California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA 2015 AND SUBSEQUENT MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted: March 22, 2012

NOTE: This document is incorporated by reference in sections 1961.2(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 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in sections 1960.1(k) and 1961(d), title 13, CCR);

2. "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.1, title 13, CCR);

3. "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.2, title 13, CCR);

4. "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976(c), title 13, CCR);

5. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978(b), title 13, CCR);

6. OBD II (section 1968, et seq. title 13, CCR, as applicable);

7. "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" (incorporated by reference in section 1965, title 13, CCR);

8. Warranty Requirements (sections 2037 and 2038, title 13, CCR);

9. "Specifications for Fill Pipes and Openings of 2015 and Subsequent Motor Vehicle Fuel Tanks" (incorporated by reference in section 2235, title 13, CCR);

10. "Guidelines for Certification of 2003 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by reference in section 1960.5, title 13, CCR);

11. "California Non-Methane Organic Gas Test Procedures," (incorporated by reference in section 1961.2(d), title 13, CCR);

12. “California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years,” (incorporated by reference in section 2317, title 13, CCR).

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

Table of Contents

Section Page No.

PART I: GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS 1

A. GENERAL APPLICABILITY 1

1. §86.1801 APPLICABILITY. 1
2. CALIFORNIA PROVISIONS. 2
3. §86.1802 SECTION NUMBERING; CONSTRUCTION. 3

B. DEFINITIONS, ACRONYMS AND ABBREVIATIONS 1

1. §86.1803 DEFINITIONS. 1
2. CALIFORNIA DEFINITIONS. 1
3. §86.1804 ACRONYMS AND ABBREVIATIONS. 8

C. GENERAL REQUIREMENTS FOR CERTIFICATION 1

1. §86.1805 USEFUL LIFE. 1
2. §86.1806 ON-BOARD DIAGNOSTICS. 1
3. §86.1807 VEHICLE LABELING. 1
4. §86.1808 MAINTENANCE INSTRUCTIONS. 4
5. §86.1809 PROHIBITION OF DEFEAT DEVICES. 4

D. §86.1810 GENERAL STANDARDS; INCREASE IN EMISSIONS; UNSAFE CONDITIONS; WAIVERS 1

1. §86.1810-09. 1
2. SUPPLEMENTAL FTP GENERAL PROVISIONS FOR CALIFORNIA. 2

E. CALIFORNIA EXHAUST EMISSION STANDARDS. 1

1. EXHAUST EMISSION STANDARDS. 2
2. EMISSION STANDARDS PHASE-IN REQUIREMENTS FOR MANUFACTURERS. 22
3. CALCULATION OF CREDITS/DEBITS. 61
4. LEV III INTERIM IN-USE COMPLIANCE STANDARDS. 67
5. SEVERABILITY. 70

F. REQUIREMENTS AND PROCEDURES FOR DURABILITY DEMONSTRATION 1

1. §86.1820 DURABILITY GROUP DETERMINATION. 1
2. §86.1821 EVAPORATIVE/REFUELING EMISSION FAMILY DETERMINATION. 1
3. §86.1822 DURABILITY DATA VEHICLE SELECTION. 1
4. §86.1823 DURABILITY DEMONSTRATION PROCEDURES FOR EXHAUST EMISSIONS. 1
5. §86.1824 DURABILITY DEMONSTRATION PROCEDURES FOR EVAPORATIVE EMISSIONS. 1
6. §86.1825 DURABILITY DEMONSTRATION PROCEDURES FOR REFUELING EMISSIONS. 1
7. §86.1826 ASSIGNED DETERIORATION FACTORS FOR SMALL VOLUME MANUFACTURERS AND SMALL VOLUME TEST GROUPS. 1

G. PROCEDURES FOR DEMONSTRATION OF COMPLIANCE WITH EMISSION STANDARDS 1

1. §86.1827 TEST GROUP DETERMINATION. 1
2. §86.1828 EMISSION DATA VEHICLE SELECTION 1

3. §86.1829 DURABILITY DATA AND EMISSION DATA TESTING REQUIREMENTS; WAIVERS. 1
4. §86.1830 ACCEPTANCE OF VEHICLES FOR TESTING. 3
5. §86.1831 MILEAGE ACCUMULATION REQUIREMENTS FOR TEST VEHICLES. 3
6. §86.1832-01 OPTIONAL EQUIPMENT AND AIR CONDITIONING. 3
7. §86.1833-01 ADJUSTABLE PARAMETERS. 4
8. §86.1834 ALLOWABLE MAINTENANCE. 4
9. §86.1835 CONFIRMATORY CERTIFICATION TESTING. 4
10. §86.1836-01 MANUFACTURER-SUPPLIED PRODUCTION VEHICLES FOR TESTING. 4
11. §86.1837 ROUNDING OF EMISSION MEASUREMENTS. 4
12. §86.1838 SMALL VOLUME MANUFACTURERS CERTIFICATION PROCEDURES. 4
13. §86.1839 CARRYOVER OF CERTIFICATION DATA. 4
14. §86.1840 SPECIAL TEST PROCEDURES. 4

H. CERTIFICATION, INFORMATION AND REPORTING REQUIREMENTS. 1

1. §86.1841 COMPLIANCE WITH EMISSION STANDARDS FOR THE PURPOSE OF CERTIFICATION 1
2. §86.1842 ADDITION OF A VEHICLE AFTER CERTIFICATION; AND CHANGES TO A VEHICLE COVERED BY CERTIFICATION. 3
3. §86.1843 GENERAL INFORMATION REQUIREMENTS. 3
4. §86.1844 INFORMATION REQUIREMENTS: APPLICATION FOR CERTIFICATION AND SUBMITTAL OF INFORMATION UPON REQUEST. 3

I. IN-USE COMPLIANCE REQUIREMENTS AND PROCEDURES 1

1. §86.1845 MANUFACTURER IN-USE VERIFICATION TESTING REQUIREMENTS. 1
2. §86.1846 MANUFACTURER IN-USE CONFIRMATORY TESTING REQUIREMENTS. 3
3. §86.1847 MANUFACTURER IN-USE VERIFICATION AND IN-USE CONFIRMATORY TESTING; SUBMITTAL OF INFORMATION AND MAINTENANCE OF RECORDS. 3

APPENDICES I, II, AND III TO §86.1845-01 4

J. PROCEDURAL REQUIREMENTS 1

1. §86.1848-10 CERTIFICATION. 1
2. §86.1849-01 RIGHT OF ENTRY. 1
3. §86.1850-01 DENIAL, SUSPENSION OR REVOCATION OF CERTIFICATE OF CONFORMITY. 1
4. §86.1851 APPLICATION OF GOOD ENGINEERING JUDGMENT TO MANUFACTURERS' DECISIONS. 1
5. §86.1852 WAIVERS FOR GOOD IN-USE EMISSION PERFORMANCE. 1
6. §86.1853 CERTIFICATION HEARINGS. 1
7. §86.1854-12 PROHIBITED ACTS. 1
8. §§86.1855 - 86.1859. 1
9. §86.1860-04 HOW TO COMPLY WITH THE TIER 2 AND INTERIM TIER 2 FLEET AVERAGE NOX STANDARDS. 1
10. §86.1861-04 HOW DO THE TIER 2 AND INTERIM TIER 2 NOX AVERAGING, BANKING AND TRADING PROGRAMS WORK? 1
11. §86.1862-04 MAINTENANCE OF RECORDS AND SUBMITTAL OF INFORMATION RELEVANT TO COMPLIANCE WITH FLEET AVERAGE NOX STANDARDS. 1
12. §86.1863-07 OPTIONAL CHASSIS CERTIFICATION FOR DIESEL VEHICLES. 1
13. §86.1865-12 HOW TO COMPLY WITH THE FLEET AVERAGE CO_2 STANDARDS. 1
14. §86.1866-12 CO_2 FLEET AVERAGE CREDIT PROGRAMS. 1
15. §86.1867-12 OPTIONAL EARLY CO_2 CREDIT PROGRAMS. 1

PART II: CALIFORNIA EXHAUST AND PARTICULATE EMISSION TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES 1

A. 40 CFR PART 86, SUBPART B - EMISSION REGULATIONS FOR 1977 AND LATER MODEL YEAR NEW LIGHT-DUTY VEHICLES AND NEW LIGHT-DUTY TRUCKS AND NEW OTTO-CYCLE COMPLETE HEAVY-DUTY VEHICLES; TEST PROCEDURES. 1

100.1 GENERAL APPLICABILITY. 1
100.2 EQUIPMENT AND FACILITY REQUIREMENTS. 1
100.3 CERTIFICATION FUEL SPECIFICATIONS. 1
100.4 CALIBRATION METHODS AND FREQUENCY. 9
100.5 TEST PROCEDURES AND DATA REQUIREMENTS. 10

B. SUBPART C - EMISSION REGULATIONS FOR 1994 AND LATER MODEL YEAR GASOLINE-FUELED NEW LIGHT-DUTY VEHICLES, NEW LIGHT-DUTY TRUCKS AND NEW MEDIUM-DUTY PASSENGER VEHICLES; COLD TEMPERATURE TEST PROCEDURES. 21

200.1 CALIFORNIA APPLICABILITY. 21
200.2 CALIFORNIA EQUIPMENT REQUIRED; OVERVIEW. 21

C. 50ºF EMISSION TEST PROCEDURE. 23

D. UNIFIED CYCLE DRIVING SCHEDULE. 24

E. HIGHWAY DRIVING SCHEDULE. 28

F. US06 BAG 2 DRIVING SCHEDULE. 31

G. HOT 1435 UNIFIED CYCLE DRIVING SCHEDULE. 33

CALIFORNIA 2015 AND SUBSEQUENT MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 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 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures 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 §86.1801-12. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: Except as otherwise indicated, the provisions of this subpart apply to new passenger cars, light-duty trucks, and medium-duty vehicles, including multi-fueled, alternative fueled, hybrid electric, plug-in hybrid electric, and 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 of this subpart.

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

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

(a) Subparagraph (c)(1) [n/a]

(b) Amend subparagraph (c)(2) as follows: A manufacturer must certify any heavy-duty complete Otto-cycle vehicle or complete diesel vehicle of 14,000 pounds Gross Vehicle Weight Rating (GVWR) or less and any medium-duty passenger vehicle in accordance with the medium-duty chassis-standards of section E.1 of these test procedures. For the 2015 through 2021 model years, a manufacturer must certify all LEV II heavy-duty engines or vehicles of 14,000 pounds GVWR or less, excluding medium-duty passenger vehicles, to the medium-duty engine standards in title 13, CCR, section 1956.8 (c) or (h), as applicable. For the 2022 and subsequent model years, a manufacturer must certify any heavy-duty vehicle of 10,000 pounds GVWR or less, including incomplete Otto-cycle vehicles and incomplete heavy-duty diesel vehicles, in accordance with the LEV III medium-duty chassis-standards of section E.1 of these test procedures. A manufacturer must certify any heavy-duty engine and vehicle of 10,001-

14,000 pounds GVWR to the medium-duty engine standards in title 13, CCR, section 1956.8 (c) or (h), as applicable. A manufacturer may request to certify LEV II heavy-duty complete diesel vehicles of 14,000 pounds GVWR or less and LEV III heavy-duty complete diesel vehicles of 10,001 - 14,000 pounds GVWR to the chassis-standards in section E.1 of these test procedures; heavy-duty engine or heavy-duty vehicle provisions of 40 CFR Part 86 subpart A do not apply to such a vehicle or engine. [No change.]

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

(d) Subparagraph (c)(4) [n/a; aftermarket conversions]

(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, as modified in section G.12 of these test procedures.

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.]

1.1.9 Subparagraph (i) [No change.]

1.1.10 Subparagraph (j) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program for the 2012 through 2016 model years, in accordance with the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

1.1.11 Subparagraph (k) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program for the 2012 through 2016 model years, in accordance with the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

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-fueled 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. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]. [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.

"**Active Aerodynamic Improvements**" means technologies that are activated only at certain speeds to improve aerodynamic efficiency by a minimum of three percent, while preserving other vehicle attributes or functions.

"**Active Cabin Ventilation**" means devices that mechanically move heated air from the cabin interior to the exterior of the vehicle.

"**Active Transmission Warmup**" means a system that uses waste heat from the exhaust system to warm the transmission fluid to an operating temperature range quickly using a heat exchanger in the exhaust system, increasing the overall transmission efficiency by reducing parasitic losses associated with the transmission fluid, such as losses related to friction and fluid viscosity.

"**Active Engine Warmup**" means a system using waste heat from the exhaust system to warm up targeted parts of the engine so that it reduces engine friction losses and enables the closed-loop fuel control more quickly. It would allow a faster transition from cold operation to warm operation, decreasing CO_2 emissions, and increasing fuel economy.

"**Active Seat Ventilation**" means a device that draws air from the seating surface which is in contact with the occupant and exhausts it to a location away from the seat.

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

"**Air basin**" means any California air basin that is described in sections 60100 through 60114, title 17, CCR.

"**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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

"**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.

"**Blower motor controls which limit waste energy**" means a method of controlling fan and blower speeds that does not use resistive elements to decrease the voltage supplied to the motor.

"**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.

"**Dedicated Ethanol-Fueled 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.

"**Default to recirculated air mode**" means that the default position of the mechanism which controls the source of air supplied to the air conditioning system shall change from outside air to recirculated air when the operator or the automatic climate control system has engaged the air conditioning system (i.e., evaporator is removing heat), except under those conditions where dehumidification is required for visibility (i.e., defogger mode). In vehicles equipped with interior air quality sensors (e.g., humidity sensor, or carbon dioxide sensor), the controls may determine proper blend of air supply sources to maintain freshness of the cabin air and prevent fogging of windows while continuing to maximize the use of recirculated air. At any time, the vehicle operator may manually select the non-recirculated air setting during vehicle operation but the system must default to recirculated air mode on subsequent vehicle operations (i.e., next vehicle start). The climate control system may delay switching to recirculation mode until the interior air temperature is less than the outside air temperature, at which time the system must switch to recirculated air mode.

"**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.

"**Electric Heater Circulation Pump**" means a pump system installed in a stop-start equipped vehicle or in a hybrid electric vehicle or plug-in hybrid electric vehicle that continues to circulate hot coolant through the heater core when the engine is stopped during a stop-start event. This system must be calibrated to keep the engine off for 1 minute or more when the external ambient temperature is 30° F.

"**Emergency Vehicle**" means a motor vehicle manufactured primarily for use as an ambulance or combination ambulance-hearse or for use by the United States Government or a State or local government for law enforcement.

"**Engine Heat Recovery**" means a system that captures heat that would otherwise be lost through the exhaust system or through the radiator and converting that heat to electrical energy that is used to meet the electrical requirements of the vehicle. Such a system must have a capacity of at least 100W to achieve 0.7 g/mi of credit. Every additional 100W of capacity will result in an additional 0.7 g/mi of credit.

"**Engine Start-Stop**" means a technology which enables a vehicle to automatically turn off the engine when the vehicle comes to a rest and restart the engine when the driver applies pressure to the accelerator or releases the brake.

"**EPA Vehicle Simulation Tool**" means the "EPA Vehicle Simulation Tool" as incorporated by reference in 40 CFR §86.1 in the Notice of Proposed Rulemaking for EPA's 2017 and subsequent MY National Greenhouse Gas Program, as proposed November 16, 2011 [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)], which is incorporated by reference in section 1961.2, title 13, CCR.

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

"Footprint" means the product of average track width (rounded to the nearest tenth of an inch) and wheelbase (measured in inches and rounded to the nearest tenth of an inch), divided by 144 and then rounded to the nearest tenth of a square foot, where the average track width is the average of the front and rear track widths, where each is measured in inches and rounded to the nearest tenth of an inch.

"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.

"**Full-size pickup truck**" means a light-duty truck that has a passenger compartment and an open cargo box and which meets the following specifications:

1. A minimum cargo bed width between the wheelhouses of 48 inches, measured as the minimum lateral distance between the limiting interferences (pass-through) of the wheelhouses. The measurement shall exclude the transitional arc, local protrusions, and depressions or pockets, if present. An open cargo box means a vehicle where the cargo box does not have a permanent roof. Vehicles sold with detachable covers are considered "open" for the purposes of these criteria.
2. A minimum open cargo box length of 60 inches, where the length is defined by the lesser of the pickup bed length at the top of the body and the pickup bed length at the floor, where the length at the top of the body is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo

floor surface along vehicle centerline, and the length at the floor is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo floor surface along vehicle centerline.

3. A minimum towing capability of 5,000 pounds, where minimum towing capability is determined by subtracting the gross vehicle weight rating from the gross combined weight rating, or a minimum payload capability of 1,700 pounds, where minimum payload capability is determined by subtracting the curb weight from the gross vehicle weight rating.

"**Global Warming Potential**" or "**GWP**" means the global warming potential of the refrigerant over a 100-year horizon, as specified in Intergovernmental Panel on Climate Change (IPCC) 2007: Climate Change 2007 – The Physical Science Basis. S. Solomon et al. (editors), Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA, ISBN 0-521-70596-7 or determined by ARB if such information is not available in the IPCC Fourth Assessment Report

"**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 8,500 pounds, except passenger cars.

"**High Efficiency Exterior Lighting**" means a lighting technology that, when installed on the vehicle, is expected to reduce the total electrical demand of the exterior lighting system by a minimum of 60 watts when compared to conventional lighting systems. To be eligible for this credit the high efficiency lighting must be installed in the following components: parking/position, front and rear turn signals, front and rear side markers, stop/brake lights (including the center-mounted location), taillights, backup/reverse lights, and license plate lighting.

"**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 that can draw propulsion energy from both of the following on-vehicle sources of stored energy: 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, or flywheel.

"**Improved condensers and/or evaporators**" means that the coefficient of performance (COP) of air conditioning system using improved evaporator and condenser designs is 10 percent higher, as determined using the bench test procedures described in SAE J2765 ''Procedure for Measuring System COP of a Mobile Air Conditioning System on a Test Bench,'' when compared to a system using standard, or prior model year, component designs. SAE J2765 is incorporated by reference herein. The manufacturer must submit an engineering analysis

demonstrating the increased improvement of the system relative to the baseline design, where the baseline component(s) for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The dimensional characteristics (e.g., tube configuration/thickness/spacing, and fin density) of the baseline component(s) shall be compared to the new component(s) to demonstrate the improvement in coefficient of performance.

"**Incomplete vehicle**" means any vehicle that 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.

"Large volume manufacturer" means a manufacturer that is not a small volume manufacturer.

"**LEV II**" refers to the standards that were initially adopted by the Board on August 5, 1999 and are set forth in section E.1.1.1 of these test procedures.

"**LEV III**" refers to the standards that are set forth in section E.1.1.2 of these test procedures.

"**Light-duty truck**" or "**LDT**" means any motor vehicle rated at 8,500 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 light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds.

"**Low-emission vehicle**" means any vehicle certified to low-emission vehicle standards.

"**Medium-duty vehicle**" or "**MDV**" means any heavy-duty vehicle having a manufacturer's gross vehicle weight rating between 8,501 and 14,000 pounds.

"**Methanol**" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH_3OH) and gasoline as specified in 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.

"Mild hybrid gasoline-electric vehicle" means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the FTP is at least 15 percent but less than 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

"Model Type" means a unique combination of car line, basic engine, and transmission class.

"2012 through 2016 MY National greenhouse gas program" or "**2012 through 2016 MY National greenhouse gas final rule**" means the national program that applies to new 2012 through 2016 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as adopted by the U.S. Environmental Protection Agency on April 1, 2010 (75 Fed. Reg. 25324, 25677 (May 7, 2010)), as incorporated in and amended by these test procedures.

"**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."

"**Off-vehicle charge capable hybrid electric vehicle**" means a hybrid electric vehicle that has the capability to charge a battery from an off-vehicle electric energy source that cannot be connected or coupled to the vehicle in any manner while the vehicle is being driven. A grid-connected hybrid electric vehicle is one example of an off-vehicle charge capable hybrid electric vehicle.

"**Oil separator**" means a mechanism that removes at least 50 percent of the oil entrained in the oil/refrigerant mixture exiting the compressor and returns it to the compressor housing or compressor inlet, or a compressor design that does not rely on the circulation of an oil/refrigerant mixture for lubrication.

"**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 LEVs, LEV630s, LEV395s, LEV160s, ULEVs, ULEV570s, ULEV400s, ULEV340s, ULEV270s, ULEV250s, ULEV200s, ULEV125s, ULEV70s, ULEV50s, SULEV230s, SULEV200s, SULEV170s, SULEV150s, SULEV30s, or SULEV20s, which accounts for changes in the ozone-forming potential of the NMOG emissions from a vehicle as it accumulates mileage.

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

"**Passive Cabin Ventilation**" means ducts or devices which utilize convective airflow to move heated air from the cabin interior to the exterior of the vehicle.

"**Reduced reheat, with externally controlled, fixed-displacement or pneumatic variable displacement compressor**" means a system in which the output of either compressor is controlled by cycling the compressor clutch off-and-on via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

"**Reduced reheat, with externally-controlled, variable displacement compressor**" means a system in which compressor displacement is controlled via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

"**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.

