California Environmental Protection Agency AIR RESOURCES BOARD

# CALIFORNIA 2015 THROUGH 2025 MODEL YEAR CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL YEAR GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

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[Note: This version of the Final Test Procedures also complies with Government Code section 11346.2 subdivision (a)(3), and 11346.8, subdivision (c). It is provided to also improve the accessibility and readability of the regulatory text. The existing, original test procedure language currently incorporated by reference in the California Code of Regulations is shown as plain, clean text, while the final amendments are shown in tracked changes. To review this document in a clean format (no underline or strikeout to show changes), please select “Simple Markup” or “No Markup” in Microsoft Word’s Review menu, or accept all changes. You can also change the view to the original (originally proposed regulatory text prior to proposed modifications) by selecting “Original” or rejecting all tracked changes. Additionally, “Advanced Track Changes Options” will allow for further options regarding color and other markings. [Instructions on using/viewing Track Changes can be found here](https://support.microsoft.com/en-us/office/track-changes-in-word-197ba630-0f5f-4a8e-9a77-3712475e806a).]

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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 2026 and Subsequent Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” (incorporated by reference in section 1961.4(c), title 13, CCR);
3. “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);
4. “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 amended September 3, 2015, (incorporated by reference in section 1961.3, title 13, CCR);
5. “California Exhaust Emission Standards and Test Procedures for 2018 through 2025 Model Year 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);
6. “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles” (incorporated by reference in section 1976(c), title 13, CCR);
7. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978(b), title 13, CCR);
8. OBD II (section 1968, et seq. title 13, CCR, as applicable);
9. “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);
10. Warranty Requirements (sections 2037 and 2038, title 13, CCR);
11. “Specifications for Fill Pipes and Openings of 2015 and Subsequent Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR);
12. “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);
13. “California Non-Methane Organic Gas Test Procedures for 1993 through 2016 Model Year Vehicles,” (incorporated by reference in section 1961.2(d), title 13, CCR);
14. “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” (incorporated by reference in section 1961.2(d), title 13, CCR);
15. “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.

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# CALIFORNIA 2015 THROUGH 2025 MODEL YEAR CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL YEAR 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 through 2025 Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Year Greenhouse Gas Exhaust Emission Standards and Test Procedures for 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

# General Applicability

* 1. **§86.1801 Applicability.**
     1. §86.1801-12. October 25, 2016. Amend as follows:
        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.
        2. Subparagraph (b) *Relationship to subpart A of this part*. [n/a]
        3. Subparagraph (c) *Clean alternative fuel conversions*. [n/a]
        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.
        5. Subparagraph (e) *You* [n/a]
        6. Subparagraph (f) *Vehicle* [no change]
        7. Amend subparagraph (g) *Complete and incomplete vehicles* 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. For the 2020 through 2025 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. 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.

* + - 1. Subparagraph (h) [No change.]
      2. Subparagraph (i) [No change.]
      3. 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.”]
      4. 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.”]

# California Provisions.

* 1. References to “light-duty trucks” in 40 CFR Part 86 and in 40 CFR Part 1066 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. Any reference to vehicle sales throughout the United States shall mean vehicle sales in California.
  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.

* 1. Regulations both herein, in Title 40, CFR Part 86, Subparts B, C, and S, and in Title 40, CFR Part 1066 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. 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.
  3. Regulations concerning federal OBD system requirements shall mean the California OBD requirements, except where specifically noted otherwise.

# §86.1802 Section Numbering; Construction.

* 1. §86.1802-01. October 25, 2016. [No change.]
  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. 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.
  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.

# Definitions, Acronyms and Abbreviations

# §86.1803 Definitions.

1.1 §86.1803-01. June 29, 2021. [No change, except as otherwise noted below.]

# 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 CO2 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 through 2025 Model Year 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.

“**Battery electric vehicle**” or “BEV” means any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking 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 30o 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. For provisions related to defeat devices and other Auxiliary Emission Control Devices, emergency vehicle means a motor vehicle that is an ambulance or fire truck.

