742 | 46.8 | 765 | 0 |
| 605 | 47.9 | 628 | 54.1 | 651 | 50.7 | 674 | 52.7 | 697 | 52.9 | 720 | 58.8 | 743 | 45.6 | | |
| 606 | 48.3 | 629 | 54.4 | 652 | 51.1 | 675 | 52.7 | 698 | 53.3 | 721 | 58.5 | 744 | 44.2 | | |
| 607 | 49 | 630 | 54.7 | 653 | 51.7 | 676 | 52.4 | 699 | 53.7 | 722 | 58.1 | 745 | 42.5 | | |