Except as provided in the last paragraph of this definition, for the 2015 through 2017 model years, 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

Except as provided in the last paragraph of this definition, for the 2018 and subsequent model years, 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 33.4% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 33.4% 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

For the purposes of this paragraph, all manufacturers whose annual sales are aggregated together under the provisions of this definition shall be defined as “related manufacturers.” Notwithstanding such aggregation, the Executive Officer may make a determination of operational independence if all of the following criteria are met for at least 24 months preceding the application submittal: (1) for the three years preceding the year in which the initial application is submitted, the average California sales for the applicant does not exceed 4,500 vehicles per year; (2) no financial or other support of economic value is provided by related manufacturers for purposes of design, parts procurement, R&D and production facilities and operation, and any other transactions between related manufacturers are conducted under normal commercial arrangements like those conducted with other parties, at competitive pricing rates to the manufacturer; (3) related manufacturers maintain separate and independent research and development, testing, and production facilities; (4) related manufacturers do not use any vehicle powertrains or platforms developed or produced by related manufacturers; (5) patents are not held jointly with related manufacturers; (6) related manufacturers maintain separate business administration, legal, purchasing, sales, and marketing departments, as well as autonomous decision-making on commercial matters; (7) the overlap of the Board of Directors between related manufacturers is limited to 25% with no sharing of top operational management, including president, chief executive officer, chief financial officer, and chief operating officer, and provided that no individual overlapping director or combination of overlapping directors exercises exclusive management control over either or both companies; and (8) parts or components supply between related companies must be established through open market process, and to the extent that the manufacturer sells parts/components to non-related manufacturers, it does so through the open market a competitive pricing. Any manufacturer applying for operational independence must submit to ARB an Attestation Engagement from an independent certified public accountant or firm of such accountants verifying the accuracy of the information contained in the application, as defined by and in accordance with the procedures established in

40 C.F.R. §80.125, as last amended January 19, 2007, which is incorporated by reference in section 1900, title 13, CCR. The applicant must submit information to update any of the above eight criteria as material changes to any of the criteria occur. If there are no material changes to any of the criteria, the applicant must certify that to the Executive Officer annually. With respect to any such changes, the Executive Officer may consider extraordinary conditions (e.g., changes to economic conditions, unanticipated market changes, etc.) and may continue to find the applicant to be operationally independent. In the event that a manufacturer loses eligibility as a "small volume manufacturer" after a material change occurs, the manufacturer must begin compliance with the primary emissions program in the third model year after the model year in which the manufacturer loses its eligibility. The Executive Officer may, in his or her discretion, re-establish lost "small volume manufacturer" status if the manufacturer shows that it has met the operational independence criteria for three consecutive years.

"**Solar Reflective Paint**" means a vehicle paint or surface coating which reflects at least 65 percent of the impinging infrared solar energy, as determined using ASTM standards E903, E1918-06, or C1549-09. These ASTM standards are incorporated by reference, herein.

"**Solar Roof Panels**" means the installation of solar panels on an electric vehicle or a plug-in hybrid electric vehicle such that the solar energy is used to provide energy to the electric drive system of the vehicle by charging the battery or directly providing power to the electric motor with the equivalent of at least 50 Watts of rated electricity output.

"**Strong hybrid gasoline-electric vehicle**" means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the Federal Test Procedure is at least 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

"**Subconfiguration**" means

"**Super-ultra-low-emission vehicle"** means any vehicle certified to super-ultra-low-emission vehicle standards.

"**Ultra-low-emission vehicle**" means any vehicle certified to ultra-low-emission vehicle standards.

"Unified Cycle" or **"UC"** means the driving schedule as set forth in Part II, Section D of these test procedures.

"**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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

3. §86.1804 Acronyms and Abbreviations.

3.1 §86.1804-01 January 17, 2006. [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.

“cc” means cubic centimeters.

“CFR” means Code of Federal Regulations.

"CH_4" 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 light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds.

“LEV” means LEV II low-emission vehicle.

“LEV II vehicle” means any vehicle certified to the LEV II exhaust standards in section E.1.1.1.

“LEV III vehicle” means any vehicle certified to the LEV III exhaust standards in section E.1.1.2.

“LEV160” means any light-duty vehicle certified to LEV III low-emission vehicle 160 standards.

“LEV395” means any medium-duty vehicle certified to LEV III low-emission vehicle 395 standards.

“LEV630” means any medium-duty vehicle certified to LEV III low-emission vehicle 630 standards.

“LVW” means loaded vehicle weight.

“MDPV” means medium-duty passenger vehicle.

“MDV” means medium-duty vehicle.

“n/a” means not applicable.

“NHTSA” means National Highway Traffic Safety Administration.

"N_2O" 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.

“PZEV” means any vehicle that receives partial zero-emission vehicle credit, in accordance with the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes” and/or the “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes.”

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

“SULEV20” means any light-duty vehicle certified to LEV III super-ultra-low-emission 20 standards.

“SULEV30” means any light-duty vehicle certified to LEV III super-ultra-low-emission vehicle 30 standards.

“SULEV150” means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 150 standards.

“SULEV170” means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 170 standards.

“SULEV200” means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 200 standards.

“SULEV230” means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 230 standards.

“UC” means Unified Cycle.

“ULEV” means LEV II ultra-low-emission vehicle.

“ULEV50” means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 50 standards.

“ULEV70” means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 70 standards.

“ULEV125” means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 125 standards.

“ULEV200” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 200 standards.

“ULEV250” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 250 standards.

“ULEV270” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 270 standards.

“ULEV340” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 340 standards.

“ULEV400” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 400 standards.

“ULEV570” means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 570 standards.

C. General Requirements for Certification

1. §86.1805 Useful Life.

1.1 §86.1805-12. May 7, 2010. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV III standards in section E.1.1.2 and/or to the SFTP 150,000 mile standards in section E.1.2.2 shall be 15 years or 150,000 miles, whichever occurs first. These full useful life values apply to all exhaust, evaporative, and refueling emission requirements except for standards which are specified to only be applicable at the time of certification.

1.1.2 Amend subparagraph (b) as follows: The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the optional LEV II 150,000 mile standards in section E.1.1.1 shall be 15 years or 150,000 miles, whichever occurs first.

1.1.3 Subparagraph (c) [No change.]

1.1.4 Subparagraph (d) [No change.]

2. §86.1806 On-Board Diagnostics.

2.1 §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 §86.1807-07. July 13, 2005. 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, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, SULEV20, 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, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20, 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. 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, the Executive Officer 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 **California Labeling Requirements**.

3.2.1. 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 Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" 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.

3.2.2. For all 2015 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) "CA OBD II" or "OBD Exempt".

(b) Identification of the Exhaust Emission Control System, including but not limited to:

AIR	-	Secondary Air Injection (Pump);
CAC	-	Charge Air Cooler;
CFI	-	Continuous Fuel Injection;
CTOX	-	Continuous (Passive) Trap Oxidizer (Diesel Engine);
DFI	-	Direct Fuel Injection;

DOR	-	Direct Ozone Reduction;
DPF	-	Diesel Particulate Filter (Active);
EGR	-	Exhaust Gas Recirculation;
EGRC	-	EGR Cooler;
EHOC	-	Electrically Heated Oxidation Catalyst;
EHTWC	-	Electrically Heated Three-Way Catalyst;
EM	-	Engine Modification;
FFS	-	Flexible Fuel Sensor;
GPF	-	Particulate Filter for Spark-Ignited Engine;
HAC	-	Hydrocarbon Adsorbing Catalyst;
HO2S	-	Heated Oxygen Sensor;
IFI	-	Indirect Fuel Injection;
MFI	-	Multiport (Electronic) Fuel Injection, (Central) Multiport Fuel Injection;
NAC	-	NOx Adsorber Catalyst;
NH3OC	-	Ammonia Slip Catalyst;
NH3S	-	Ammonia Sensor;
NOXS	-	NOx Sensor;
OC	-	Oxidation Catalyst Only;
O2S	-	Oxygen Sensor;
PAIR	-	Pulsed Secondary Air Injection;
PMS	-	Particulate Matter Sensor;
RDQS	-	Reductant Quality Sensor;
SC	-	Supercharger;
SCRC	-	Selective Catalytic Reduction Catalyst (Urea-Based);
SCRC-NH3	-	Selective Catalytic Reduction Catalyst (Ammonia-Based);
SFI	-	Sequential Multipoint (Electronic) Fuel Injection;
TBI	-	Throttle Body (Electronic) Fuel Injection;
TC	-	Turbocharger;
TWC	-	Three-Way Catalyst;
TWC+OC	-	Three-Way Catalyst + Oxidation Catalyst;
WR-HO2S	-	Wide Range/Linear/Air-Fuel Ratio Heated Oxygen Sensor;
WU-TWC	-	Warm-Up Catalyst with Three-Way Catalyst;
WU-OC	-	Warm-Up Catalyst with Oxidation Catalyst.

Abbreviations used shall be in accordance with SAE J1930, October 2008, including the above nomenclature unless the Executive Officer approves a more current version of SAE J1930. For components not listed in SAE J1930, the manufacturer shall request Executive Officer approval of the abbreviations to be used for the components. Executive Officer approval shall be based on the consistency of the abbreviation with existing terminology used for the component in the applicable industry, ability to provide appropriate distinction from other similar components, and ability to be deciphered intuitively by users of the label.

3.2.3 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."

3.2.4 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 §86.1808-07. July 13, 2005. [No change.]

5. §86.1809 Prohibition of Defeat Devices.

5.1 §86-1809-12. May 7, 2010. [No change.]

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

1. §86.1810-09. July 6, 2011. Amend §86.1810-09 as follows:

This section applies to model year 2015 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. [No change, except that 50°F standards shall only apply at low 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) Amend as follows: For gasoline and diesel-fueled LEV II and LEV III vehicles, manufacturers may measure non-methane hydrocarbons (NMHC) in lieu of NMOG. For LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.1, manufacturers must multiply NMHC measurements by an adjustment factor of 1.04 before comparing with the NMOG standard to determine compliance with the standard. For LEV III vehicles and LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.2, manufacturers must multiply NMHC measurements by an adjustment factor of 1.1 before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard. Manufacturers may use other factors to adjust NMHC results to more properly represent NMOG results. Such factors must be based upon comparative testing of NMOG and NMHC emissions and be approved in advance by the Administrator.

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 LEV II and LEV III 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."

1.1.2 For diesel vehicles, NMOG shall mean non-methane hydrocarbons 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."

1.1.3 For vehicles certifying to the SFTP standards set forth in section E.1.2 of these test procedures, hydrocarbon emissions 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." For alcohol-fueled vehicles certifying to the standards in section E.1.2, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

2. Supplemental FTP General Provisions for California.

2.1 Amend 40 CFR §86.1810-09(i) as follows:

2.1.1 Delete subparagraphs (1) through (3) [The implementation schedules for SFTP are set forth in section E.2.4 of these test procedures.]

2.1.2 Delete subparagraph (4); replace with: The SFTP standards set forth in section E.1.2 of these test procedures apply to PCs, LDTs, and MDVs certified on alternative fuels. The standards also apply to the gasoline and diesel fuel operation of fuel-flexible PCs, LDTs, and MDVs, and dual-fuel PCs, LDTs, and MDVs.

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 that 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);

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 LEV II and LEV III vehicles and references to NMHC+NOx shall mean NMOG+NOx.]

2.1.9 Subparagraph (14); references to Tier 2 and non-Tier 2 vehicles shall mean California LEV II and LEV III vehicles.

Add the following sentence: 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.

2.2 For gasoline and diesel-fueled LEV II and LEV III vehicles, manufacturers may measure non-methane hydrocarbons (NMHC) in lieu of NMOG. Manufacturers shall multiply NMHC measurements by an adjustment factor of 1.03 before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard.

E. California Exhaust Emission Standards.

Delete 40 CFR §§86.1811 through 86.1819.

Introduction. The following section E. contains the exhaust emission standards and phase-in requirements 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. For model years 2015 and 2016, a manufacturer shall demonstrate compliance with the requirements of sections E.2.5 and E.3.2 by demonstrating compliance with sections E.2.5 and E.3.2 of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

For the 2015 through 2021 model years, a manufacturer has the option of certifying LEV II engines used in incomplete Otto-cycle and incomplete diesel medium-duty vehicles with a gross vehicle weight rating of greater than 8,500 lbs. GVW to the heavy-duty engine standards and test procedures set forth in title 13, CCR, sections 1956.8(c) and (h). All 2015 through 2021 model LEV II medium-duty vehicles with a gross vehicle weight rating of less than or equal to 8,500 lbs. GVW and all LEV III medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete Otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the chassis standards and test procedures set forth in this section E. For the 2022 and subsequent model years, a manufacturer has the option of certifying LEV III engines used in incomplete Otto-cycle and incomplete diesel medium-duty vehicles with a gross vehicle weight rating of greater than 10,000 lbs. GVW to the heavy-duty engine standards and test procedures set forth in title 13, CCR, sections 1956.8(c) and (h). All 2022 and subsequent model medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete Otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the LEV III chassis standards and test procedures set forth in this section E.

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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

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 II Exhaust Standards.** The following LEV II standards are the maximum exhaust emissions for the intermediate and full useful life from new 2015 through 2019 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, except that for the 2015 through 2019 model years, SULEV exhaust standards shall only apply to vehicles that receive partial zero-emission vehicle credits according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2, title 13, CCR. Vehicles that are certified to the particulate standards in section E.1.1.2.1 may not certify to LEV II standards.

2015 – 2019 model-year LEV II LEV vehicles may be certified to the NMOG+NOx numerical values for LEV160, LEV395, or LEV630, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1; LEV II ULEV vehicles may be certified to the NMOG+NOx numerical values for ULEV125, ULEV340, or ULEV570, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1; and LEV II SULEV vehicles may be certified to the NMOG+NOx numerical values for SULEV30, SULEV170, or SULEV230, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1.

LEV II Exhaust Mass Emission Standards for New 2015 Through 2019 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicle							
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. GVWR 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. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	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
	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. GVWR 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

1.1.2 **LEV III Exhaust Standards.** The following standards are the maximum exhaust emissions for the full useful life from new 2015 and subsequent model year "LEV III" passenger cars, light-duty trucks, and medium-duty vehicles, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on both of the fuels they are designed to use. Before the 2015 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 III vehicles for purposes of the fleet-wide phase-in requirements.

LEV III Exhaust Mass Emission Standards for New 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	NMOG + Oxides of Nitrogen (g/mi)	Carbon Monoxide (g/mi)	Formaldehyde (mg/mi)	Particulates[1] (g/mi)
All PCs; LDTs 8500 lbs. GVWR or less; and MDPVs Vehicles in this category are tested at their loaded vehicle weight	150,000	LEV160	0.160	4.2	4	0.01
		ULEV125	0.125	2.1	4	0.01
		ULEV70	0.070	1.7	4	0.01
		ULEV50	0.050	1.7	4	0.01
		SULEV30	0.030	1.0	4	0.01
		SULEV20	0.020	1.0	4	0.01
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV395	0.395	6.4	6	0.12
		ULEV340	0.340	3.2	6	0.06
		ULEV250	0.250	2.6	6	0.06
		ULEV200	0.200	2.6	6	0.06
		SULEV170	0.170	1.5	6	0.06
		SULEV150	0.150	1.5	6	0.06
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV630	0.630	7.3	6	0.12
		ULEV570	0.570	3.7	6	0.06
		ULEV400	0.400	3.0	6	0.06
		ULEV270	0.270	3.0	6	0.06
		SULEV230	0.230	1.7	6	0.06
		SULEV200	0.200	1.7	6	0.06

[1] These standards shall apply only to vehicles not included in the phase-in of the particulate standards set forth in Section E.1.1.2.1.

[2] The numeric portion of the category name is the NMOG+NOx value in thousandths of grams per mile.

1.1.2.1 **LEV III Particulate Standards.**

1.1.2.1.1 **Particulate Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its passenger car, light-duty truck, and medium-duty vehicle fleet to the following particulate standards according to the following phase-in schedule. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2.

LEV III Particulate Emission Standard Values and Phase-in for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles		
Model Year	**% of vehicles certified to a 3 mg/mi standard**	**% of vehicles certified to a 1 mg/mi standard**
2017	10	0
2018	20	0
2019	40	0
2020	70	0
2021	100	0
2022	100	0
2023	100	0
2024	100	0
2025	75	25
2026	50	50
2027	25	75
2028 and subsequent	0	100

1.1.2.1.2 **Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.**

1.1.2.1.2.1 Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its medium-duty vehicle fleet to the following particulate standards. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2. This section E.1.1.2.1.2.1 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Values for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Vehicle Type[1]	**Particulates (mg/mi)**
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs	8
MDVs 10,001 - 14,000 lbs. GVWR	10

[1] Vehicles in these categories are tested at their adjusted loaded vehicle weight.

1.1.2.1.2.2 A manufacturer of medium-duty vehicles, except a small volume manufacturer, shall certify at least the following percentage of its medium-duty vehicle fleet to the particulate standards in section E.1.1.2.1.2.1 according to the following phase-in schedule. This section E.1.1.2.1.2.2 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Phase-in for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Model Year	**Total % of MDVs certified to the 8 mg/mi PM Standard or to the 10 mg/mi PM Standard, as applicable**
2017	10
2018	20
2019	40
2020	70
2021 and subsequent	100

1.1.2.1.3 **Particulate Standards for Small Volume Manufacturers.** In the 2021 through 2027 model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 3 mg/mi particulate standard. In the 2028 and subsequent model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 1 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 8501 - 10,000 lbs. GVWR, excluding MDPVs, to the 8 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 10,001 - 14,000 lbs. GVWR to the 10 mg/mi particulate standard. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2.

1.1.2.1.4 **Alternative Phase-in Schedule for Particulate Standards.**

1.1.2.1.4.1 **Alternative Phase-in Schedules for the 3 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 3 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

1.1.2.1.4.2 **Alternative Phase-in Schedules for the 1 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 1 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2028 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 1 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2025 model year, 3 for the 2026 model year, 2 for the 2027 model year, and 1 for the 2028 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 500 in the 2028 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2025 model year (e.g., the percent of vehicles introduced in 2024 would be multiplied by 4) to the cumulative total.

1.1.2.1.4.3 **Alternative Phase-in Schedules for the Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from medium-duty vehicles other than medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the total percent of MDVs certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, in a

given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for MDVs shall be summed together to determine a cumulative total for MDVs. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

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

1.2.1 **4,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.** The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for 2015 through 2020 model year passenger cars, and light-duty truck and medium-duty vehicles (less than 8,501 pounds gross vehicle weight rating) certifying to the LEV II exhaust emission standards in section E.1.1.1:

SFTP Exhaust Emission Standards for LEV II Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles[1,2]

Vehicle Type	*Gross Vehicle Weight Rating (lbs.)*	*Test Weight*[3] *(lbs.)*	*US06 Test (g/mi)*		*A/C Test (g/mi)*	
			NMHC + NOx	*CO*	*NMHC + NOx*	*CO*
PC	All	All	0.14	8.0	0.20	2.7
LDT	≤ 6000 lbs.	0-3750 lbs.	0.14	8.0	0.20	2.7
		3751-5750 lbs.	0.25	10.5	0.27	3.5
MDV	6,001-8,500 lbs.	3751-5750 lbs.	0.40	10.5	0.31	3.5
		5751-8500 lbs.	0.60	11.8	0.44	4.0

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

[2] 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 rating 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 vehicle) 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 and light-duty trucks. Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this section E.1.2.1.

[3] PCs and LDTs are tested at their loaded vehicle weight (curb weight plus 300 lbs.). MDVs are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).

1.2.2 **150,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.**

1.2.2.1 **SFTP NMOG+NOx and CO Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** Manufacturers shall certify 2015 and subsequent model year LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes to either the *SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards* set forth in section E.1.2.2.1.1, or in accordance with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in section E.1.2.2.1.2. A manufacturer may also certify 2014 model LEVs, ULEVs, or SULEVs in the PC, LDT, or MDPV classes to LEV III SFTP standards, in which case, the manufacturer shall be subject to the LEV III SFTP emission standards and requirements, including the sales-weighted fleet-average NMOG+NOx composite emission standard applicable to 2015 model vehicles if choosing to comply with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in subsection E.1.2.2.1.2. The manufacturer shall notify the Executive Officer of its selected emission standard type in the Application for Certification of the first test group certifying to SFTP NMOG+NOx and CO emission standards on a 150,000 mile durability basis. Once an emission standard type for NMOG+NOx and CO is selected for a fleet, and the Executive Officer is notified of such selection, the selection must be kept through the 2025 model year for the entire fleet, which includes LEV II vehicles if selecting to comply with section E.1.2.2.1.2. The manufacturer may not change its selection until the 2026 model year. Test groups not certifying to the 150,000-mile SFTP NMOG+NOx and CO emission standards pursuant to this section E.1.2.2 shall be subject to the 4,000-mile SFTP NMOG+NOx and CO emission standards set forth in section E.1.2.1.

1.2.2.1.1 **SFTP NMOG+NOx and CO Exhaust Stand-Alone Emission Standards.** The following standards are the maximum SFTP NMOG+NOx and CO exhaust emissions through full useful life from 2015 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards for 2015 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles						
Vehicle Type	*Durability Vehicle Basis (mi)*	*Vehicle Emission Category*[1]	*US06 Test (g/mi)*		*SC03 Test (g/mi)*	
			NMOG + NOx	*CO*	*NMOG + NOx*	*CO*
All PCs; LDTs 0- 8,500 lbs. GVWR; and MDPVs Vehicles in these categories are tested at their loaded vehicle weight (curb weight plus 300 pounds).	150,000	LEV	0.140	9.6	0.100	3.2
		ULEV	0.120	9.6	0.070	3.2
		SULEV (Option A)[2]	0.060	9.6	0.020	3.2
		SULEV	0.050	9.6	0.020	3.2

[1] *Vehicle Emission Category*. Manufacturers must certify all vehicles, which are certifying to a LEV III FTP emission category on a 150,000-mile durability basis, to the emission standards of the equivalent, or a more stringent, SFTP emission category set forth on this table. That is, all LEV III LEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP LEV emission standards in this table, all LEV III ULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP ULEV emission standards in this table, and all LEV III SULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP SULEV emission standards in this table.

[2] *Optional SFTP SULEV Standards.* A manufacturer may certify light-duty truck test groups from 6,001 to 8,500 lbs. GVWR and MDPV test groups to the SULEV, option A, emission standards set forth in this table for the 2015 through 2020 model year, only if the vehicles in the test group are equipped with a particulate filter and the manufacturer extends the particulate filter emission warranty mileage to 200,000 miles. Passenger cars and light-duty trucks 0-6,000 lbs. GVWR are not eligible for this option.

1.2.2.1.2 **SFTP NMOG+NOx and CO Composite Exhaust Emission Standards.** For the 2015 and subsequent model years, a manufacturer must certify LEV II and LEV III LEVs, ULEVs, and SULEVs, such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value, does not exceed the applicable NMOG+NOx composite emission standard set forth in the following table. In addition, the CO composite emission value of any LEV III test group shall not exceed the CO composite emission standard set forth in the following table. SFTP compliance shall be demonstrated using the same gaseous or liquid fuel used for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

For each test group subject to this subsection, manufacturers shall calculate a Composite Emission Value for NMOG+NOx and, for LEV III test groups, a separate Composite Emission Value for CO, using the following equation:

Composite Emission Value = 0.28 x US06 + 0.37 x SC03 + 0.35 x FTP [Eq. 1]

where "US06" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the US06 test;

"SC03" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the SC03 test; and

"FTP" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the FTP test.

If no vehicles in a test group have air conditioning units, the FTP cycle emission value can be used in place of the SC03 value in Equation 1. To determine compliance with the SFTP NMOG+NOx composite emission standard applicable to the model year, manufacturers shall use a sales-weighted fleet average of the NMOG+NOx composite emission values of every applicable test group. The sales-weighted fleet average shall be calculated using a combination of carry-over and new certification SFTP composite emission values (converted to NMOG+NOx, as applicable). LEV II test groups will use their emission values in the fleet average calculation but will not be considered LEV III test groups. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging. The NMOG+NOx sales-weighted fleet-average composite emission value for the fleet and the CO composite emission value for each test group shall not exceed:

SFTP NMOG+NOx and CO Composite Emission Standards for 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles (g/mi) [1]											
Model Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025+**
All PCs; LDTs 8,500 lbs. GVWR or less; and MDPVs[3]	***Sales-Weighted Fleet Average NMOG+NOx Composite Exhaust Emission Standards***[2,4,5,6]										
	0.140	0.110	0.103	0.097	0.090	0.083	0.077	0.070	0.063	0.057	0.050
Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 pounds).	***CO Composite Exhaust Emission Standard***[7]										
	4.2										

[1] *Mileage for Compliance.* All test groups certifying to LEV III FTP emission standards on a 150,000-mile durability basis shall also certify to the SFTP on a 150,000-mile durability basis, as tested in accordance with these test procedures.

[2] *Determining NMOG+NOx Composite Emission Values of LEV II Test Groups.* For test groups certified to LEV II FTP emission standards, SFTP emission values shall be converted to NMOG+NOx and projected out to 120,000 miles or 150,000 miles (depending on LEV II FTP certification) using deterioration factors or aged components. NMHC emission values for the US06 and SC03 test cycles shall be converted to NMOG emission values by multiplying by a factor of 1.03. In lieu of deriving a deterioration factor specific to SFTP test cycles, carry-over test groups may use the applicable deterioration factor from the FTP cycle in order to determine the carry-over composite emission values for the purpose of the NMOG+NOx sales-weighted fleet-average calculation. If an SFTP full-useful life emission value is used to comply with SFTP 4k standards, that value may be used in the sales-weighted fleet-average without applying an additional deterioration factor.

[3] MDPVs are excluded from SFTP NMOG+NOx and CO emission standards and the sales-weighted fleet average until they are certified to LEV III FTP 150,000-mile NMOG+NOx and CO requirements.

[4] Test groups shall certify to bins in increments of 0.010 g/mi. Beginning with the 2018 model year, vehicles may not certify to bin values above a maximum of 0.180 g/mi.

[5] *Calculating the sales-weighted average for NMOG+NOx.* For each model year, the manufacturer shall calculate its sales-weighted fleet-average NMOG+NOx composite emission value as follows.

$$\frac{\left[\sum_{i=1}^{n}(\textit{number of vehicles in the test group})_i \times (\textit{composite value of bin})_i\right]}{\sum_{i=1}^{n}(\textit{number of vehicles in the test group})_i} \qquad \text{[Eq. 2]}$$

where "n" = a manufacturer's total number of PC, LDT, and, if applicable, MDPV certification bins, in a given model year including carry-over certification bins, certifying to SFTP composite emission standards in that model year;

"number of vehicles in the test group" = the number of vehicles produced and delivered for sale in California in the certification test group; and

"Composite Value of Bin" = the numerical value selected by the manufacturer for the certification bin that serves as the emission standard for the vehicles in the test group with respect to all testing for test groups certifying to SFTP on a 150,000-mile durability basis, and the SFTP carry-over composite emission value, as described in footnote 7 of this table, for carry-over LEV II test groups.

[6] *Calculation of Fleet Average Total NMOG+NOx Credits or Debits.* A manufacturer shall calculate the total NMOG+NOx credits or debits, as follows:

[(NMOG+NOx Composite Emission Standard) – (Manufacturer's Sales-Weighted Fleet-Average Composite Emission Value)]
x (Total Number of Vehicles Produced and Delivered for Sale in California in the 0-8,500 lbs GVWR plus MDPVs classes, if applicable) [Eq. 3]

A negative number constitutes total NMOG+NOx debits, and a positive number constitutes total NMOG+NOx credits accrued by the manufacturer for the given model year. Total NMOG+NOx credits earned in a given model year retain full value through the fifth model year after they are earned. At the beginning of the sixth model year, the total NMOG+NOx credits have no value. A manufacturer may trade credits with other manufacturers

A manufacturer shall equalize total NMOG+NOx debits within three model years after they have been incurred by earning NMOG+NOx credits in an amount equal to the total NMOG+NOx debits. If total NMOG+NOx debits are not equalized within the three model-year period, the manufacturer is 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 total NMOG+NOx debits are not equalized by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's emission standards is determined by dividing the NMOG+NOx debits for the model year by the NMOG+NOx composite emission standard in effect during the model year in which the debits were incurred.

[7] *Calculating the CO composite emission value.* Composite emission values for CO shall be calculated in accordance with Equation 1 above. Unlike the NMOG+NOx composite emission standards, manufacturers would not be able to meet the proposed CO composite emission standard through fleet averaging: each individual test group must comply with the standard. Test groups certified to 4,000-mile SFTP emission standards are not subject to this CO emission standard.

1.2.2.2 **SFTP PM Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** The following standards are the maximum PM exhaust emissions through the full useful life from 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of flex-fueled vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles[1]				
Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Test Cycle*	*PM (mg/mi)*
All PCs; LDTs 0-6,000 lbs GVWR	Loaded vehicle weight	150,000	US06	10
LDTs 6,001-8,500 lbs GVWR; MDPVs	Loaded vehicle weight	150,000	US06	20

[1] All PCs, LDTs, and MDPVs certified to LEV III FTP PM emission standards in section E.1.1.2.1 on a 150,000-mile durability basis shall comply with the SFTP PM Exhaust Emission Standards in this table.

1.2.2.3 **SFTP NMOG+NOx and CO Exhaust Emission Standards for Medium-Duty Vehicles.** The following standards are the maximum NMOG+NOx and CO composite emission values for full useful life of 2016 and subsequent model-year medium-duty LEV III ULEVs and SULEVs from 8,501 through 14,000 pounds GVWR when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. The following composite emission standards do not apply to MDPVs subject to the emission standards set forth in sections E.1.2.2.1 and E.1.2.2.2.

SFTP NMOG+NOx and CO Composite Exhaust Emission Standards for 2016 and Subsequent Model ULEVs and SULEVs in the Medium-Duty Vehicle Class						
Vehicle Type	*Mileage for Compliance*	*HP/GVWR[2]*	*Test Cycle[3,4,5]*	*Vehicle Emission Category[6]*	*Composite Emission Standard[1] (g/mi)*	
					NMOG + NOx	*Carbon Monoxide*
MDVs 8,501 - 10,000 lbs GVWR	150,000	≤ 0.024	US06 Bag 2, SC03, FTP	ULEV	0.550	22.0
				SULEV	0.350	12.0
		> 0.024	Full US06, SC03, FTP	ULEV	0.800	22.0
				SULEV	0.450	12.0
MDVs 10,001-14,000 lbs GVWR	150,000	n/a	Hot 1435 UC (Hot 1435 LA92), SC03, FTP	ULEV	0.550	6.0
				SULEV	0.350	4.0

[1] Manufacturers shall use Equation 1 in subsection E.1.2.2.1.2 to calculate SFTP Composite Emission Values for each test group subject to the emission standards in this table. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's maximum rated horsepower, as established by the engine manufacturer in the vehicle's Application for Certification, to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Test Weight*. Medium-duty vehicles are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).

[4] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[5] If a manufacturer provides an engineering evaluation for a test group showing that SC03 emissions will be equivalent to or lower than FTP emissions, the FTP emission value may be used in place of the SC03 emission value when determining the composite emission value for that test group.

[6] *Vehicle Emission Categories.* For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section E.1.2.2.3 shall be equal to or greater than the total percentage certified to the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth this section E.1.2.2.3 shall be equal to or greater than the total percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

1.2.2.4 **SFTP PM Exhaust Emission Standards for Medium-Duty Vehicles.** The following standards represent the maximum PM composite emission values for the full useful life of 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. The following composite emission standards do not apply to MDPVs subject to the emission standards set forth in sections E.1.2.2.1 and E.1.2.2.2.

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model Medium-Duty Vehicles[1]

Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Hp/GVWR[2]*	*Test Cycle[3,4]*	*PM (mg/mi)*
MDVs 8,501-10,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	≤ 0.024	US06 Bag 2	7
			>0.024	US06	10
MDVs 10,001-14,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	n/a	Hot 1435 UC (Hot 1435 LA92)	7

[1] Except for MDPVs subject to the emission standards set forth in section E.1.2.2.2, MDVs certified to 150,000-mile FTP PM emission standards in section E.1.1.2 shall comply with the SFTP PM Exhaust Emission Standards in this table.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's horsepower to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[4] Manufacturers shall use Equation 1 above to calculate SFTP Composite PM Emission Values for each test group subject to the emission standards in this table. For MDVs 8,501-10,000 lbs. GVWR certifying to the US06 Bag 2 PM emission standard, the emission results from the US06 Bag 2 test shall be used in place of results from the full US06 test. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

1.3 NMOG+NOx Standards for Fuel-Flexible, Bi-Fuel and Dual-Fuel Vehicles.

For fuel-flexible, bi-fuel and dual-fuel PCs, LDTs and MDVs, compliance with the NMOG+NOx exhaust mass emission standards must 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 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, NOx, and formaldehyde standards are set forth in section E.1.1 above.

1.3.1 For 2015 through 2019 model year LEV II vehicles, a manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG, CO, NOx and formaldehyde set forth in the tables in section E.1.1.1 when certifying the vehicle for operation on the gaseous or alcohol fuel. If the manufacturer elects to use them, the following exhaust mass emission standards represent the maximum NMOG emissions when certifying the vehicle for operation on gasoline (as specified in Part II, Section A. paragraph 100.3.1).

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

1.3.2 For the 2015 and subsequent model year LEV III vehicles, a manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG+NOx, CO, and formaldehyde set forth in the tables in section E.1.1.2 when

certifying the vehicle for operation on both gasoline or diesel, as applicable, and on the gaseous or alcohol fuel, as applicable.

1.4 50°F Exhaust Emission Standards.

1.4.1 Standards for Vehicles Certified to the LEV II Standards.

All passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV II exhaust emission standards set forth in subparagraph E.1.1.1 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. A manufacturer may demonstrate compliance with the NMOG and HCHO certification standards contained in this subparagraph 1.4.1 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 NOx measured at 50°F shall not exceed the standards set forth in section E.1.1.1 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.

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

1.4.2 Standards for Vehicles Certified to the LEV III Standards.

All passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV III exhaust emission standards set forth in subparagraph E.1.1.2, other than natural gas and diesel fueled vehicles, must demonstrate compliance with the following exhaust emission standards for NMOG+NOx 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. A manufacturer may demonstrate compliance with the NMOG+NOx and HCHO certification standards contained in this subparagraph 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 measured at 50°F shall not exceed the standards set forth in section E.1.1.2 applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86°F.

1.4.2.1 **Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles Certified to the LEV III Standards.**

50°F Exhaust Emission Standards for LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV160	0.320	0.320	0.030
ULEV125	0.250	0.250	0.016
ULEV70	0.140	0.250	0.016
ULEV50	0.100	0.140	0.016
SULEV30	0.060	0.125	0.008
SULEV20	0.040	0.075	0.008

1.4.2.2 **Standards for Medium-Duty Vehicles (Excluding MDPVs) Certified to the LEV III Standards.**

50°F Exhaust Emission Standards for LEV III Medium-Duty Vehicles (Excluding MDPVs)			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV395	0.790	0.790	0.064
ULEV340	0.680	0.680	0.032
ULEV250	0.500	0.500	0.032
ULEV200	0.400	0.500	0.016
SULEV170	0.340	0.425	0.016
SULEV150	0.300	0.375	0.016
LEV630	1.260	1.260	0.080
ULEV570	1.140	1.140	0.042
ULEV400	0.800	0.800	0.042
ULEV270	0.540	0.675	0.020
SULEV230	0.460	0.575	0.020
SULEV200	0.400	0.500	0.020

1.5 Cold CO Standards.

The following standards are the maximum 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2015 and subsequent model-year passenger cars, light-duty trucks, and medium-duty passenger vehicles:

2015 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; MDPVs 10,000 lbs. GVW and less	12.5

These standards apply 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 NMOG + NOx Standard.

The maximum emissions of NMOG+NOx measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B, which is incorporated herein by reference) must not be greater than the applicable LEV III NMOG+NOx standard set forth in section E.1.1.2. Both the sum of the NMOG+NOx emissions and the HWFET standard must be rounded in accordance with ASTM E29-67 to the nearest 0.001 g/mi before being compared.

1.7 Requirement to Generate Additional NMOG+NOx Fleet Average Credit.

A vehicle that is certified to the LEV III standards in section E.1.1.2, which does not 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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," a manufacturer may subtract 5 mg/mi from the NMOG+NOx emission standard value set forth in section E.3.1.1 when calculating the manufacturer's fleet average, provided that the manufacturer extends the performance and defects warranty period to 15 years or 150,000 miles, whichever occurs first.

1.8 Requirement to Generate a Partial ZEV Allowance.

For the 2015 through 2017 model years, a manufacturer that certifies to the 150,000 mile LEV II SULEV standards, the LEV III SULEV30, or the LEV III SULEV20 standards may 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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

1.9 Optional LEV II NOx Standard.

For the 2015 through 2019 model years, 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 II, option 1, standard set forth in section E.1.1.1 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.

1.10 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 for which it seeks credit, 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 When a Federally-Certified Vehicle Model is Required in California.

1.11.1 **Basic Requirement.** Whenever a manufacturer federally-certifies a 2015 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.

1.11.2 **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 Emission Requirements 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 ULEV125 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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable. If the on-board fuel-fired heater is capable of operating at ambient temperatures above 40°F, the measured emission levels of the on-board fuel-fired heater shall be added to the emissions measured on the FTP (40 CFR, Part 86, Subpart B) to determine compliance with the exhaust emission standards in section E.1.1.

1.13 Greenhouse Gas Emission Requirements. The greenhouse gas emission levels from new 2017 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. GVWR with a maximum base payload of 2500 lbs. or more that certify to the LEV II LEV Option 1 exhaust standards in section E.1.1.1 are exempt from these greenhouse gas emission requirements. 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 + NOx Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

2.1.1 The fleet average non-methane organic gas plus oxides of nitrogen exhaust mass emission values from the passenger cars, light-duty trucks, and medium-duty passenger vehicles produced and delivered for sale in California each model year by a manufacturer other than a small volume manufacturer shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS PLUS OXIDES OF NITROGEN EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY PASSENGER VEHICLES (150,000 mile Durability Vehicle Basis)		
Model Year	Fleet Average NMOG + NOx (g/mi)	
	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs
2014[1]	0.107	0.128
2015	0.100	0.119
2016	0.093	0.110
2017	0.086	0.101
2018	0.079	0.092
2019	0.072	0.083
2020	0.065	0.074
2021	0.058	0.065
2022	0.051	0.056
2023	0.044	0.047
2024	0.037	0.038
2025+	0.030	0.030

[1] For the 2014 model year, a manufacturer may comply with the fleet average NMOG+NOx values in this table in lieu of complying with the NMOG fleet average values in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful life standards.

2.1.1.1 *Pooling Provision.*

a. For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in this section E.2.1.1 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.1.1, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.1.1, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's exhaust emission standards in section E.1.1 for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

b. If a manufacturer selects Option 2, that manufacturer must demonstrate compliance with sections E.1.1.2.1, E.2.1, E.2.2, E.2.3, and E.2.4 based on Option 2.

c. A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection in writing prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

d. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in sections E.2.1.2 and E.3.1 means California, the District of Columbia, and all states that have adopted California's exhaust emission standards in section E.1.1 for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

e. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each test group produced and delivered for sale in the District of Columbia and for each individual state within the average.

2.1.1.2 **PZEVs Anti-Backsliding Requirement**. In the 2018 and subsequent model years, a manufacturer must produce and deliver for sale in California a minimum percentage of its passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards. This minimum percentage must be equal to the average percentage of PZEVs produced and deliver for sale in California for that manufacturer for the 2015 through 2017 model year. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

2.1.2 **Calculation of Fleet Average NMOG + NOx Value**.

2.1.2.1 **Basic Calculation.**

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

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +
Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG+NOx contribution factor]) ÷

Total Number of PCs plus LDT1s Produced and Delivered for sale in California, Including ZEVs and HEVs

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

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +
Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG+NOx contribution factor]) ÷
Total Number of LDT2s plus MDPVs Produced and Delivered for sale in California, Including ZEVs and HEVs

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

Model Year	Emission Category	Emission Standard Value[1] (g/mi)	
		All PCs; LDTs 0-3750 lbs. LVW	**LDTs 3751-5750 lbs. LVW; All MDPVs**
2015 and subsequent model year federally-certified vehicles	All	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified
Model Year	**Emission Category**	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs**
2015 through 2019 model year vehicles certified to the "LEV II" standards in E.1.1.1; 2015 and subsequent model year vehicles certified to the "LEV III" standards in E.1.1.2	LEV II LEVs; LEV160s	0.160	0.160
	LEV II ULEVs; LEV125s	0.125	0.125
	ULEV70s	0.070	0.070
	ULEV50s	0.050	0.050
	LEV II SULEVs; SULEV30s	0.030	0.030
	SULEV20s	0.020	0.020
	LEV II LEVs; LEV395s	n/a	0.395
	LEV II ULEVs	n/a	0.343
	ULEV340s	n/a	0.340
	ULEV250s	n/a	0.250
	ULEV200s	n/a	0.200
	SULEV170s	n/a	0.170
	SULEV150s	n/a	0.150

[1] For LEV III vehicle test groups that meet the extended emission warranty requirements in section E.1.7, the applicable emission standard value shall be the emission standard value set forth in this table minus 5 mg/mi.

2.1.2.2 **NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs.** The HEV NMOG+NOx contribution factor for light-duty off-vehicle charge capable hybrid electric vehicles is calculated as follows:

LEV160 HEV Contribution Factor = 0.160 - [(Zero-emission VMT Allowance) x 0.035]
ULEV125 HEV Contribution Factor = 0.125 - [(Zero-emission VMT Allowance) x 0.055]
ULEV70 HEV Contribution Factor = 0.070 - [(Zero-emission VMT Allowance) x 0.020]
ULEV50 HEV Contribution Factor = 0.050 - [(Zero-emission VMT Allowance) x 0.020]
SULEV30 HEV Contribution Factor = 0.030 - [(Zero-emission VMT Allowance) x 0.010]
SULEV20 HEV Contribution Factor = 0.020 - [(Zero-emission VMT Allowance) x 0.020]

where the Zero-emission VMT Allowance for off-vehicle charge capable HEVs is determined in accordance with section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable, except that for the purposes of this section E.2.1.2.2, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0. This section E.2.1.2.2 shall only apply to off-vehicle charge capable HEVs certified to the LEV III standards set forth in section E.1.1.2.

2.1.3 **Phase-in Requirements for Small Volume Manufacturers.**

(a) In the 2015 through 2021 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.160 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.160 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with section E.2.1.2. In 2022 through 2024 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.125 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.125 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with section E.2.1.2. In 2025 and subsequent model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.070 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.070 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with section E.2.1.2. For the 2015 through 2021 model years, a small volume manufacturer may certify its vehicles to the LEV II exhaust standards in section E.1.1.1. All vehicles certified by a small volume manufacturer for the 2022 and subsequent model years must meet the LEV III exhaust standards in section E.1.1.2.

(b) If a manufacturer's average California sales exceeds 4500 units of new PCs, LDTs, MDVs, heavy-duty vehicles, 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. If this is the first time the manufacturer exceeds the 4500 unit sales limit, the manufacturer must comply with the fleet average requirements applicable to a large volume manufacturer, as specified in section E.2.1.1 beginning with the fourth model year after the last of the three consecutive model years. If during this four year lead time period the manufacturer's sales drop below the 4500 unit sales limit and then increase again above the 4500 unit sales limit, the four year lead time period shall be calculated based on the first model year in which the manufacturer again exceeds the 4500 unit sales limit. Except as noted above – i.e., if this is not the first time the manufacturer has exceeded the 4500 unit sales limit – the manufacturer shall comply with the fleet average requirements applicable to larger manufacturers as specified in section E.2.1.1 beginning with the following 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, heavy-duty vehicles, 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 **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 2009 through 2017 Model Zero-Emission Vehicles Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," shall be included in this equation.

2.2 LEV III Phase-In Requirement for Light-Duty Vehicles and Medium-Duty Passenger Vehicles.

For the 2015 and 2016 model years, the LEV II SULEV emission standards set forth in section E.1.1.1 that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that certify to SULEV emission standards using "carryover" of emission test data from a previous model year in accordance with U.S. EPA OMS Advisory Circular A/C No. 17F, issued November 16, 1982, and last amended January 21, 1988, incorporated by reference in section 1961.2, title 13, CCR. Beginning in the 2017 model year, the LEV II SULEV emission standards set forth in section E.1.1.1 that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that receive partial ZEV allowances in accordance with the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes." A manufacturer, other than a small volume manufacturer, must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in section E.1.1.2 in 2020 and subsequent model years. A small volume manufacturer must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in section E.1.1.2 in 2022 and subsequent model years.

2.3 LEV III Phase-In Requirements for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.

2.3.1 (a) A manufacturer of MDVs, other than a small volume manufacturer, shall certify 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(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2015	40	60	0	0	100
2016	20	60	20	0	100
2017	10	50	40	0	100
2018	0	40	50	10	100
2019	0	30	40	30	100
2020	0	20	30	50	100
2021	0	10	20	70	100
2022 +	0	0	10	90	100

(b) **Requirements for Small Volume Manufacturers.** In the 2015 through 2017 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II LEV standards or to the LEV III LEV395 or LEV III LEV630 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2018 through 2021 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II ULEV standards or to the LEV III ULEV340 or LEV III ULEV570 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2022 and subsequent model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV III ULEV250 or LEV III ULEV400 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. Engines certified to these MDV standards are not eligible for emissions averaging.

(c) **Alternate Phase-In Schedules for LEV III MDVs.** For the 2016 and subsequent model years, a manufacturer, that produces and delivers for sale in California four or fewer medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

1. A manufacturer that produces and delivers for sale in California four medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2017	1	2	1	0	100
2018	0	2	2	0	100
2019	0	1	2	1	100
2020	0	1	1	2	100
2021	0	0	1	3	100
2022 +	0	0	0	4	100

2. A manufacturer that produces and delivers for sale in California three medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	2	0	0	100
2017	0	2	1	0	100
2018	0	1	2	0	100
2019-2020	0	1	1	1	100
2021	0	0	1	2	100
2022 +	0	0	0	3	100

3. A manufacturer that produces and delivers for sale in California two medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	1	0	0	100
2017-2019	0	1	1	0	100
2020-2021	0	0	1	1	100
2022 +	0	0	0	2	100

4. A manufacturer that produces and delivers for sale in California one medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2018	0	1	0	0	100
2019-2021	0	0	1	0	100
2022 +	0	0	0	1	100

2.3.2 **Identifying a Manufacturer's MDV Fleet**. 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. 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 **Phase-In Requirement for PC, LDT, and MDPV Manufacturers**. A test group certifying to LEV III FTP emission categories on a 150,000-mile durability basis shall also certify to SFTP requirements on a 150,000-mile durability basis.

Manufacturers shall have two options for phase in to the SFTP NMOG+NOx and CO emission standards.

(a) Under Option 1, beginning with the 2015 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs to the SFTP NMOG+NOx and CO emission standards in section E.1.2.2.1.1 when the vehicles are also certifying to a LEV III FTP emission category at 150,000-mile durability.

(b) Under Option 2, for 2015 and subsequent model years, a manufacturer shall certify its fleet of PCs, LDTs, and MDPVs such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value does not exceed the composite emission standard in effect for that model year. During the 150,000-mile durability phase-in, the sales-weighted fleet-average NMOG+NOx composite emission value shall be calculated using a combination of carry-over values and new-certification values. Carry-over test groups shall convert values to NMOG+NOx and may use the applicable deterioration factor from the FTP cycle in lieu of deriving a deterioration factor specific to SFTP test cycles. Any vehicle certified to SFTP requirements on a 150,000-mile durability basis shall be subject to the applicable emission standards for the full useful life of that vehicle. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging.

Beginning with the 2017 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis to the SFTP PM emission standards in section E.1.2.2.2.

2.4.2 **Phase-In Requirements for MDV Manufacturers**. Phase-in for NMOG+NOx and CO emission standards begins with the 2016 model year. For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to 150,000-mile SFTP exhaust emission standards shall be equal to or greater than the total percentage certified the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to 150,000-mile SFTP SULEV emission standards shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to 150,000-mile SFTP exhaust emission standards shall be equal to or greater than the percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories, and the percentage of MDVs certified to 150,000-mile SFTP SULEV exhaust emission standards shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

In addition, 2017 and subsequent model MDVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis must also certify to the SFTP emission standards set forth in section E.1.2.2.4.

2.4.3 **Identifying a Manufacturer's MDV Fleet**. For the 2016 and subsequent model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs, other than MDPVs, produced and delivered for sale in California. For 2016 and subsequent model years, a manufacturer that elects to certify engines to the optional medium-duty engine emission 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.

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

2.5.1 *Fleet Average Carbon Dioxide Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* For the purpose of determining compliance with this section E.2.5, the applicable fleet average CO_2 mass emissions standards for each model year is the sales-weighted average of the calculated CO_2 exhaust mass emission target values for each manufacturer. For each model year, the sales-weighted fleet average CO_2 mass emissions value shall not exceed the sales-weighted average of the calculated CO_2 exhaust mass emission target values for that manufacturer.

2.5.1.1 *Fleet Average Carbon Dioxide Target Values for Passenger Cars.* The fleet average CO_2 exhaust mass emission target values for passenger cars that are produced and delivered for sale in California each model year shall be determined as follows:

2.5.1.1.1 For passenger cars with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	195.0
2018	185.0
2019	175.0
2020	166.0
2021	157.0
2022	150.0
2023	143.0
2025	137.0
2025 and subsequent	131.0

2.5.1.1.2 For passenger cars with a footprint of greater than 56 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	263.0
2018	250.0
2019	238.0
2020	226.0
2021	215.0
2022	205.0
2023	196.0
2025	188.0
2025 and subsequent	179.0

2.5.1.1.3 For passenger cars with a footprint that is greater than 41 square feet and less than or equal to 56 square feet, the gram per mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target } gCO_2/\text{mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and
coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*a*	*b*
2017	4.53	8.9
2018	4.35	6.5
2019	4.17	4.2
2020	4.01	1.9
2021	3.84	-0.4
2022	3.69	-1.1
2023	3.54	-1.8
2024	3.4	-2.5
2025 and subsequent	3.26	-3.2

2.5.1.2 *Fleet Average Carbon Dioxide Target Values for Light-Duty Trucks and Medium-Duty Passenger Vehicles.* The fleet average CO_2 exhaust mass emission

target values for light-duty trucks and medium-duty passenger vehicles that are produced and delivered for sale in California each model year shall be determined as follows:

2.5.1.2.1 For light-duty trucks and medium-duty passenger vehicles with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	238.0
2018	227.0
2019	220.0
2020	212.0
2021	195.0
2022	186.0
2023	176.0
2025	168.0
2025 and subsequent	159.0

2.5.1.2.2 For light-duty trucks and medium-duty passenger vehicles with a footprint of greater than 41 square feet and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target } gCO_2/\text{mile} = [a \times f] + b$$

Where: f is the vehicle footprint and
coefficients a and b are selected from the following table for the applicable model year.

Model year	*Maximum Footprint*	*a*	*b*
2017	50.7	4.87	38.3
2018	60.2	4.76	31.6
2019	66.4	4.68	27.7
2020	68.3	4.57	24.6
2021	73.5	4.28	19.8
2022	74.0	4.09	17.8
2023	74.0	3.91	16.0
2024	74.0	3.74	14.2
2025 and subsequent	74.0	3.58	12.5

2.5.1.2.3 For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum footprint value specified in the table below and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target } gCO_2/\text{mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and
coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*Minimum Footprint*	*Maximum Footprint*	*a*	*b*
2017	50.7	66.0	4.04	80.5
2018	60.2	66.0	4.04	75.0

2.5.1.2.4 For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum value specified in the table below for each model year, the gram/mile CO_2 target value shall be selected for the applicable model year from the following table:

Model year	*Minimum Footprint*	*CO_2 target value (grams/mile)*
2017	66.0	347.0
2018	66.0	342.0
2019	66.4	339.0
2020	68.3	337.0
2021	73.5	335.0
2022	74.0	321.0
2023	74.0	306.0
2024	74.0	291.0
2025 and subsequent	74.0	277.0

2.5.1.3 *Calculation of Fleet Average Carbon Dioxide Standards.* For each model year, a manufacturer must comply with its fleet average CO_2 standards for passenger cars and for light-duty trucks plus medium-duty passenger vehicles, as applicable, calculated for that model year as follows. A manufacturer shall calculate separate fleet average CO_2 values for its passenger car fleet and for its combined light-duty truck plus medium-duty passenger vehicle fleet.

2.5.1.3.1 A CO_2 target value shall be calculated in accordance with subparagraph E.2.5.1.1 or E.2.5.1.2, as applicable, for each unique combination of model type and footprint value.

2.5.1.3.2 Each CO_2 target value, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

2.5.1.3.3 The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the applicable fleet average CO_2 standard for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

2.5.2 *Nitrous Oxide (N_2O) and Methane (CH_4) Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* Each manufacturer's fleet of combined passenger automobile, light-duty trucks, and medium-duty passenger vehicles must comply with N_2O and CH_4 standards using either the provisions of section E.2.5.2.1, section E.2.5.2.2, or section E.2.5.2.3. Except with prior approval of the Executive Officer, a manufacturer may not use the provisions of both section E.2.5.2.1 and section E.2.5.2.2 in the same model year. For example, a manufacturer may not use the provisions of section E.2.5.2.1 for their passenger automobile fleet and the provisions of section E.2.5.2.2 for their light-duty truck and medium-duty passenger vehicle fleet in the same model year. The manufacturer may use the provisions of both section E.2.5.2.1 and section E.2.5.2.3 in the same model year. For example, a manufacturer may meet the N_2O standard in section E.2.5.2.1 and an alternative CH_4 standard determined under section E.2.5.2.3.

2.5.2.1 *Standards Applicable to Each Test Group.*

2.5.2.1.1 Exhaust emissions of N_2O shall not exceed 0.010 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures. Manufacturers may optionally determine an alternative N_2O standard under section E.2.5.2.3.

2.5.2.1.2 Exhaust emissions of CH_4 shall not exceed 0.030 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures. Manufacturers may optionally determine an alternative CH_4 standard under section E.2.5.2.3.

2.5.2.2 *Including N_2O and CH_4 in Fleet Averaging Program.* Manufacturers may elect to not meet the emission standards in section E.2.5.2.1. Manufacturers making this election shall measure N_2O and CH_4 emissions for each unique combination of model type and footprint value on both the FTP test cycle and the Highway Fuel Economy test cycle at full useful life, multiply the measured N_2O emissions value by 298 and the measured CH_4 emissions value by 25, and include both of these adjusted N_2O and CH_4 full useful life values in the fleet average calculations for passenger automobiles and light-duty trucks plus medium-duty passenger vehicles, as calculated in accordance with section E.2.5.2.4.

2.5.2.3 *Optional Use of Alternative N_2O and/or CH_4 Standards.* Manufacturers may select an alternative standard applicable to a test group, for either N_2O or CH_4, or both. For example, a manufacturer may choose to meet the N_2O standard in section E.2.5.2.1.1 and an alternative CH_4 standard in lieu of the standard in section E.2.5.2.1.2. The alternative standard for each pollutant must be less stringent than the applicable exhaust emission standard specified in section E.2.5.2.1. Alternative N_2O and CH_4 standards apply to emissions as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures, for the full useful life, and become the applicable certification and in-use emission standard(s) for the test group. Manufacturers using an alternative standard for N_2O and/or CH_4 must calculate emission debits according to the

provisions of section E.2.5.2.4 for each test group/alternative standard combination. Debits must be included in the calculation of total credits or debits generated in a model year as required under section E.2.5.2.2. Flexible fuel vehicles (or other vehicles certified for multiple fuels) must meet these alternative standards when tested on all applicable test fuel type.

2.5.2.4 *CO_2-Equivalent Debits.* CO_2-equivalent debits for test groups using an alternative N_2O and/or CH_4 standard as determined under E.2.5.2.3 shall be calculated according to the following equation and rounded to the nearest whole gram per mile:

Debits = GWP × (Production) × (AltStd - Std)

Where:

Debits = N_2O or CH_4 CO_2-equivalent debits for a test group using an alternative N_2O or CH_4 standard;

GWP = 25 if calculating CH_4 debits and 298 if calculating N_2O debits;

Production = The number of vehicles of that test group produced and delivered for sale in California;

AltStd = The alternative standard (N_2O or CH_4) selected by the manufacturer under 1961.3(a)(2)(C); and

Std = The exhaust emission standard for N_2O or CH_4 specified in 1961.3(a)(2)(A).

2.5.3 *Alternative Fleet Average Standards for Manufacturers with Limited U.S. Sales.* Manufacturers meeting the criteria in this section E.2.5.3 may request that the Executive Officer establish alternative fleet average CO_2 standards that would apply instead of the standards in section E.2.5.1. The provisions of this section E.2.5.3 are applicable only to the 2017 and subsequent model years.

2.5.3.1 *Eligibility for Alternative Standards.* Eligibility as determined in this section E.2.5.3 shall be based on the total sales of combined passenger cars, light-duty trucks, and medium-duty passenger vehicles. The terms “sales” and “sold” as used in this section E.2.5.3 shall mean vehicles produced and delivered for sale (or sold) in the states and territories of the United States. For the purpose of determining eligibility the sales of related companies shall be aggregated according to the provisions of title 13, CCR, section 1900. To be eligible for alternative standards established under this section E.2.5.3, the manufacturer's average sales for the three most recent consecutive model years must remain below 5,000. If a manufacturer's average sales for the three most recent consecutive model years exceeds 4,999, the manufacturer will no longer be eligible for exemption and must meet applicable emission standards as follows.

2.5.3.1.1 If a manufacturer's average sales for three consecutive model years exceeds 4,999, and if the increase in sales is the result of corporate acquisitions, mergers, or purchase by another manufacturer, the manufacturer shall comply with the emission standards described in sections E.2.5.1 and E.2.5.2, as applicable,

beginning with the first model year after the last year of the three consecutive model years.

2.5.3.1.2 If a manufacturer's average sales for three consecutive model years exceeds 4,999 and is less than 50,000, and if the increase in sales is solely the result of the manufacturer's expansion in vehicle production (not the result of corporate acquisitions, mergers, or purchase by another manufacturer), the manufacturer shall comply with the emission standards described in sections E.2.5.1 and E.2.5.2, as applicable, beginning with the second model year after the last year of the three consecutive model years.

2.5.3.2 *Requirements for New Entrants into the U.S. Market.* New entrants are those manufacturers without a prior record of automobile sales in the United States and without prior certification to (or exemption from, under 40 CFR §86.1801-12(k)) greenhouse gas emission standards in 40 CFR §86.1818-12 or greenhouse gas standards in section 1961.1, title 13, CCR. In addition to the eligibility requirements stated in section E.2.5.3.1, new entrants must meet the following requirements:

2.5.3.2.1 In addition to the information required under section E.2.5.3.4, new entrants must provide documentation that shows a clear intent by the company to actually enter the U.S. market in the years for which alternative standards are requested. Demonstrating such intent could include providing documentation that shows the establishment of a U.S. dealer network, documentation of work underway to meet other U.S. requirements (e.g., safety standards), or other information that reasonably establishes intent to the satisfaction of the Executive Officer.

2.5.3.2.2 Sales of vehicles in the U.S. by new entrants must remain below 5,000 vehicles for the first two model years in the U.S. market and the average sales for any three consecutive years within the first five years of entering the U.S. market must remain below 5,000 vehicles. Vehicles sold in violation of these limits will be considered not covered by the certificate of conformity and the manufacturer will be subject to penalties on an individual-vehicle basis for sale of vehicles not covered by a certificate. In addition, violation of these limits will result in loss of eligibility for alternative standards until such point as the manufacturer demonstrates two consecutive model years of sales below 5,000 automobiles.

2.5.3.2.3 A manufacturer with sales in the most recent model year of less than 5,000 automobiles, but where prior model year sales were not less than 5,000 automobiles, is eligible to request alternative standards under section E.2.5.3. However, such a manufacturer will be considered a new entrant and subject to the provisions regarding new entrants in this section E.2.5.3, except that the requirement to demonstrate an intent to enter the U.S. market in section E.2.5.3.2 shall not apply.

2.5.3.3 *How to Request Alternative Fleet Average Standards.* Eligible manufacturers may petition for alternative standards for up to five consecutive model years if sufficient information is available on which to base such standards.

2.5.3.3.1 To request alternative standards starting with the 2017 model year, eligible manufacturers must submit a completed application no later than July 30, 2013.

2.5.3.3.2 To request alternative standards starting with a model after 2017, eligible manufacturers must submit a completed request no later than 36 months prior to the start of the first model year to which the alternative standards would apply.

2.5.3.3.3 The request must contain all the information required in section E.2.5.3.4, and must be signed by a chief officer of the company. If the Executive Officer determines that the content of the request is incomplete or insufficient, the manufacturer will be notified and given an additional 30 days to amend the request.

2.5.3.4 *Data and Information Submittal Requirements.* Eligible manufacturers requesting alternative standards under section E.2.5.3.3 must submit the following information to the California Air Resources Board. The Executive Officer may request additional information as s/he deems appropriate. The completed request must be sent to the California Air Resources Board at the following address: Chief, Mobile Source Operations Division, California Air Resources Board, 9480 Telstar Avenue, Suite 4, El Monte, California 91731.

2.5.3.4.1 *Vehicle Model and Fleet Information*.

a. The model years to which the requested alternative standards would apply, limited to five consecutive model years.

b. Vehicle models and projections of production volumes for each model year.

c. Detailed description of each model, including the vehicle type, vehicle mass, power, footprint, and expected pricing.

d. The expected production cycle for each model, including new model introductions and redesign or refresh cycles.

2.5.3.4.2 *Technology Evaluation Information*.

a. The CO_2 reduction technologies employed by the manufacturer on each vehicle model, including information regarding the cost and CO_2 -reducing effectiveness. Include technologies that improve air conditioning efficiency and reduce air conditioning system leakage, and any “off-cycle” technologies that potentially provide benefits outside the operation represented by the FTP and the HWFET.

b. An evaluation of comparable models from other manufacturers, including CO_2 results and air conditioning credits generated by the models. Comparable vehicles should be similar, but not necessarily identical, in the following respects: vehicle type, horsepower, mass, power-to-weight ratio, footprint, retail price, and any other relevant factors. For manufacturers requesting alternative standards starting with the 2017 model year, the analysis of comparable vehicles should include vehicles from the 2012 and 2013 model years, otherwise the analysis should at a minimum include vehicles from the most recent two model years.

c. A discussion of the CO_2-reducing technologies employed on vehicles offered outside of the U.S. market but not available in the U.S., including a discussion as to why those vehicles and/or technologies are not being used to achieve CO_2 reductions for vehicles in the U.S. market.

d. An evaluation, at a minimum, of the technologies projected by the California Air Resources Board in the "Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the "LEV III" Amendments to The California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles" and the appendices to this report, released on December 7, 2011, as those technologies likely to be used to meet greenhouse gas emission standards and the extent to which those technologies are employed or projected to be employed by the manufacturer. For any technology that is not projected to be fully employed, the manufacturer must explain why this is the case.

2.5.3.4.3 *Information Supporting Eligibility*.

a. U.S. sales for the three previous model years and projected sales for the model years for which the manufacturer is seeking alternative standards.

b. Information regarding ownership relationships with other manufacturers, including details regarding the application of the provisions of 40 CFR §86.1838–01(b)(3) and title 13, CCR, section 1900 regarding the aggregation of sales of related companies.

2.5.3.5 *Alternative Standards.* Upon receiving a complete application, the Executive Officer will review the application and determine whether an alternative standard is warranted. If the Executive Officer judges that an alternative standard is warranted, the following standards shall apply. For the purposes of this section E.2.5.3.5, an "ultra-small volume manufacturer" shall mean a manufacturer that meets the requirements of section E.2.5.3.

2.5.3.5.1 At the beginning of the model year that is three model years prior to the model year for which an alternative standard is requested, each ultra-small

volume manufacturer shall identify all vehicle models from the model year that is four model years prior to the model year for which an alternative standard is requested, certified by a large volume manufacturer that are comparable to that small volume manufacturer's vehicle models for the model year for which an alternative standard is requested, based on model type and footprint value. The ultra-small 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 ultra-small volume manufacturer the target grams CO_2 per mile for each vehicle model type and footprint value that is approved. The ultra-small volume manufacturer shall calculate its fleet average CO_2 standard in accordance with section E.2.5.1.3 based on these target grams CO_2 per mile values provided by the Executive Officer.

2.5.3.5.2 In the 2017 and subsequent model years, an ultra-small volume manufacturer shall either:

a. not exceed its fleet average CO_2 standard calculated in accordance with section E.2.5.1.3 based on the target grams CO_2 per mile values provided by the Executive Officer; or

b. upon approval of the Executive Officer, if an ultra-small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system and has a footprint value that are identical to a configuration certified for sale in California by a large volume manufacturer, those ultra-small volume manufacturer vehicle models are exempt from meeting the requirements in section E.2.5.3.5.2.a.

2.5.3.6 *Restrictions on Credit Trading.* Manufacturers subject to alternative standards approved by the Executive Officer under this section E.2.5.3 may not trade credits to another manufacturer. Transfers of credits between a manufacturer's car and truck fleets are allowed.

2.5.4 *Greenhouse Gas Emissions Values for Electric Vehicles, "Plug-In" Hybrid Electric Vehicles, and Fuel Cell Vehicles.*

2.5.4.1 *Electric Vehicle Calculations.*

2.5.4.1.1 For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value using the following formula:

$$City\ CO_2\ Value = (270\ gCO_2e/kWh) * E_{EV} - 0.25 * CO_{2\ target}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated by reference in section 1961.2, title 13, CCR).

2.5.4.1.2 For each unique combination of model type and footprint value, a manufacturer shall calculate the Highway CO_2 Value using the following formula:

$$\textit{Highway } CO_2 \textit{ Value} = (270\ gCO_2e/kWh) * E_{EV} - 0.25 * CO_{2\ target}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated herein by reference).

2.5.4.2 *"Plug-In" Hybrid Electric Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$\textit{City } CO_2 \textit{ Value} = GHG_{urban}$$

and

$$\textit{Highway } CO_2 \textit{ Value} = GHG_{highway}$$

Where GHG_{urban} and $GHG_{highway}$ are measured in accordance with section G.12 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable.

2.5.4.3 *Fuel Cell Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$\textit{City } CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

and

$$\textit{Highway } CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

Where H_{FCV} means hydrogen consumption in kilograms of hydrogen per mile, measured for the applicable test cycle, in accordance with SAE J2572 (published October 2008), incorporated by reference in section 1961.2, title 13, CCR.

2.5.5 *Calculation of Fleet Average Carbon Dioxide Value.*

2.5.5.1 For each unique combination of model type and footprint value, a manufacturer shall calculate a combined city/highway CO_2 exhaust emission value as follows:

$$0.55 \text{ x City } CO_2 \text{ Value} + 0.45 \text{ x Highway } CO_2 \text{ Value}$$

"City" CO_2 exhaust emissions shall be measured using the FTP test cycle (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles." "Highway" CO_2 exhaust emission shall be measured using the using the Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B).

2.5.5.2 Each combined city/highway CO_2 exhaust emission, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

2.5.5.3 The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the manufacturer's actual sales-weighted fleet average CO_2 value for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

2.5.5.4 For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in section E.2.5 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.2.5, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.2.5, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

1. A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

2. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in sections E.2.5 and E.3.2 means California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

3. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each model type and footprint value produced and delivered for sale in the District of Columbia and for each individual state within the average and the City CO_2 Value and Highway CO_2 exhaust emission values that apply to each model type and footprint value.

2.5.6 *Credits for Reduction of Air Conditioning Direct Emissions.* Manufacturers may generate A/C Direct Emissions Credits by implementing specific air conditioning system technologies designed to reduce air conditioning direct emissions over the useful life of their vehicles. A manufacturer may only use an A/C Direct Emissions Credit for vehicles within a model type upon approval of the A/C Direct Emissions Credit for that model type by the Executive Officer. The conditions and requirements for obtaining approval of an A/C Direct Emissions Credit are described below.

2.5.6.1 Applications for approval of an A/C Direct Emissions Credit must be organized by model type. The applications must also include:

- vehicle make and
- number of vehicles within the model type that will be equipped with the air conditioning system to which the leakage credit shall apply.

Separate applications must be submitted for any two configurations of an A/C system with differences other than dimensional variation.

2.5.6.2 To obtain approval of the A/C Direct Emissions Credit, the manufacturer must demonstrate through an engineering evaluation that the A/C system under consideration reduces A/C direct emissions. The demonstration must include all of the following elements:

- the amount of A/C Direct Emissions Credit requested, in grams of CO_2-equivalent per mile (gCO_2e/mi);
- the calculations identified in section 1961.3(a)(6)(C) justifying that credit amount,
- schematic of the A/C system;
- specifications of the system components with sufficient detail to allow reproduction of the calculation; and
- an explanation describing what efforts have been made to minimize the number of fittings and joints and to optimize the components in order to minimize leakage.

Calculated values must be carried to at least three significant figures throughout the calculations, and the final credit value must be rounded to one tenth of a gram of CO_2-equivalent per mile (gCO_2e/mi).

2.5.6.3 The calculation of A/C Direct Emissions Credit depends on the refrigerant or type of system, and is defined in paragraphs E. 2.5.6.3.1, E. 2.5.6.3.2, and E. 2.5.6.3.3.

2.5.6.3.1 HFC-134a vapor compression systems

For A/C systems that use HFC-134a refrigerant, the A/C Direct Emissions Credit shall be calculated using the following formula:

$$A/C\ Direct\ Credit = Direct\ Credit\ Baseline \times (1 - \frac{LR}{Avg\ LR})$$

Where:

Direct Credit Baseline = 12.6 gCO_2e/mi for passenger cars;

Direct Credit Baseline = 15.6 gCO2e/mi for light-duty trucks and medium-duty passenger vehicles;

Avg LR = 16.6 grams/year for passenger cars;

Avg LR = 20.7 grams/year for light-duty trucks and medium-duty passenger vehicles;

LR = the larger of *SAE LR* or *Min LR*;

Where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008) incorporated by reference in section 1961.2, title 13, CCR;

Min LR = 8.3 grams/year for passenger car A/C systems with belt-driven compressors;

Min LR = 10.4 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with belt-driven compressors;

Min LR = 4.1 grams/year for passenger car A/C systems with electric compressors;

Min LR = 5.2 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with electric compressors.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of the August 2008 version of SAE J2727 or an alternate method if s/he determines that the updated SAE J2727 or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2.5.6.3.2 Low-GWP vapor compression systems

For A/C systems that use a refrigerant having a GWP of 150 or less, the A/C Direct Emissions Credit shall be calculated using the following formula:

$$A/C\ Direct\ Credit = Low\ GWP\ Credit - High\ Leak\ Penalty$$

Where:

$$Low\ GWP\ Credit = Max\ Low\ GWP\ Credit \times (1 - \frac{GWP}{1{,}430}),$$

and

$$High\ Leak\ Penalty = \begin{cases} Max\ High\ Leak\ Penalty, & \text{if } SAE\ LR > Avg\ LR; \\ Max\ High\ Leak\ Penalty \times \frac{SAE\ LR - Min\ LR}{Avg\ LR - Min\ LR}, & \text{if } Min\ LR < SAE\ LR \le Avg\ LR; \\ 0, & \text{if } SAE\ LR \le Min\ LR. \end{cases}$$

Where:

Max Low GWP Credit = 13.8 gCO_2e/mi for passenger cars;

Max Low GWP Credit = 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;

GWP = the global warming potential of the refrigerant over a 100-year horizon, as specified in section E.2.5.6.6;

Max High Leak Penalty = 1.8 gCO_2e/mi for passenger cars;

Max High Leak Penalty = 2.1 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;

Avg LR = 13.1 g/yr for passenger cars;

Avg LR = 16.6 g/yr for light-duty trucks and medium-duty passenger vehicles;

and where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008);

Min LR = 8.3 g/yr for passenger cars;

Min LR = 10.4 g/yr for light-duty trucks and medium-duty passenger vehicles.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of SAE J2727 or an alternate applicable test method if s/he finds the update or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2.5.6.3.3 Other A/C systems

For an A/C system that uses a technology other than vapor compression cycles, an A/C Direct Emissions Credit may be approved by the Executive Officer. The amount of credit requested must be based on demonstration of the reduction of A/C direct emissions of the technology using an engineering evaluation that includes verifiable laboratory test data, and cannot exceed 13.8 gCO_2e/mi for passenger cars and 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles.

2.5.6.4 The total leakage reduction credits generated by the air conditioning system shall be calculated separately for passenger cars and for light-duty trucks and medium-duty passenger vehicles according to the following formula:

$$Total\ Credits\ (g/mi) = A/C\ Direct\ Credit \times Production$$

Where:

A/C Direct Credit is calculated as specified in section E.2.5.6.3.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which the *A/D Direct Credit* value from section E.2.5.6.3 applies.

2.5.6.5 The results of section E.2.5.6.4, rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in section E.3.2.1.2.

2.5.6.6 The following values for refrigerant global warming potential (GWP), or alternative values as determined by the Administrator, shall be used in the calculations of this section E.2.5.6. The Executive Officer shall determine values for refrigerants not included in this section E.2.5.6.6 upon request by a manufacturer, based on findings by the Intergovernmental Panel on Climate Change (IPCC) or from other applicable research studies.

Refrigerant	*GWP*
HFC–134a	1,430
HFC–152a	124
HFO–1234yf	4
CO_2	1

2.5.7 *Credits for Improving Air Conditioning System Efficiency.* Manufacturers may generate CO_2 credits by implementing specific air conditioning system technologies designed to reduce air conditioning-related CO_2 emissions over the useful life of their passenger cars, light-duty trucks, and/or medium-duty passenger vehicles. Credits shall be calculated according to this section E.2.5.7 for each air conditioning system that the manufacturer is using to generate CO_2 credits. The eligibility requirements specified in section E.2.5.7.5 must be met before an air conditioning system is allowed to generate credits.

2.5.7.1 Air conditioning efficiency credits are available for the following technologies in the gram per mile amounts indicated for each vehicle category in the following table:

Air Conditioning Technology	*Passenger Cars (g/mi)*	*Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)*
Reduced reheat, with externally-controlled, variable-displacement compressor (*e.g.* a compressor that controls displacement based on temperature setpoint and/or cooling demand of the air conditioning system control settings inside the passenger compartment).	1.5	2.2
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor (*e.g.* a compressor that controls displacement based on conditions within, or internal to, the air conditioning system, such as head pressure, suction pressure, or evaporator outlet temperature).	1.0	1.4
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the ambient temperature is 75 °F or higher: Air conditioning systems that operated with closed-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.5	2.2
Default to recirculated air with open-loop control air supply (no sensor feedback) whenever the ambient temperature is 75 °F or higher. Air conditioning systems that operate with open-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.0	1.4
Blower motor controls which limit wasted electrical energy (*e.g.* pulse width modulated power controller).	0.8	1.1
Internal heat exchanger (*e.g.* a device that transfers heat from the high-pressure, liquid-phase refrigerant entering the evaporator to the low-pressure, gas-phase refrigerant exiting the evaporator).	1.0	1.4
Improved condensers and/or evaporators with system analysis on the component(s) indicating a coefficient of performance improvement for the system of greater than 10% when compared to previous industry standard designs).	1.0	1.4
Oil separator. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The characteristics of the baseline component shall be compared to the new component to demonstrate the improvement.	0.5	0.7

2.5.7.2 Air conditioning efficiency credits are determined on an air conditioning system basis. For each air conditioning system that is eligible for a credit based on the use of one or more of the items listed in section E.2.5.7.1, the total credit value is the sum of the gram per mile values listed in section E.2.5.7.1 for each item that applies to the air conditioning system. The total credit value for an air conditioning

system may not be greater than 5.0 grams per mile for any passenger car or 7.2 grams per mile for any light-duty truck or medium-duty passenger vehicle.

2.5.7.3 The total efficiency credits generated by an air conditioning system shall be calculated separately for passenger cars and for light-duty trucks plus medium-duty passenger vehicles according to the following formula:

Total Credits (g/mi) = Credit × Production

Where:

Credit = the CO_2 efficiency credit value in grams per mile determined in section E.2.5.7.2 or E. 2.5.7.5, whichever is applicable.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which to the efficiency credit value from section E.2.5.7.2 applies.

2.5.7.4 The results of section E.2.5.7.3, rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in section E.3.2.1.2.

2.5.7.5 For the purposes of this section E.2.5.7.5, the AC17 Test Procedure shall mean the AC17 Air Conditioning Efficiency Test Procedure set forth in Part II, Section A.100.5.6 of these test procedures

2.5.7.5.1 For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure.

2.5.7.5.2 Using good engineering judgment, the manufacturer must select the vehicle configuration to be tested that is expected to result in the greatest increased CO_2 emissions as a result of the operation of the air conditioning system for which efficiency credits are being sought. If the air conditioning system is being installed in passenger cars, light-duty trucks, and medium-duty passenger vehicles, a separate determination of the quantity of credits for passenger cars and for light-duty trucks and medium-duty passenger vehicles must be made, but only one test vehicle is required to represent the air conditioning system, provided it represents the worst-case impact of the system on CO_2 emissions.

2.5.7.5.3 For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure according to the following requirements. Each air conditioning system shall be tested as follows:

a. Perform the AC17 test on a vehicle that incorporates the air conditioning system with the credit-generating technologies.

b. Perform the AC17 test on a vehicle which does not incorporate the credit-generating technologies. The tested vehicle must be similar to the vehicle tested under section E.2.5.7.5.3.a.

c. Subtract the CO_2 emissions determined from testing under section E.2.5.7.5.3.a from the CO_2 emissions determined from testing under subsection E.2.5.7.5.3.b and round to the nearest 0.1 grams/mile. If the result is less than or equal to zero, the air conditioning system is not eligible to generate credits. If the result is greater than or equal to the total of the gram per mile credits determined under section E.2.5.7.2, then the air conditioning system is eligible to generate the maximum allowable value determined under section E.2.5.7.2. If the result is greater than zero but less than the total of the gram per mile credits determined under section E.2.5.7.2, then the air conditioning system is eligible to generate credits in the amount determined by subtracting the CO_2 emissions determined from testing under section E.2.5.7.5.3.a from the CO_2 emissions determined from testing under section E.2.5.7.5.3.b and rounding to the nearest 0.1 grams/mile.

2.5.7.5.4 For the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform that uses the air conditioning system. Credits may continue to be generated by the air conditioning system installed in a vehicle platform provided that:

a. The air conditioning system components and/or control strategies do not change in any way that could be expected to cause a change in its efficiency;

b. The vehicle platform does not change in design such that the changes could be expected to cause a change in the efficiency of the air conditioning system; and

c. The manufacturer continues to test at least one sub-configuration within each platform using the air conditioning system, in each model year, until all sub-configurations within each platform have been tested.

2.5.7.5.5 Each air conditioning system must be tested and must meet the testing criteria in order to be allowed to generate credits. Using good engineering judgment, in the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform using the air conditioning system. Credits may continue to be generated by an air conditioning system in subsequent model years if the manufacturer continues to test at least one sub-configuration within each platform on an annual basis, as long as the air conditioning system and vehicle platform do not change substantially.

2.5.8 *Off-Cycle Credits.* Manufacturers may generate credits for CO_2-reducing technologies where the CO_2 reduction benefit of the technology is not adequately captured on the FTP and/or the HWFET. These technologies must have a measurable, demonstrable, and verifiable real-world CO_2 reduction that occurs outside the conditions of the FTP and the HWFET. These optional credits are referred to as "off-cycle" credits. Off-cycle technologies used to generate emission credits are considered emission-related components subject to applicable requirements, and must be demonstrated to be effective for the full useful life of the vehicle. Unless the manufacturer demonstrates that the technology is not subject to in-use deterioration, the manufacturer must account for the deterioration in their analysis. The manufacturer must use one of the three options specified in this section E.2.5.8 to determine the CO_2 gram per mile credit applicable to an off-cycle technology. The manufacturer should notify the Executive Officer in its pre-model year report of its intention to generate any credits under this section E.2.5.8.

2.5.8.1 *Credit available for certain off-cycle technologies.*

2.5.8.1.1 The manufacturer may generate a CO_2 gram/mile credit for certain technologies as specified in the following table, provided that each technology is applied to the minimum percentage of the manufacturer's total U.S. production of passenger cars, light-duty trucks, and medium-duty passenger vehicles specified in the table in each model year for which credit is claimed. Technology definitions are in section B.

Off-Cycle Technology	**Passenger Cars (g/mi)**	**Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)**	**Minimum percent of U.S. production**
Active aerodynamics	0.6	1.0	10
High efficiency exterior lighting	1.1	1.1	10
Engine heat recovery	0.7 per 100W of capacity	0.7 per 100W of capacity	10
Engine start-stop (idle-off)	2.9	4.5	10
Active transmission warm-up	1.8	1.8	10
Active engine warm-up	1.8	1.8	10
Electric heater circulation pump	1.0	1.5	n/a
Solar roof panels	3.0	3.0	n/a
Thermal control	≤3.0	≤4.3	n/a

a. Credits may also be accrued for thermal control technologies as defined in section B in the amounts shown in the following table:

Thermal Control Technology	Credit value: Passenger Cars (g/mi)	Credit Value: Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)
Glass or glazing	≤2.9	≤3.9
Active seat ventilation	1.0	1.3
Solar reflective paint	0.4	0.5
Passive cabin ventilation	1.7	2.3
Active cabin ventilation	2.1	2.8

b. The maximum credit allowed for thermal control technologies is limited to 3.0 g/mi for passenger cars and to 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles. The maximum credit allowed for glass or glazing is limited to 2.9 g/mi for passenger cars and to 3.9 g/mi for light-duty trucks and medium-duty passenger vehicles.

c. Glass or glazing credits are calculated using the following equation:

$$\text{Credit} = \left[Z \times \sum_{i=1}^{n} \frac{T_i \times G_i}{G} \right]$$

Where:

Credit = the total glass or glazing credits, in grams per mile, for a vehicle, which may not exceed 3.0 g/mi for passenger cars or 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles;

Z = 0.3 for passenger cars and 0.4 for light-duty trucks and medium-duty passenger vehicles;

G_i = the measured glass area of window i, in square meters and rounded to the nearest tenth;

G = the total glass area of the vehicle, in square meters and rounded to the nearest tenth;

Ti = the estimated temperature reduction for the glass area of window *i*, determined using the following formula:

$$T_i = 0.3987 \times (Tts_{base} - Tts_{new})$$

Where:

Tts_{new} = the total solar transmittance of the glass, measured according to ISO 13837, "Safety glazing materials – Method for determination of solar transmittance" (incorporated by reference in section 1961.2, title 13, CCR).

Tts_{base} = 62 for the windshield, side-front, side-rear, rear-quarter, and backlite locations, and 40 for rooflite locations.

2.5.8.1.2 The maximum allowable decrease in the manufacturer's combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet average CO_2 emissions attributable to use of the default credit values in section E.2.5.8.1.1 is 10 grams per mile. If the total of the CO_2 g/mi credit values from the table in section E.2.5.8.1.1 does not exceed 10 g/mi for any passenger automobile or light truck in a manufacturer's fleet, then the total off-cycle credits may be calculated according to section E.2.5.8.4. If the total of the CO_2 g/mi credit values from the table in section E.2.5.8.1 exceeds 10 g/mi for any passenger car, light-duty truck, or medium-duty passenger vehicle in a manufacturer's fleet, then the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet must be determined according to section E.2.5.8.1.2.a to determine whether the 10 g/mi limitation has been exceeded.

a. Determine the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet using the following formula:

$$\text{Decrease} = \frac{Credits \times 1{,}000{,}000}{[(\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)]}$$

Where:

Credits = The total of passenger car and light-duty truck plus medium-duty passenger vehicles credits, in Megagrams, determined according to section E.2.5.8.4 and limited to those credits accrued by using the default gram per mile values in section E.2.5.8.1.1.

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

b. If the value determined in section E.2.5.8.1.2.a is greater than 10 grams per mile, the total credits, in Megagrams, that may be accrued by a manufacturer using the default gram per mile values in section E.2.5.8.1.1 shall be determined using the following formula:

$$\text{Credit (Megagrams)} = \frac{\left[10 \times \left((\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)\right)\right]}{1{,}000{,}000}$$

Where:

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

c. If the value determined in section E.2.5.8.1.2.a is not greater than 10 grams per mile, then the credits that may be accrued by a manufacturer using the default gram per mile values in section E.2.5.8.1.1 do not exceed the allowable limit, and total credits may be determined for each category of vehicles according to section E.2.5.8.4.

d. If the value determined in section E.2.5.8.1.2.a is greater than 10 grams per mile, then the combined passenger car and light-duty truck plus medium-duty passenger vehicle credits, in Megagrams, that may be accrued using the calculations in section E.2.5.8.4 must not exceed the value determined in section E.2.5.8.1.2.b. This limitation should generally be done by reducing the amount of credits attributable to the vehicle category that caused the limit to be exceeded such that the total value does not exceed the value determined in section E.2.5.8.1.2.b.

2.5.8.1.3. In lieu of using the default gram per mile values specified in section E.2.5.8.1.1 for specific technologies, a manufacturer may determine an alternative value for any of the specified technologies. An alternative value must be determined using one of the methods specified in section 2.5.8.2 or section 2.5.8.3.

2.5.8.2 *Technology demonstration using EPA 5-cycle methodology.* To demonstrate an off-cycle technology and to determine a CO_2 credit using the EPA 5-cycle methodology, the manufacturer shall determine the off-cycle city/highway combined carbon-related exhaust emissions benefit by using the EPA 5-cycle methodology described in 40 CFR Part 600. Testing shall be performed on a representative vehicle, selected using good engineering judgment, for each model type for which the credit is being demonstrated. The emission benefit of a technology is determined by testing both with and without the off-cycle technology operating. Multiple off-cycle technologies may be demonstrated on a test vehicle. The manufacturer shall conduct the following steps and submit all test data to the Executive Officer.

2.5.8.2.1 Testing without the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the FTP, the HWFET, the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified in 40 CFR part 600 subpart B and using the calculation procedures specified in §600.113–08 of this chapter. Run each of these tests a minimum of three times without the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. The resulting combined city/highway value is the baseline 5-cycle carbon-related exhaust emission value for the vehicle.

2.5.8.2.2 Testing with the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified

in 40 CFR part 600 subpart B and using the calculation procedures specified in 40 CFR §600.113–08. Run each of these tests a minimum of three times with the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. Use the averaged per phase results for the FTP and HWFET determined in section E.2.5.8.2.1 for operation without the off-cycle technology in this calculation. The resulting combined city/highway value is the 5-cycle carbon-related exhaust emission value showing the off-cycle benefit of the technology but excluding any benefit of the technology on the FTP and HWFET.

2.5.8.2.3 Subtract the combined city/highway value determined in section E.2.5.8.2.1 from the value determined in section E.2.5.8.2.2. The result is the off-cycle benefit of the technology or technologies being evaluated. If this benefit is greater than or equal to three percent of the value determined in section E.2.5.8.2.1 then the manufacturer may use this value, rounded to the nearest tenth of a gram per mile, to determine credits under section E.2.5.8.3.

2.5.8.2.4 If the value calculated in section E.2.5.8.2.3 is less than two percent of the value determined in section E.2.5.8.2.1, then the manufacturer must repeat the testing required under sections E.2.5.8.2.1 and E.2.5.8.2.2, except instead of running each test three times they shall run each test two additional times. The off-cycle benefit of the technology or technologies being evaluated shall be calculated as in section E.2.5.8.2.3 using all the tests conducted under sections E.2.5.8.2.1, E.2.5.8.2.2, and E.2.5.8.2.4. If the value calculated in section E.2.5.8.2.3 is less than two percent of the value determined in section E.2.5.8.2.1, then the manufacturer must verify the emission reduction potential of the off-cycle technology or technologies using the EPA Vehicle Simulation Tool, and if the results support a credit value that is less than two percent of the value determined in section E.2.5.8.2.1 then the manufacturer may use the off-cycle benefit of the technology or technologies calculated as in section E.2.5.8.2.3 using all the tests conducted under sections E.2.5.8.2.1, E.2.5.8.2.2, and E.2.5.8.2.4, rounded to the nearest tenth of a gram per mile, to determine credits under section E.2.5.8.3.

2.5.8.3 *Review and approval process for off-cycle credits.*

2.5.8.3.1 *Initial steps required.*

a. A manufacturer requesting off-cycle credits under the provisions of section E.2.5.8.2 must conduct the testing and/or simulation described in that paragraph.

b. A manufacturer requesting off-cycle credits under section E.2.5.8.2 must conduct testing and/or prepare engineering analyses that demonstrate the in-use durability of the technology for the full useful life of the vehicle.

2.5.8.3.2 *Data and information requirements*. The manufacturer seeking off-cycle credits must submit an application for off-cycle credits determined under section E.2.5.8.2. The application must contain the following:

a. A detailed description of the off-cycle technology and how it functions to reduce CO_2 emissions under conditions not represented on the FTP and HWFET.

b. A list of the vehicle model(s) which will be equipped with the technology.

c. A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.

d. All testing and/or simulation data required under section 2.5.8.2, as applicable, plus any other data the manufacturer has considered in the analysis.

e. An estimate of the off-cycle benefit by vehicle model and the fleetwide benefit based on projected sales of vehicle models equipped with the technology.

f. An engineering analysis and/or component durability testing data or whole vehicle testing data demonstrating the in-use durability of the off-cycle technology components.

2.5.8.3.3 R*eview of the off-cycle credit application*. Upon receipt of an application from a manufacturer, the Executive Officer will do the following:

a. Review the application for completeness and notify the manufacturer within 30 days if additional information is required.

b. Review the data and information provided in the application to determine if the application supports the level of credits estimated by the manufacturer.

2.5.8.3.4 *Decision on off-cycle application.* The Executive Officer will notify the manufacturer in writing of its decision to approve or deny the application within 60 days of receiving a complete application, and if denied, the Executive Officer will provide the reasons for the denial.

2.5.8.4 *Calculation of total off-cycle credits.* Total off-cycle credits in grams per mile of CO_2 (rounded to the nearest tenth of a gram per mile) shall be calculated separately for passenger cars and light-duty trucks plus medium-duty passenger vehicles according to the following formula:

Total Credits (g/mi) = Credit × Production

Where:

Credit = the credit value in grams per mile determined in section E.2.5.8.1 or section E.2.5.8.2.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, produced with the off-cycle technology to which to the credit value determined in section E.2.5.8.1 or section E.2.5.8.2 applies.

2.5.9 *Credits for certain full-size pickup trucks.* Full-size pickup trucks may be eligible for additional credits based on the implementation of hybrid technologies or on exhaust emission performance, as described in this section E.2.5.9. Credits may be generated under either section E.2.5.9.1 or section E.2.5.9.2 for a qualifying pickup truck, but not both.

2.5.9.1 *Credits for implementation of gasoline-electric hybrid technology.* Full-size pickup trucks that implement hybrid gasoline-electric technologies may be eligible for an additional credit under this section E.2.5.9.1. Pickup trucks using the credits under this section E.2.5.9.1 may not use the credits described in section E.2.5.9.2.

2.5.9.1.1 Full-size pickup trucks that are mild hybrid gasoline-electric vehicles and that are produced in the 2017 through 2021 model years are eligible for a credit of 10 grams/mile. To receive this credit, the manufacturer must produce a quantity of mild hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	Required minimum percent of full-size pickup trucks
2017	30%
2018	40%
2019	55%
2020	70%
2021	80%

2..5.9.1.2 Full-size pickup trucks that are strong hybrid gasoline-electric vehicles and that are produced in the 2017 through 2025 model years are eligible for a credit of 20 grams/mile. To receive this credit, the manufacturer must produce a quantity of strong hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent for each model year.

2.5.9.2 *Credits for emission reduction performance.* Full-size pickup trucks that achieve carbon-related exhaust emission values below the applicable target value

determined in section E.2.5.9.2 may be eligible for an additional credit. Pickup trucks using the credits under this section E.2.5.9.2 may not use the credits described in section E.2.5.9.1.

2.5.9.2.1 Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in section E.2.5.1.2 multiplied by 0.85 (rounded to the nearest gram per mile) and greater than the applicable target value determined in section E.2.5.1.2 multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 10 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for subsequent model years through the 2021 model year if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck qualified for the credit. To qualify for this credit in each model year, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of this section E.2.5.9.2.1 such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	*Required minimum percent of full-size pickup trucks*
2017	15%
2018	20%
2019	28%
2020	35%
2021	40%

2.5.9.2.2 Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in section E.2.5.1.2 multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 20 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for a maximum of five subsequent model years if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck first qualified for the credit. This credit may not be claimed in any model year after 2025. To qualify for this credit, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of section E.2.5.9.2.1 such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent in each model year.

2.5.9.3 *Calculation of total full-size pickup truck credits*. Total credits in grams per mile of CO_2 (rounded to the nearest whole gram per mile) shall be calculated for qualifying full-size pickup trucks according to the following formula:

$$\text{Total Credits (g/mi)} = (10 \times \text{Production}_{10}) + (20 \times \text{Production}_{20})$$

Where:

$Production_{10}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 10 grams per mile from section E.2.5.9.1 and section E.2.5.9.2.

$Production_{20}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 20 grams per mile from section E.2.5.9.1 and section E.2.5.9.2.

3. Calculation of Credits/Debits

3.1 Calculation of NMOG+NOx Credits/Debits

3.1.1 Calculation of NMOG+NOx Credits and Debits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

3.1.1.1 In 2015 and subsequent model years, a manufacturer shall calculate its credits or debits using the following equation.

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

3.1.1.2 In 2015 and subsequent model years, a manufacturer that achieves fleet average NMOG+NOx values lower than the fleet average NMOG+NOx requirement for the corresponding model year shall receive credits in units of g/mi NMOG+NOx . A manufacturer with 2015 and subsequent model year fleet average NMOG+NOx values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG+NOx equal to the amount of negative credits determined by the aforementioned equation. The total g/mi NMOG+NOx credits or debits earned for PCs and LDTs 0 3750 lbs. LVW, for LDTs 3751-5750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVWR shall be summed together. The resulting amount shall constitute the g/mi NMOG+NOx credits or debits accrued by the manufacturer for the model year.

3.1.2 Calculation of Vehicle-Equivalent NMOG+NOx Credits for Medium-Duty Vehicles Other than MDPVs.

3.1.2.1 In 2016 and subsequent model years, a manufacturer that produces and delivers for sale in California MDVs, other than MDPVs, in excess of the equivalent requirements for LEV III vehicles certified to the exhaust emission standards set forth in section E.1 of these test procedures 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:

(1.00) x {[(No. of LEV395s and LEV630s Produced excluding HEVs) +
(No. of LEV395 HEVs x HEV VEC factor for LEV395s) +
(No. of LEV630 HEVs x HEV VEC factor for LEV630s)] –
(No. of LEV395s and LEV630s Required to be Produced)} +

(1.14) x {[(No. of ULEV340s and ULEV570s Produced excluding HEVs) +
(No. of ULEV340 HEVs x HEV VEC factor for ULEV340s) +
(No. of ULEV570 HEVs x HEV VEC factor for ULEV570s)] –
(No. of ULEV340s and ULEV570s Required to be Produced)} +

(1.37) x {[(No. of ULEV250s and ULEV400s Produced excluding HEVs) +
(No. of ULEV250 HEVs x HEV VEC factor for ULEV250s) +
(No. of ULEV400 HEVs x HEV VEC factor for ULEV400s)] -
(No. of ULEV250s and ULEV400s Required to be Produced)} +

(1.49) x {[(No. of ULEV200s and ULEV270s Produced excluding HEVs) +
(No. of ULEV200 HEVs x HEV VEC factor for ULEV200s) +
(No. of ULEV270 HEVs x HEV VEC factor for ULEV270s)] -
(No. of ULEV200s and ULEV270s Required to be Produced)} +

(1.57) x {[(No. of SULEV170s and SULEV230s Produced excluding HEVs) +
(No. of SULEV170 HEVs x HEV VEC factor for SULEV170s) +
(No. of SULEV230 HEVs x HEV VEC factor for SULEV230s)] -
(No. of SULEV170s and SULEV230s Required to be Produced)} +

(1.62) x {[(No. of SULEV150s and SULEV200s Produced excluding HEVs) +
(No. of SULEV150 HEVs x HEV VEC factor for SULEV150s) +
(No. of SULEV200 HEVs x HEV VEC factor for SULEV200s)] -
(No. of SULEV150s and SULEV200s Required to be Produced)} +

[(2.00) x (No. of ZEVs Certified and Produced as MDVs)].

3.1.2.2 The MDV HEV VEC factor is calculated as follows:

For LEV395s: $$1+\left[\frac{(LEV395\ standard-ULEV340\ standard)\times Zero-emission\ VMT\ Allowance}{LEV395\ standard}\right];$$

For ULEV340s: $$1+\left[\frac{(ULEV340\ standard-ULEV250\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV340\ standard}\right];$$

For ULEV250s: $$1+\left[\frac{(ULEV250\ standard-ULEV200\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV250\ standard}\right];$$

For ULEV200s: $1+\left[\frac{(ULEV200\ standard-SULEV170\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV3200\ standard}\right]$;

For SULEV170s: $1+\left[\frac{(SULEV170\ standard-SULEV150\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV170\ standard}\right]$;

For SULEV150s: $1+\left[\frac{(SULEV150\ standard-ZEV\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV150\ standard}\right]$;

For LEV630s: $1+\left[\frac{(LEV630\ standard-ULEV570\ standard)\times Zero-emission\ VMT\ Allowance}{LEV630\ standard}\right]$;

For ULEV570s: $1+\left[\frac{(ULEV570\ standard-ULEV400\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV570\ standard}\right]$;

For ULEV400s: $1+\left[\frac{(ULEV400\ standard-ULEV270\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV400\ standard}\right]$;

For ULEV270s: $1+\left[\frac{(ULEV270\ standard-SULEV230\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV270\ standard}\right]$;

For SULEV230s: $1+\left[\frac{(SULEV230\ standard-SULEV200\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV230\ standard}\right]$

For SULEV200s: $1+\left[\frac{(SULEV200\ standard-ZEV\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV200\ standard}\right]$

where "Zero-emission VMT Allowance" for an HEV is determined in accordance with section C of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," applicable, except that for the purposes of this section E.3.1.2.2, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0.

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

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

3.1.2.5 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 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+NOx Debits.**

3.1.3.1 A manufacturer shall equalize emission debits by earning g/mi NMOG+NOx emission credits or VECs in an amount equal to the g/mi NMOG+NOx debits or VEDs, or by submitting a commensurate amount of g/mi NMOG+NOx credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. A manufacturer shall equalize NMOG+NOx debits for PCs, LDTs, and MDPVs and VEC debits for MDVs within three model years. 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. A manufacturer demonstrating compliance under Option 2 in section E.2.1.1.1.a, must calculate the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 separately for California, the District of Columbia, and for each individual state that is included in the fleet average greenhouse gas requirements in section E.2.1.1.1.a. The manufacturer must calculate these emission debits separately for California, the District of Columbia, and each individual state using the formula in sections E.3.1.1 and E.3.1.2, except that the "Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs" shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code §43211, the number of passenger cars, light-duty trucks, and medium-duty passenger vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG+NOx emission debits for the model year by the g/mi NMOG+NOx fleet average requirement for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVW and MDPVs 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 five subsequent model years. Credits will have no value if not used by the beginning of the sixth model year after being earned.

3.1.4 **Changing NMOG Credits and Debits to NMOG+NOx Credits and Debits.** The value of any emission credits that have not been used prior to the start of the 2015 model year and any emission debits that have not been equalized prior to the start of the 2015 model year earned shall be converted to NMOG+NOx credits at the start of the 2015 model year by multiplying their values by a factor of 3.0. These credits and debits are subject to the provisions in subsection 1961(c)(3), title 13, CCR.

3.2 Calculation of Greenhouse Gas Credits/Debits.

Credits and debits that are earned as part of the 2012 through 2016 MY National greenhouse gas program shall not be applicable to California's greenhouse gas program.

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

3.2.1.1 A manufacturer that achieves fleet average CO_2 values lower than the fleet average CO_2 requirement for the corresponding model year shall receive credits for each model year in units of g/mi. A manufacturer that achieves fleet average CO_2 values higher than the fleet average CO_2 requirement for the corresponding model year shall receive debits for each model year in units of g/mi. Manufacturers must calculate greenhouse gas credits and greenhouse gas debits separately for passenger cars and for combined light-duty trucks and medium-duty passenger vehicles as follows:

CO_2 Credits or Debits = (CO_2 Standard - Manufacturer's Fleet Average CO_2 Value) × (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

Where:

CO_2 Standard = the applicable standard for the model year as determined in section E.2.5.1.3;

Manufacturer's Fleet Average CO_2 Value = average calculated according to section E.2.5.5;

3.2.1.2 A manufacturer's total Greenhouse Gas credits or debits generated in a model year shall be the sum of its CO_2 credits or debits and any of the following credits, if applicable. The manufacturer shall calculate, maintain, and report Greenhouse Gas credits or debits separately for its passenger car fleet and for its light-duty truck plus medium-duty passenger vehicle fleet.

3.2.1.2.1 Air conditioning leakage credits earned according to the provisions of section E.2.5.6;

3.2.1.2.2 Air conditioning efficiency credits earned according to the provisions of section E.2.5.7;

3.2.1.2.3 Off-cycle technology credits earned according to the provisions of section E.2.5.8.

3.2.1.2.4 CO_2-equivalent debits earned according to the provisions of section E.2.5.2.4.

3.2.2 A manufacturer with 2017 and subsequent model year fleet average Greenhouse Gas values greater than the fleet average CO_2 standard applicable 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 2017 and subsequent model years, the total g/mi Greenhouse Gas credits or debits earned for passenger cars and for light-duty trucks and medium-duty passenger vehicles 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 Debits.**

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. A manufacturer shall equalize Greenhouse Gas debits for passenger cars, light-duty trucks, and medium-duty passenger vehicles within five model years after they are earned. 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 a manufacturer demonstrating compliance under Option 2 in section E.2.5.5.4, the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 shall be calculated separately for California, the District of Columbia, and each individual state that is included in the fleet average greenhouse gas requirements in section E.2.5.1. These emission debits shall be calculated for each individual state using the formula in sections E.3.2.1 and E.3.2.2, except that the "Total No. of Vehicles Produced and Delivered for Sale in California, including ZEVs and HEVs" shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code section 43211, the number of passenger cars 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 calculated for California by the g/mi Greenhouse Gas fleet average requirement for passenger car applicable for the model year in which the debits were first incurred. For the purposes of

Health and Safety Code section 43211, the number of light-duty trucks and medium-duty passenger vehicles 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 calculated for California by the g/mi Greenhouse Gas fleet average requirement for light-duty trucks and medium-duty passenger vehicles, applicable for the model year in which the debits were first incurred.

3.2.3.2 Greenhouse Gas emission credits earned in the 2017 and subsequent model years shall retain full value through the fifth model year after they are earned, and will have no value if not used by the beginning of the sixth model year after being earned.

3.2.4 **Use of Greenhouse Gas Emission Credits to Offset a Manufacturer's ZEV Obligations**.

3.2.4.1 For a given model year, a manufacturer that has Greenhouse Gas credits remaining after equalizing all of its Greenhouse Gas debits may use those Greenhouse Gas credits to comply with its ZEV obligations for that model year, in accordance with the provisions set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, title 13, CCR, or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2, title 13, CCR.

3.2.4.2 Any Greenhouse Gas credits used by a manufacturer to comply with its ZEV obligations shall retain no value for the purposes of complying with these test procedures.

3.2.5 Credits and debits that are earned as part of the 2012 through 2016 MY National Greenhouse Gas Program, shall have no value for the purpose of complying with these test procedures.

4. LEV III Criteria Pollutant Interim In-Use Compliance Standards.

The following interim in-use compliance standards shall apply for the first two model years that a test group is certified to the LEV III standards.

4.1 **LEV III NMOG+NOx Interim In-Use Compliance Standards.**

4.1.1 **NMOG+NOx Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2015 through 2019 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III PCs, LDTs, and MDPVs
		NMOG + NOx (g/mi)
LEV160	150,000	n/a
ULEV125	150,000	n/a
ULEV70	150,000	0.098
ULEV50	150,000	0.070
SULEV30	150,000	0.042[1]
SULEV20	150,000	0.028[1]

[1]not applicable to test groups that receive PZEV credits

4.1.2 **NMOG+NOx Interim In-Use Compliance Standards for Medium-Duty Vehicles, Excluding Medium-Duty Passenger Vehicles.** For the 2015 through 2020 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III MDVs (excluding MDPVs) 8,501 - 10,000 lbs. GVW	LEV III MDVs 10,001 - 14,000 lbs. GVW
		NMOG + NOx (g/mi)	NMOG + NOx (g/mi)
LEV395	150,000	n/a	n/a
ULEV340	150,000	n/a	n/a
ULEV250	150,000	0.370	n/a
ULEV200	150,000	0.300	n/a
SULEV170	150,000	0.250	n/a
SULEV150	150,000	0.220	n/a
LEV630	150,000	n/a	n/a
ULEV570	150,000	n/a	n/a
ULEV400	150,000	n/a	0.600
ULEV270	150,000	n/a	0.400
SULEV230	150,000	n/a	0.340
SULEV200	150,000	n/a	0.300

4.2 **LEV III Particulate Interim In-Use Compliance Standards.**

4.2.1 **LEV III Particulate Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2017 through 2021 model years, the interim in-use compliance standard for vehicles certifying to the 3 mg/mi particulate standard is 6 mg/mi. For the 2025 through 2028 model years, the interim in-use compliance standard for vehicles certifying to the 1 mg/mi particulate standard is 2 mg/mi.

4.2.2 **LEV III Particulate Interim In-Use Compliance Standards for Medium-Duty Vehicles, excluding Medium-Duty Passenger Vehicles.** For the 2017 through 2021 model years, the interim in-use compliance standard for vehicles certifying to the 8 mg/mi particulate standard is 16 mg/mi and the interim in-use compliance standard for vehicles certifying to the 10 mg/mi particulate standard is 20 mg/mi.

4.3 **SFTP Interim In-Use Compliance Emission Standards.**

4.3.1 Test groups certified prior to the 2020 model year may use an in-use compliance standard for NMOG+NOx for the first two model years that they are certified to new standards.

(a) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in section E.1.2.2.1.1, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

(b) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in section E.1.2.2.1.2, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the Composite Value of the bin to which a test group is certified.

(c) For medium-duty vehicle tests groups certifying to the standards in section E.1.2.2.3, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

4.3.2 Test groups certified prior to the 2021 model year will be allowed an in-use compliance standard for PM for the first five model years that they are certified to the SFTP PM standard.

(a) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to SFTP PM exhaust emission standards in section E.1.2.2.2, in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

(b) For medium-duty vehicle test groups certifying to SFTP PM Exhaust Emission Standards in section E.1.2.2.4, in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

5. LEV III Greenhouse Gas In-Use Compliance Standards.

The in-use exhaust CO_2 emission standard shall be the combined city/highway exhaust emission value calculated according to the provisions of section E.2.5.5.1 for the vehicle model type and footprint value multiplied by 1.1 and rounded to the nearest whole gram per mile. For vehicles that are capable of operating on multiple fuels, a separate value shall be determined for each fuel that the vehicle is capable of operating on. These standards apply to in-use testing performed by the manufacturer pursuant to the regulations at §86.1845-04 and §86.1846-01 and to in-use testing performed by the Air Resources Board.

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. February 26, 2007.

4.2 §86.1823-08. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]. [No change, except that subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

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

4.4 **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. January 17, 2006. [No change.]

G. Procedures for Demonstration of Compliance with Emission Standards

1. §86.1827 Test Group Determination.

1.1 §86.1827-01. May 7, 2010. [No change, except that for the 2012 through 2016 MYs, subparagraphs (a)(5) and (f) shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

2. §86.1828 Emission data vehicle selection

2.1 §86.1828-10. February 26, 2007. Amend as follows:

2.1.1 Add the following sentence to (a): Incomplete medium-duty Otto-cycle and diesel vehicles 8,501-10,000 lbs. GVW certifying to LEV III standards shall be tested in a configuration that represents the maximum curb weight, frontal area, and gross vehicle weight rating affecting the emission certification applicable to that vehicle.

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 LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20 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 LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20 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.2.3.1), 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.

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

3.1 §86.1829-01. May 7, 2010. 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 LEV II and LEV III vehicles.]

3.1.3 (b)(1)(iii)(G) [n/a]

3.1.4 Amend (b)(4)(i) as follows: All 2015 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.

3.1.5 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 passenger cars and light-duty trucks comply with the I/M emission standards.

3.1.6 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.2.3 of these test procedures. 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, including non-methane organic gas 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 added to the non-methane organic gas emissions. This sum shall be rounded and compared with the NMOG+NOx certification level, as required in section E.1.6. 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 SC03 Test.

Except for medium-duty passenger vehicles, in lieu of testing a medium-duty vehicle for SC03 emissions for certification, 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 SC03 standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data. In that event, the manufacturer shall use FTP results in lieu of SC03 results when calculating compliance with the composite emission standards.

3.5 LEV III PM Testing Requirements.

For the 2017 and subsequent model years, a manufacturer must submit test data for test groups certifying to the LEV III PM standards in section E.1.1.2.1 according to the following table. Once a test group has been used to meet the requirements of this section G.3.5 for a model year, that same test group shall not be selected in the succeeding two model years unless the manufacturer produces fewer than four test groups that are certified to LEV III PM standards. For all test groups that are certified to LEV III PM standards for which test data is not submitted, the manufacturer must, in accordance with good engineering practices, attest that such test groups will comply with the applicable LEV III PM standards.

Number of Test Groups Certified to LEV III PM Standards	Number of Test Groups That Must Be Tested to Demonstrate Compliance with LEV III PM Standards
1 or 2	All test groups certifying to LEV III PM standards
3	2
4 or more	25% of test groups certifying to LEV III PM standards

4. §86.1830 Acceptance of Vehicles for Testing.

4.1 §86.1830-01. January 17, 2006. [No change.]

5. §86.1831 Mileage accumulation requirements for test vehicles.

5.1 §86.1831-01. January 17, 2006. [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. July 13, 2005. [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.**

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.

9. **§86.1835 Confirmatory certification testing.**

9.1 §86.1835-01. May 7, 2010. [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. January 17, 2006. [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 Carryover of certification data.**

13.1 §86.1839-01. January 17, 2006. [No change.]

14. **§86.1840 Special test procedures.**

14.1 §86.1840-01. August 30, 2006. [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 6, 2011. [No Change.]

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 section, "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, full useful life shall mean 15 years or 150,000 miles, whichever occurs first.

1.4 **Certification of a Federal Vehicle in California.** Whenever a manufacturer federally-certifies a 2015 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 150,000 mile federal standards to the LEV III NMOG+NOx standards or the sum of the 120,000 mile

federal standards to the sum of the 120,000 mile LEV II NMOG and NOx standards, as applicable.

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 FTP exhaust emissions and cold CO emissions. The vehicle model shall be subject to all other California requirements including evaporative emissions, OBD II, SFTP emissions, 50°F exhaust emissions, highway NMOG+NOx emissions, greenhouse gas emissions, and emissions warranty.

1.4.2 Prior to certification of a 2015 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 1.5.

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 FTP exhaust emission levels and cold CO emission levels; and (ii) evidence of compliance with California evaporative and SFTP emission requirements, California 50°F exhaust emissions, California OBD II requirements, California highway NMOG+NOx emissions, and California greenhouse gas 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+NOx fleet average phase-in requirements or for determining vehicle equivalent credits, the applicable California NMOG+NOx value for passenger cars and light-duty trucks or vehicle equivalent credits for medium-duty vehicles shall be the sum of the federal full useful life (150,000 miles or 120,000 miles, as applicable) NMOG and NOx values.

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 California Environmental Performance 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.

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 passenger cars, light-duty trucks, and medium-duty vehicles not certified exclusively on gasoline or diesel, except for vehicles that use hydrogen fuel, 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. For vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, thirty-three 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 and phase-in requirements in sections E.2.1 through E.2.4, or the greenhouse gas requirements in section E.2.5 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 or May 1, respectively, of the calendar year following the close of the model year.

3.4 **SFTP.**

Prior to the 2016 model year, a manufacturer that introduces MDVs certified to the SFTP requirements set forth in E.1.2.2 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. September 15, 2011. Amend as follows:

4.1.1 All NMOG test results and certification levels and all NOx test results and certification levels must be reported as separate values and as NMOG plus NOx values for the purpose of complying with this section H.4.

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

(a) Delete §86.1844-01(d)(9).

(b) Delete §86.1844-01(d)(15)(ii) and replace it with the following: For vehicles with fuel fired heaters, a manufacturer must include the information specified in section H.4.4.

4.1.3 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.1.2 of these test procedures.

4.2 **OBD Requirements.**

For 2015 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 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," 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.

4.5 **Greenhouse Gas Reporting Requirements.**

(a) For the purpose of demonstrating compliance with greenhouse gas requirements, the manufacturer shall provide by May 1 of the calendar year following the close of the model year:

(i) all data in accordance with the reporting requirements as required under 40 CFR §86.1865-12; and

(ii) final combined and individual state volumes of vehicles produced and delivered for sale for each model type and footprint for California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(b) All data submitted in accordance with this section H.4.5, must be submitted electronically and organized in a format specified by the Executive Officer to clearly demonstrate compliance with California's greenhouse gas exhaust emission requirements in section E.2.5.

I. In-Use Compliance Requirements and Procedures

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

1.1 §86.1845-04. May 7, 2010. Amend as follows:

1.1.1 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[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.
[2] Particulate emissions must be measured for one vehicle per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.

1.1.2 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[1]	3[2]	4[2]
High Mileage	4[2]	5[3]	6[3]

[1] Particulate emissions must be measured for one vehicle per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.
[2] Particulate emissions must be measured for two vehicles per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.
[3] Particulate emissions must be measured for three vehicles per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.

1.1.3 **High Mileage Testing.** Amend subparagraph (c)(2) of 40 CFR §86.1845-04 to read as follows: All test vehicles certified to the emission standards in Part I, Section E.1.1.1 of these procedures 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. All test vehicles 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 112,500 miles. 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 **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. For LEV II vehicles, the equivalent NMOG exhaust emission value shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (LEV, ULEV, or SULEV) in which the test group was certified. For LEV III vehicles, the equivalent NMOG exhaust emission value shall be added to the measured NOx exhaust emissions and compared to the NMOG+NOx exhaust emission standard applicable to the vehicle emission category (LEV630, LEV395, LEV160, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20) in which the test group was certified.

(b) For fuel-flexible vehicles certified to NMOG standards or NMOG+NOx 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. For LEV II vehicles, the equivalent NMOG exhaust emission value shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (LEV, ULEV, SULEV) in which the test group was certified. For LEV III vehicles, the equivalent NMOG exhaust emission value shall be added to the measured NOx exhaust emissions and compared to the NMOG+NOx exhaust emission standard applicable to the vehicle emission category (LEV630, LEV395, LEV160, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20) 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.

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

2.1 §86.1846-01. May 7, 2010. [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.

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. §86.1848-10 Certification. July 6, 2011. [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. §86.1854-12 Prohibited acts. May 7, 2010. [No change.]
8. §§86.1855 - 86.1859. [Reserved]
9. §86.1860-04 How to comply with the Tier 2 and interim Tier 2 fleet average NOx standards. [n/a]
10. §86.1861-04 How do the Tier 2 and interim Tier 2 NOx averaging, banking and trading programs work? [n/a]
11. §86.1862-04 Maintenance of records and submittal of information relevant to compliance with fleet average NOx standards. [n/a]
12. §86.1863-07 Optional Chassis Certification for Diesel Vehicles. September 15, 2011. [No change]
13. §86.1865-12 How to comply with the fleet average CO_2 standards. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
14. §86.1866-12 CO_2 fleet average credit programs. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75372 (December 1, 2011)]. [No change, except that for the 2012 through 2016 model years this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
15. §86.1867-12 Optional early CO_2 credit programs. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75387 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

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; 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 and New Otto-Cycle Complete Heavy-Duty Vehicles; 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. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)].
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.

100.3.1.1 Certification Gasoline Fuel Specifications for LEV II Light-Duty Vehicles and Medium-Duty Vehicles.

Add the following subparagraph which reads: For light-duty vehicles and medium-duty vehicles certified to the LEV II exhaust emission standards set forth in section E.1.1.1, gasoline having the specifications listed below or gasoline having the specifications

listed in section 100.3.1.2 may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §86.113-04(a)(1). If a manufacturer elects to utilize gasoline having the specifications listed below for LEV II vehicles, exhaust emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed below. If a manufacturer elects to utilize gasoline having the specifications listed in section 100.3.1.2, exhaust emission testing shall be conducted by the manufacturer with gasoline having the specifications listed in section 100.3.1.2, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed in section 100.3.1.2. Use of this fuel for evaporative emission testing shall be required as specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

California Certification Gasoline Specifications for LEV II Light-Duty Vehicles and Medium-Duty Vehicles		
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 ^{o}F	
50% point [d]	200-210 ^{o}F	
90% point [e]	290-300 ^{o}F	
EP, maximum	390 ^{o}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.

100.3.1.2 Certification Gasoline Fuel Specifications for LEV III Light-Duty Vehicles and Medium-Duty Vehicles.

Add the following subparagraph which reads: For all light-duty vehicles and medium-duty vehicles certifying to the LEV III standards in section E.1.1.2, gasoline having the specifications listed below shall be used in exhaust emission testing, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed below. Use of this fuel for evaporative emission testing shall be required as specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

California Certification Gasoline Specifications for LEV III Light-Duty Vehicles and Medium-Duty Vehicles		
Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2 [c]	87-88.4; 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[d]
10% point	130-150 ^{o}F	
50% point	205-215 ^{o}F	
90% point	310-320 ^{o}F	

EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§2263, title 13 CCR
Benzene	0.6-0.8 vol. %	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	13-15 vol. %[e]	
MTBE	0.05 vol. %	§2263, title 13 CCR
Ethanol	9.8-10.2 vol. %	
Total Oxygen	3.3-3.7 wt. %	§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 [f]	
Heat of Combustion	Report [f]	
Carbon	Report wt. % [f]	
Hydrogen	Report wt. % [f]	

[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] For vehicles/engines that require the use of premium gasoline as part of their warranty, the Octane ((R+M)/2) may be a 91 minimum. All other certification gasoline specifications, as shown in this table, must be met. For all other vehicles/engines, the Octane ((R+M)/2) shall be 87-88.4.

[d] 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.

[e] "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.

[f] 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 2015 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 §86.113-07(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 2015 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 ^{o}F	
10% point	400-490 ^{o}F	
50% point	470-560 ^{o}F	
90% point	550-610 ^{o}F	
EP	580-660 ^{o}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 ^{o}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	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	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 100.3.1.1	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 100.3.1.1	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.100.3.1.1 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, the fuel for evaporative emission testing shall be the gasoline set forth in Part II, Section A.100.3.1.2 of these test procedures. Alternative alcohol-gasoline blends may be used in place of 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 paragraphs 86.113-94, 86.113-04, or 86.113-07, 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, NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years." 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. December 8, 2005.
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. July 13, 2005.
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.

86.127-12 Test procedures; overview. May 7, 2010.
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:

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

where:
Hp = the dynamometer power absorber setting at 50 mph (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.
Cd = aerodynamic drag coefficient.
A = reference frontal area in square ft.
32.2 ft/s^2 = gravitational acceleration
P = protuberance power (horsepower)

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

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

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

(4) Where it is expected that more than 33 percent of a vehicle line within an engine-system combination will be equipped with air conditioning, per §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 2001 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).

100.5.2.3 Greenhouse Gas Requirements.

For the purpose of determining conformity with greenhouse gas fleet average requirements, the CO_2, CH_4, and N_2O 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 2015 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 2001 and Subsequent Model Motor Vehicles" 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. December 8, 2005.
86.135-12 Dynamometer procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change.]
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. July 13, 2005.

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."

100.5.4.2 Add the following calculation:

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

$$OMNMHCE_{mass} = NMHC_{mass} + (13.8756/32.042) \times (CH_3OH)_{mass} + (13.8756/23.035) \times (CH_3CH_2OH)_{mass} + (13.8756/30.0262) \times (HCHO)_{mass} + (13.8756/22.027) \times (CH_3CHO)_{mass}$$

86.145-82 Calculations; particulate emissions. November 2, 1982.
86.146-96 to 85.157-98 [n/a; (ORVR)]
86.158-08 Supplemental Federal Test Procedures; overview. December 27, 2006.
86.159-08 Exhaust emission test procedures for US06 emissions. December 27, 2006.

100.5.5 California exhaust emission test procedures for US06 emissions.

100.5.5.1 Amend §86.159-08 as follows: Add the following sentence: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions

accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored.

100.5.5.2 Delete subparagraph (b)(9) of §86.159-08 and replace with: During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

100.5.5.3 **Hot 1435 LA92 (Hot 1435 Unified Cycle) Test Procedure.**

Amend §86.159-08 as follows: Add the following sentences: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored. The NMOG, CO, NOx, and formaldehyde emissions shall be measured according to the US06 Test Procedure as set forth in Subpart B, 40 CFR 86.159-08 with the following modifications:

1. Replace all references to "US06" with "Hot 1435 Unified Cycle." Where §86.159-08 references another section of 40 CFR part 86, replace all mention of "US06" with "Hot 1435 Unified Cycle" in referenced sections.

2. Amend 40 CFR 86.159-08 as follows:

2.1 Delete Paragraph (a); replace with: **Overview.**

The dynamometer operation consists of a single test starting from second 0 and ending at second 1435 in the driving schedule shown in Part II, Section G. This cycle will herein be referred to as "Hot 1435 Unified Cycle." The vehicle is preconditioned in accordance with the instructions in this section to bring it up to a warmed-up, stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the Hot 1435 Unified Cycle driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis.

2.2 Paragraph (b)

2.2.1 Subparagraphs (1) through (8) [No change.]

2.2.2 Delete subparagraph (9); replace with: **Dynamometer activities.**

During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a

fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

2.3 Paragraph (c) through (f) [No change.]

100.5.5.4 **US06 Bag 2 Test Procedure.**

Amend §86.159-08 as follows: Add the following sentences: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored. The NMOG, CO, NOx, and formaldehyde emissions shall be measured according to the US06 Test Procedure as set forth in Subpart B, 40 CFR §86.159-08 with the following modifications:

1. Replace all references to "US06" with "US06 Bag 2." Where §86.159-08 references another section of 40 CFR part 86, replace all mention of "US06" with "US06 Bag 2" in referenced sections.

2. Amend 40 CFR 86.159-08 as follows:

2.1 Delete Paragraph (a); replace with: **Overview.**

The dynamometer operation consists of a single, 365 second test starting as shown in Part II, Section F. This cycle will herein be referred to as "US06 Bag 2." The vehicle is preconditioned in accordance with the instructions in this section to bring it up to a warmed-up, stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 Bag 2 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis.

2.2 Paragraph (b)

2.2.1 Subparagraphs (1) through (8) [No change.]

2.2.2 Delete subparagraph (9); replace with: **Dynamometer activities.**

During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in § 86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling.

The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

2.3 Paragraph (c) through (f) [No change.]

86.160-00 Exhaust emission test procedure for SC03 emissions. December 8, 2005.

86.161-00 Air conditioning environmental test facility ambient requirements. July 13, 2005.

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.

86.164-08 Supplemental federal test procedure calculations. December 27, 2006.

86.165-12 Air Conditioning idle test procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that for the 2016 model years, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

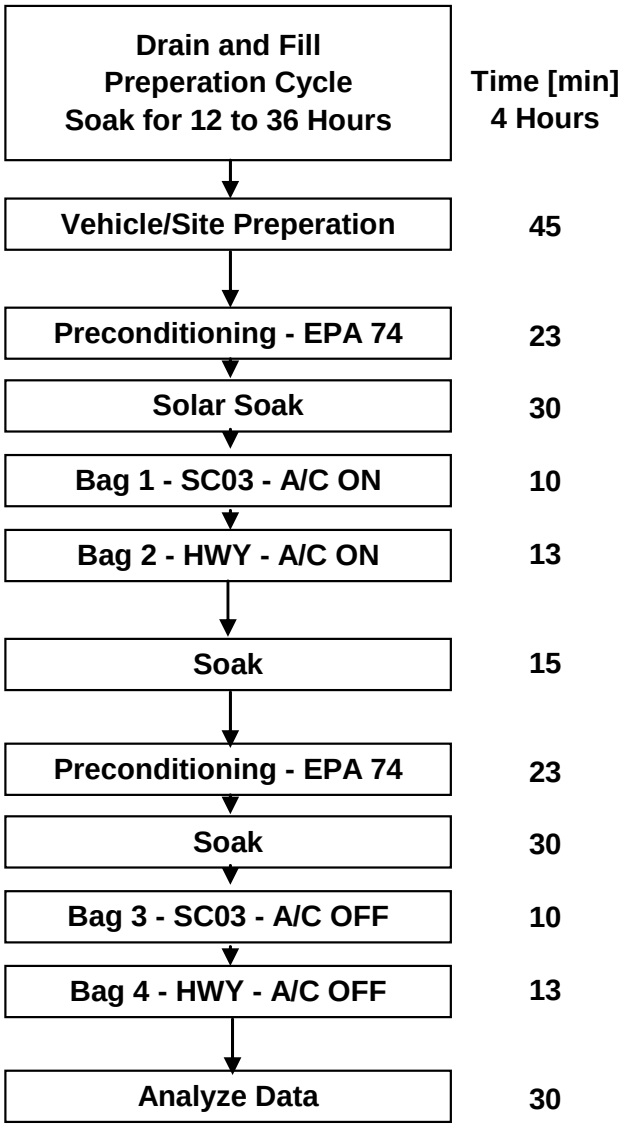
86.166-12 Method for calculating emissions due to air conditioning leakage. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

86.167-17 AC17 Air Conditioning Efficiency Test Procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75358 (December 1, 2011)]. [No change, except that for the 2012 through 2016 model years, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

100.5.6 AC17 Air Conditioning Efficiency Test Procedure.

1. Overview. The dynamometer operation consists of four elements: a pre-conditioning cycle, a 30-minute soak period under simulated solar heat, an SC03 drive cycle, and a Highway Fuel Economy Test (HWFET) drive cycle. The vehicle is preconditioned with the UDDS to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 30 minute vehicle soak (engine off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The SC03 driving schedule is followed immediately by the HWFET cycle, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the preconditioning driving, vehicle soak, and SC03 and HWFET official test cycles, is conducted in an environmental test facility. The environmental test facility must be capable of providing the following nominal ambient test conditions of: 77 °F air temperature, 50 percent relative humidity, a solar heat load intensity of 850 W/m2, and

vehicle cooling air flow proportional to vehicle speed. Section §86.161–00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The entire test sequence is run twice; with and without the vehicle's air conditioner operating during the SC03 and HFET test cycles. For gasoline-fueled Otto-cycle vehicles, the composite samples collected in bags are analyzed for THC, CO, CO_2, and CH_4. For petroleum-fueled diesel-cycle vehicles, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, and CH_4. The following figure shows the basic sequence of the test procedure.



2. **Dynamometer requirements**.

2.1 Tests shall be run on a large single roll electric dynamometer or an equivalent dynamometer configuration that satisfies the requirements of §86.108–00.

2.2 Position (vehicle can be driven) the test vehicle on the dynamometer and restrain.

2.3 Required dynamometer inertia weight class selections are determined by the test vehicle's test weight basis and corresponding equivalent weight as listed in the tabular information of §86.129–00(a) and discussed in §86.129–00 (e) and (f).

2.4 Set the dynamometer test inertia weight and roadload horsepower requirements for the test vehicle (see §86.129–00 (e) and (f)). The dynamometer's horsepower adjustment settings shall be set such that the force imposed during dynamometer operation matches actual road load force at all speeds.

2.5 The vehicle speed as measured from the dynamometer rolls shall be used. A speed vs. time recording, as evidence of dynamometer test validity, shall be supplied at request of the Executive Officer.

2.6 The drive wheel tires may be inflated up to a gauge pressure of 45 psi (310 kPa), or the manufacturer's recommended pressure if higher than 45 psi, in order to prevent tire damage. The drive wheel tire pressure shall be reported with the test results.

2.7 The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the test.

2.8 Four-wheel drive and all-wheel drive vehicles may be tested either in a four-wheel drive or a two-wheel drive mode of operation. In order to test in the two-wheel drive mode, four-wheel drive and all-wheel drive vehicles may have one set of drive wheels disengaged; four-wheel and all-wheel drive vehicles which can be shifted to a two-wheel mode by the driver may be tested in a two-wheel drive mode of operation.

3. **Test cell ambient conditions**.

3.1 **Ambient air temperature**.

3.1.1 Ambient air temperature is controlled, within the test cell, during all phases of the test sequence to 77 ±2 °F on average and 77 ±5 °F as an instantaneous measurement.

3.1.2 Air temperature is recorded continuously at a minimum of 30 second intervals. Records of cell air temperatures and values of average test temperatures are maintained by the manufacturer for all certification related programs.

3.2 **Ambient humidity**.

3.2.1 Ambient humidity is controlled, within the test cell, during all phases of the test sequence to an average of 69 ±5 grains of water/pound of dry air.

3.2.2 Humidity is recorded continuously at a minimum of 30 second intervals. Records of cell humidity and values of average test humidity are maintained by the manufacturer for all certification related programs.

3.3 **Solar heat loading**. The requirements of 86.161-00(d) regarding solar heat loading specifications shall apply. The solar load of 850 W/m^2 is applied only during specified portions of the test sequence.

4. **Interior temperature measurement**. The interior temperature of the vehicle shall be measured during the emission sampling phases of the test(s).

4.1 Interior temperatures shall be measured by placement of thermocouples at the following locations:

4.1.1 The outlet of the center duct on the dash.

4.1.2 Behind the driver and passenger seat headrests. The location of the temperature measuring devices shall be 30 mm behind each headrest and 330 mm below the roof.

4.2 The temperature at each location shall be recorded a minimum of every 5 seconds.

5. **Air conditioning system settings**. For the portion of the test where the air conditioner is required to be operating the settings shall be as follows:

5.1 Automatic systems shall be set to automatic and the temperature control set to 72 °F.

5.2 Manual systems shall be set at the start of the SC03 drive cycle to full cool with the fan on the highest setting and the airflow setting to "recirculation." Within the first idle period of the SC03 drive cycle (186 to 204 seconds) the fan speed shall be reduced to the setting closest to 6 volts at the motor, the temperature setting shall be adjusted to provide 55 °F at the center dash air outlet, and the airflow setting changed to "outside air."

6. **Vehicle and test activities**. The AC17 air conditioning test in an environmental test cell is composed of the following sequence of activities.

6.1 Drain and fill the vehicle's fuel tank to 40 percent capacity with test fuel. If a vehicle has gone through the drain and fuel sequence less than 72 hours previously and has remained under laboratory ambient temperature conditions, this drain and fill operation can be omitted (see §86.132–00(c)(2)(ii)).

6.2.1 Position the variable speed cooling fan in front of the test vehicle with the vehicle's hood down. This air flow should provide representative cooling at the front of the test vehicle (air conditioning condenser and engine) during the driving cycles. See §86.161–00(e) for a discussion of cooling fan specifications.

6.2.2 In the case of vehicles with rear engine compartments (or if this front location provides inadequate engine cooling), an additional cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The fan capacity shall normally not exceed 5300 cfm (2.50 m^3/s). If, however, it can be demonstrated that during road operation the vehicle receives additional cooling, and that such additional cooling is needed to provide a representative test, the fan capacity may be increased or additional fans used if approved in advance by the Executive Officer.

6.3 Open all vehicle windows.

6.4 Connect the emission test sampling system to the vehicle's exhaust tail pipe(s).

6.5 Set the environmental test cell ambient test conditions to the conditions defined in paragraph (c) of this section, except that the solar heat shall be off.

6.6 Set the air conditioning system controls to off.

6.7 Start the vehicle (with air conditioning system off) and conduct a preconditioning EPA urban dynamometer driving cycle (§86.115).

6.7.1 If engine stalling should occur during any air conditioning test cycle operation, follow the provisions of §86.136–90 (Engine starting and restarting).

6.7.2 For manual transmission vehicles, the vehicle shall be shifted according the provisions of §86.128–00.

6.8 Following the preconditioning cycle, the test vehicle and cooling fan(s) are turned off, all windows are rolled up, and the vehicle is allowed to soak in the ambient conditions of paragraph (c)(1) of this section for 30 ±1 minutes. The solar heat system must be turned on and generating 850 W/m^2 within 1 minute of turning the engine off.

6.9 **Air conditioning on test**.

6.9.1 Start engine (with air conditioning system also running). Fifteen seconds after the engine starts, place vehicle in gear.

6.9.2 Eighteen seconds after the engine starts, begin the initial vehicle acceleration of the SC03 driving schedule.

6.9.3 Operate the vehicle according to the SC03 driving schedule, as described in 40 CFR Part 86 Appendix I, paragraph (h), while sampling the exhaust gas.

6.9.4 At the end of the deceleration which is scheduled to occur at 594 seconds, simultaneously switch the sample flows from the SC03 bags and samples to the "HWFET" bags and samples, switch off gas flow measuring device No. 1, switch off the No. 1 petroleum-fueled diesel hydrocarbon integrator, mark the petroleum-fueled diesel hydrocarbon recorder chart, and start gas flow measuring device No. 2, and start the petroleum-fueled diesel hydrocarbon integrator No. 2.

6.9.5 Allow the vehicle to idle for 14-16 seconds. Before the end of this idle period, record the measured roll or shaft revolutions and reset the counter or switch to a second counter. As soon as possible transfer the SC03 exhaust and dilution air samples to the analytical system and process the samples according to §86.140 obtaining a stabilized reading of the bag exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample collection phase of the test.

6.9.6 Operate the vehicle according to the HWFET driving schedule, as described in 40 CFR 600.109-08, while sampling the exhaust gas.

6.9.7 Turn the engine off 2 seconds after the end of the last deceleration.

6.9.8 Five seconds after the engine stops running, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the petroleum-fueled diesel hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, and position the sample selector valves to the "standby" position. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and re-set the counter. As soon as possible, transfer the HWFET exhaust and dilution air samples to the analytical system and process the samples according to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period.

6.10 **Air conditioning off test**. The air conditioning off test is identical to the steps identified in paragraphs 6.1 through 6.9 of this section, except that the air conditioning system and fan speeds are set to complete off or the lowest. It is preferred

that the air conditioning off test be conducted sequentially after the air conditioning on test, following a 10-15 minute soak.

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

86.201-11 General applicability. December 27, 2006.

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 2015 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.
86.205-11 Introduction; structure of subpart. December 27, 2006.
86.206-11 Equipment required; overview. December 27, 2006.

200.2 California Equipment Required; Overview.

Amend §86.206-11, 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. December 27, 2006.
86.213-11 Fuel specifications. December 27, 2006.
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.
86.230-11 Test Sequence; general requirements. December 27, 2006.
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.
86.237-08 Dynamometer test run, gaseous emissions. December 27, 2006.
86.240-94 Exhaust sample analysis. July 17, 1992.
86.242-94 Records required. July 17, 1992.
86.244-94 Calculations; exhaust emissions. February 21, 2007.
86.246-94 Intermediate temperature testing. July 17, 1992.

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

C. 50ºF Emission Test Procedure.

The NMOG, CO, NOx, and formaldehyde emissions from all light- and medium-duty vehicles 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. 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		

E. 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		

F. US06 Bag 2 Driving Schedule.

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US06 Bag 2 Driving Schedule
(Speed vs Time Sequence)

Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)
1	0	74	62.8	147	62.1	220	65.9	293	70.9
2	0	75	63	148	62	221	66.2	294	70.2
3	0	76	64.1	149	62.4	222	66.1	295	71
4	0	77	63.9	150	62.2	223	67.1	296	70.2
5	0	78	64.1	151	62.2	224	67.4	297	70.3
6	0	79	64.3	152	62.4	225	68.3	298	69.1
7	2.7	80	64.5	153	62.7	226	68.3	299	68.8
8	9.2	81	64.9	154	62.6	227	68.7	300	68.2
9	16.1	82	65.3	155	63.7	228	68.2	301	68.3
10	22.7	83	66	156	64.3	229	68.1	302	68.2
11	29.2	84	66	157	64.8	230	68	303	67.7
12	34.2	85	66.4	158	65.1	231	67.1	304	67.3
13	38.8	86	64.1	159	65.9	232	66.4	305	67.5
14	43	87	63.6	160	66.1	233	66.1	306	67.6
15	45.3	88	63.9	161	67	234	65.7	307	67.6
16	46.8	89	64.1	162	67.2	235	66	308	67.2
17	48	90	63.7	163	67.5	236	66.4	309	67
18	49.5	91	64.3	164	68.3	237	66	310	66.3
19	50.3	92	64.2	165	68.3	238	66.3	311	66.6
20	51.5	93	63.9	166	68.8	239	67	312	66.2
21	52.2	94	64.2	167	69.1	240	67.5	313	66.4
22	52.6	95	63.4	168	69.4	241	67.9	314	65.9
23	53	96	64	169	71.7	242	68.1	315	66.1
24	53.8	97	63.9	170	72.1	243	68.5	316	65.5
25	53.8	98	64	171	74.9	244	68.9	317	62.2
26	53.8	99	63.8	172	72.6	245	68.6	318	62.2
27	54.6	100	64	173	72.2	246	69.4	319	61.4
28	56.3	101	63.3	174	72.2	247	69.4	320	61.1
29	56.9	102	63.4	175	72	248	69.4	321	61.4
30	58.1	103	63.9	176	72.5	249	70	322	61.1
31	58.4	104	64	177	72.8	250	70.4	323	61.4
32	59.6	105	64.3	178	72.7	251	70.6	324	61.4
33	59.9	106	64.8	179	71.8	252	70.9	325	61.8
34	60.2	107	65.1	180	71.4	253	70.3	326	61.8
35	60.5	108	64	181	71.1	254	70.6	327	61.8
36	59.7	109	64.2	182	71.1	255	70.3	328	61.8
37	58.3	110	63.1	183	70.9	256	69.7	329	62.2
38	58.1	111	63.7	184	71	257	69.9	330	61.8
39	57.8	112	63.1	185	71	258	70.1	331	62.2
40	57.3	113	63.7	186	71.2	259	69.6	332	62.6
41	57.5	114	63.5	187	72.1	260	69.3	333	62.2
42	56.6	115	63	188	72.6	261	69.9	334	62.6
43	57	116	63.1	189	73.6	262	69.7	335	62.2
44	56.6	117	63	190	74.8	263	69.5	336	62.6
45	56.5	118	63.3	191	75.7	264	69.9	337	62.6
46	56.2	119	63.4	192	77.3	265	70.2	338	63
47	56.4	120	63.3	193	78.4	266	70.2	339	62.6
48	56.6	121	62.5	194	79.3	267	70.2	340	62.2
49	56.4	122	62.5	195	78.2	268	71	341	61.1
50	56.1	123	62.9	196	76	269	70.8	342	59.5
51	56	124	62.8	197	75.6	270	70.9	343	58.8
52	55.9	125	62.2	198	76.4	271	70.7	344	56.8
53	54.8	126	62.4	199	77.6	272	70.9	345	55.7
54	54.2	127	62.3	200	78	273	71.2	346	54.1
55	54.6	128	62.3	201	79.1	274	71.3	347	51.5
56	52.2	129	62.4	202	79.5	275	70.8	348	49.2
57	54.7	130	62.1	203	79.9	276	71.2	349	48.8
58	55.7	131	62.5	204	79.9	277	71.7	350	47.6
59	57	132	62.8	205	80.3	278	71.9	351	44.9
60	58	133	62.3	206	80.3	279	72.6	352	41.5
61	58.1	134	62.3	207	79.5	280	72.3	353	37.2
62	59.4	135	62.4	208	79.5	281	72.3	354	34.6
63	59.9	136	61.9	209	79.1	282	72.1	355	33
64	61	137	62.8	210	78.7	283	72	356	29.2
65	61.4	138	62.8	211	77.6	284	71.9	357	22.3
66	61.9	139	62.3	212	76.5	285	72.6	358	17.7
67	62.5	140	62.8	213	74.3	286	72.8	359	17.3
68	62.5	141	62.4	214	72.6	287	73.2	360	14
69	62.7	142	62.1	215	70.8	288	72.1	361	10
70	62.2	143	61.9	216	67.6	289	71.5	362	6
71	62.5	144	61.8	217	66.4	290	70.9	363	2
72	63.1	145	62.1	218	66.7	291	70.4	364	0
73	62.7	146	62.1	219	66.1	292	70.5	365	0

G. Hot 1435 Unified Cycle Driving Schedule.

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Hot 1435 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

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	651	24.6	717	28	783	20.4	849	30.7	915	63.4	981	38	1047	28
586	16.9	652	25	718	28	784	21.1	850	33.8	916	63	982	38	1048	23.8
587	13.4	653	26.5	719	27.6	785	22.3	851	37.6	917	63.4	983	38	1049	18.8
588	13.4	654	28	720	26.5	786	22.3	852	40.7	918	64.1	984	37.2	1050	11.9
589	15.7	655	29.6	721	24.6	787	22.7	853	43.8	919	64.9	985	36.9	1051	6.1
590	18.4	656	30.7	722	20.7	788	22.3	854	46.1	920	65.3	986	36.1	1052	1.5
591	21.1	657	32.3	723	16.5	789	22.7	855	48	921	64.5	987	35.7	1053	1.5
592	23.4	658	33	724	15	790	22.3	856	49.5	922	64.1	988	34.9	1054	4.2
593	25.3	659	34.2	725	14.2	791	23.8	857	51.5	923	63.4	989	34.9	1055	8.1
594	27.6	660	34.6	726	14.2	792	25.7	858	53	924	63.7	990	33.8	1056	10.4
595	28.8	661	35.3	727	13.8	793	27.6	859	54.5	925	63.4	991	31.5	1057	13.1
596	30.3	662	36.1	728	13.8	794	29.6	860	55.7	926	63.4	992	28.8	1058	15.4
597	30.7	663	36.1	729	11.9	795	30	861	56.8	927	63.4	993	25.7	1059	18
598	31.5	664	36.9	730	8.4	796	29.2	862	58	928	63.4	994	24.6	1060	20.4
599	31.1	665	36.9	731	4.2	797	27.6	863	59.1	929	63.7	995	23.4	1061	23
600	31.1	666	37.6	732	1.2	798	25	864	60.3	930	64.5	996	22.3	1062	25.3
601	30.3	667	37.6	733	0	799	23.8	865	61.1	931	65.3	997	21.5	1063	27.3
602	30.3	668	38.4	734	0	800	23.4	866	61.8	932	64.9	998	20	1064	28.8
603	30.3	669	38	735	0	801	24.2	867	61.8	933	63.7	999	20	1065	30.3
604	30.7	670	37.6	736	0	802	23.4	868	61.8	934	63	1000	19.2	1066	31.1
605	31.1	671	37.6	737	0	803	23	869	61.8	935	59.9	1001	19.2	1067	32.3
606	32.3	672	37.2	738	0	804	20.4	870	62.6	936	55.3	1002	18	1068	31.9
607	32.6	673	36.9	739	0	805	18.8	871	63.4	937	50.7	1003	11.9	1069	32.3
608	32.6	674	36.1	740	0	806	17.3	872	63	938	49.2	1004	6.9	1070	31.9
609	32.6	675	35.7	741	0	807	15	873	63	939	48	1005	2.7	1071	31.1
610	31.1	676	36.1	742	0	808	13.1	874	62.6	940	46.1	1006	0.8	1072	28.8
611	26.9	677	35.7	743	0	809	9.2	875	61.8	941	44.2	1007	0.4	1073	25
612	22.3	678	35.7	744	0	810	6.9	876	61.8	942	41.1	1008	0	1074	22.7
613	18	679	35.7	745	0	811	4.6	877	62.2	943	39.9	1009	0	1075	18.8
614	13.8	680	36.1	746	0	812	4.6	878	62.2	944	36.1	1010	0	1076	15.4
615	9.6	681	36.1	747	0	813	4.6	879	62.6	945	32.6	1011	0	1077	13.4
616	4.6	682	35.7	748	0	814	4.2	880	63.7	946	29.2	1012	0	1078	11.9
617	6.1	683	35.7	749	0	815	5.4	881	64.5	947	24.6	1013	0	1079	8.8
618	10	684	34.9	750	0	816	4.6	882	64.9	948	20.7	1014	0	1080	5
619	14.2	685	34.6	751	0	817	3.5	883	66	949	19.2	1015	0	1081	1.9
620	17.3	686	34.2	752	0	818	2.3	884	66	950	16.5	1016	0	1082	2.3
621	20	687	33.8	753	0	819	2.3	885	66.8	951	15	1017	0	1083	2.7
622	21.5	688	33.4	754	0	820	1.9	886	66.4	952	11.9	1018	0	1084	3.5
623	22.3	689	33	755	0	821	3.1	887	66.8	953	9.6	1019	0	1085	6.5
624	22.3	690	30.3	756	0	822	6.1	888	67.2	954	8.4	1020	0	1086	10.8
625	22.3	691	29.2	757	0	823	4.6	889	66.4	955	5.8	1021	0	1087	13.8
626	22.3	692	28.4	758	0	824	2.7	890	66.4	956	1.2	1022	0	1088	16.1
627	23	693	25	759	0	825	2.3	891	66	957	0	1023	0.4	1089	18.4
628	23	694	21.1	760	0	826	2.3	892	65.7	958	0	1024	2.7	1090	20.4
629	22.7	695	16.9	761	0	827	3.1	893	65.7	959	0	1025	6.1	1091	21.9
630	22.3	696	13.4	762	0	828	4.2	894	66.4	960	1.2	1026	9.2	1092	21.9
631	21.9	697	13.1	763	1.5	829	3.5	895	66	961	3.1	1027	11.5	1093	20.7
632	22.7	698	12.3	764	5.4	830	3.8	896	65.7	962	5	1028	14.2	1094	17.3
633	23.8	699	12.7	765	9.2	831	4.2	897	65.3	963	8.4	1029	16.1	1095	13.1
634	25	700	15.7	766	11.5	832	3.5	898	65.3	964	11.5	1030	18	1096	9.6
635	25.3	701	19.2	767	14.6	833	3.5	899	64.5	965	14.6	1031	20	1097	8.8
636	25.7	702	22.3	768	17.3	834	3.5	900	64.5	966	16.9	1032	21.5	1098	10.8
637	26.5	703	24.6	769	19.2	835	4.6	901	64.1	967	18.8	1033	23	1099	12.7
638	26.9	704	25.7	770	21.1	836	5.8	902	63.7	968	21.1	1034	24.2	1100	14.2
639	27.3	705	26.5	771	20.7	837	3.5	903	63.7	969	23.8	1035	25	1101	14.6
640	28	706	26.5	772	20.7	838	0.8	904	63.7	970	26.5	1036	25.7	1102	13.1
641	29.2	707	26.9	773	19.6	839	3.5	905	64.5	971	28	1037	26.9	1103	11.1
642	30	708	27.3	774	18.4	840	3.8	906	64.5	972	29.6	1038	27.6	1104	11.1
643	30	709	27.3	775	16.9	841	2.3	907	64.9	973	30.7	1039	27.6	1105	11.1
644	29.6	710	27.6	776	16.9	842	0	908	64.5	974	32.6	1040	28.4	1106	13.1
645	29.6	711	28.4	777	16.5	843	1.2	909	64.1	975	34.2	1041	29.2	1107	15.7
646	28.8	712	28.8	778	16.9	844	6.9	910	64.9	976	35.3	1042	29.2	1108	18.4
647	28.4	713	28.8	779	16.9	845	13.8	911	65.3	977	36.1	1043	30	1109	20.7
648	28	714	29.2	780	16.9	846	18.8	912	65.3	978	36.9	1044	29.6	1110	23.8
649	27.3	715	28.8	781	17.3	847	23.8	913	65.3	979	38	1045	29.6	1111	25.7
650	25.7	716	28.8	782	19.2	848	27.3	914	64.1	980	38	1046	28.8	1112	28

Hot 1435 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)
1113	30	1154	14.6	1195	15.4	1236	0	1277	39.2	1318	37.2	1359	32.6	1400	11.1
1114	31.1	1155	12.3	1196	19.2	1237	0	1278	40.7	1319	36.5	1360	31.5	1401	13.1
1115	32.3	1156	9.2	1197	21.9	1238	0	1279	42.2	1320	34.6	1361	30	1402	15
1116	34.2	1157	5.8	1198	23.8	1239	0	1280	43.4	1321	31.5	1362	28.8	1403	16.9
1117	35.7	1158	1.9	1199	25	1240	3.5	1281	44.9	1322	29.6	1363	27.3	1404	16.9
1118	36.9	1159	0.4	1200	26.1	1241	10.4	1282	45.7	1323	29.2	1364	23.8	1405	16.1
1119	38.8	1160	0	1201	27.3	1242	15.4	1283	46.1	1324	28.8	1365	23	1406	15.7
1120	40.3	1161	0	1202	28.8	1243	17.3	1284	46.8	1325	28.8	1366	23	1407	15.4
1121	41.5	1162	0	1203	30	1244	17.3	1285	46.5	1326	28	1367	22.3	1408	15
1122	42.2	1163	0	1204	29.6	1245	18.4	1286	46.5	1327	28	1368	20.4	1409	13.8
1123	43	1164	0	1205	29.6	1246	21.5	1287	46.5	1328	28.4	1369	18.8	1410	10.8
1124	43.8	1165	0.4	1206	28.8	1247	24.6	1288	46.1	1329	29.6	1370	17.7	1411	8.4
1125	43.8	1166	4.2	1207	26.1	1248	27.3	1289	46.1	1330	30	1371	16.1	1412	6.1
1126	43.4	1167	9.2	1208	22.3	1249	30	1290	46.1	1331	30.3	1372	14.6	1413	4.2
1127	43	1168	11.9	1209	19.2	1250	31.5	1291	46.8	1332	29.2	1373	12.7	1414	3.5
1128	42.2	1169	14.2	1210	16.5	1251	31.9	1292	47.6	1333	26.5	1374	11.1	1415	3.5
1129	41.9	1170	15.7	1211	12.7	1252	32.6	1293	48	1334	25.3	1375	9.2	1416	1.5
1130	41.5	1171	15	1212	9.6	1253	33.4	1294	48.4	1335	25	1376	8.8	1417	0
1131	41.9	1172	14.2	1213	6.9	1254	34.9	1295	48	1336	24.6	1377	7.3	1418	0
1132	41.9	1173	13.4	1214	4.2	1255	36.5	1296	48	1337	24.6	1378	6.1	1419	0
1133	41.9	1174	13.8	1215	2.3	1256	37.6	1297	47.2	1338	25.3	1379	5	1420	0
1134	42.2	1175	14.6	1216	0.8	1257	39.2	1298	46.5	1339	26.1	1380	4.2	1421	0
1135	42.6	1176	14.6	1217	0	1258	40.3	1299	46.8	1340	27.3	1381	3.5	1422	0
1136	42.6	1177	14.2	1218	0	1259	40.7	1300	47.2	1341	28.4	1382	2.7	1423	0
1137	42.6	1178	16.1	1219	0	1260	41.1	1301	48.4	1342	29.2	1383	2.3	1424	0
1138	42.6	1179	15.7	1220	0	1261	40.7	1302	48.4	1343	29.2	1384	1.5	1425	0
1139	42.6	1180	15.7	1221	0	1262	40.7	1303	48.8	1344	29.6	1385	1.2	1426	0
1140	42.6	1181	14.6	1222	0	1263	40.7	1304	48.4	1345	30	1386	0	1427	0
1141	42.6	1182	13.1	1223	0	1264	41.5	1305	47.6	1346	31.1	1387	1.2	1428	0
1142	42.2	1183	10	1224	0	1265	42.6	1306	46.5	1347	32.6	1388	4.2	1429	0
1143	43	1184	7.3	1225	0	1266	43	1307	44.2	1348	33.8	1389	7.3	1430	0
1144	43.4	1185	3.5	1226	0	1267	44.5	1308	42.2	1349	34.6	1390	8.8	1431	0
1145	43	1186	0.8	1227	0	1268	45.3	1309	41.5	1350	34.9	1391	10.8	1432	0
1146	42.6	1187	0	1228	0	1269	45.3	1310	41.1	1351	34.6	1392	12.3	1433	0
1147	41.9	1188	0	1229	0	1270	44.9	1311	40.7	1352	34.9	1393	13.1	1434	0
1148	40.7	1189	0	1230	0	1271	43.4	1312	40.3	1353	34.6	1394	12.3	1435	0
1149	36.9	1190	0	1231	0	1272	40.3	1313	39.6	1354	34.9	1395	12.3		
1150	32.6	1191	0.4	1232	0	1273	38	1314	39.2	1355	34.9	1396	11.5		
1151	28	1192	2.7	1233	0	1274	36.1	1315	38.8	1356	34.9	1397	11.5		
1152	23.4	1193	7.3	1234	0	1275	36.5	1316	38	1357	34.2	1398	11.1		
1153	18.4	1194	11.5	1235	0	1276	38	1317	37.6	1358	33.8	1399	11.1		