“**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 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 (CH3CH2OH) and gasoline as specified in Part II, Section A.100.3 (Certification Fuel Specifications) of these test procedures. The required fuel blend is based on the type of ethanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

**“Federal Tier II emission Bin 3, Bin 4, or Bin 8**” means the federal Tier II emission Bin 3, Bin 4, or Bin 8, set forth in 40 CFR §86.1811-04 (February 26, 2007).

**“Federal Tier III emission Bin 85 or Bin 110**” means the federal Tier III emission Bin 85 or Bin110, set forth in 40 CFR §86.1811-17 (April 28, 2014).

**“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.

“**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 greenhouse gas phase 2 regulations”** (or “HD GHG Phase 2 regulations”) means the greenhouse gas regulations that apply to new 2021 and subsequent model year medium- and heavy-duty vehicles, excluding medium-duty passenger vehicles, and new 2020and subsequent model year trailers, in section 1956.8, title 13, CCR, and sections 95660 through 95664, title 17, CCR.

“**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 40 CFR Part 600 Subpart B or 40 CFR §1066.840, as modified in Part II of these test procedures with the migration provisions of §600.111-08 introduction, 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.

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

“**Methanol**” means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH3OH) and gasoline as specified in Part II, Section A.100.3.1 (Certification Fuel Specifications) of these procedures. The required fuel blend is based on the type of methanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

**“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.

**“2017 through 2025 MY National greenhouse gas program”** or “**2017 through 2025 MY National greenhouse gas final rule**” means the national program that applies to new 2017 through 2025 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as adopted by the U.S. Environmental Protection Agency as codified in 40 CFR Part 86, Subpart S, as incorporated in and amended by these test procedures.

For model years 2021 through 2025, the **“2017 through 2025 MY National greenhouse gas program”** means the national program that applies to new 2017 through 2025 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as adopted by the U.S. Environmental Protection Agency as codified in 40 CFR Part 86, Subpart S, as last amended on October 25, 2016 that incorporates CFR sections 86.1818-12 (October 25, 2016), 86.1865-12(October 25, 2016), 86.1866-12 (October 25, 2016), 86.1867-12 (October 25, 2016), 86.1868-12

(October 25, 2016), 86.1869-12 (October 25, 2016), 86.1870-12 (October 25, 2016), and

86.1871-12 (October 25, 2016), 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 for 1993 through 2016 Model Year Vehicles” or the “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” as applicable.

“**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 that meets the “small volume manufacturer” definition as set forth in section 1900, title 13, CCR.

“**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 a unique combination within a vehicle configuration that meets the criteria in 40 CFR §600.002 (October 25, 2016).

“**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 through 2025 Model Year Zero- Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes.”

# §86.1804 Acronyms and Abbreviations.

* 1. §86.1804-01 January 17, 2006. [No change.]

# 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. "CH4" means methane.

"GHG" means greenhouse gas.

“GWP” means Global Warming Potential. “HEV” means hybrid-electric vehicle. “LDT” means light-duty truck.

“LDT1” means a light-duty truck with a loaded vehicle weight of 0-3750 pounds. “LDT2” means a 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. "N2O" means nitrous oxide.

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

“OBD” means on-board diagnostic system. “PC” means passenger car.

“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 through 2025 Model Year 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.

# General Requirements for Certification

# §86.1805 Useful Life.

* 1. §86.1805-12. May 7, 2010. Amend as follows:
     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. 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.
    2. Subparagraph (c) [No change.]
    3. Subparagraph (d) [No change.]
  1. §86.1805-17. October 25, 2016. Amend as follows:
     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. The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV II standards in section E.1.1.1 shall be 10 years or 120,000 miles, whichever occurs first, except that 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. 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. Amend subparagraph (b) as follows: Delete; Replace with: The full useful life of passenger cars, light-duty trucks, and medium-duty passenger vehicles certified to the greenhouse gas standards in section E.2.5 shall be 15 years or 150,000 miles, whichever occurs first.
    2. Subparagraph (c) [No change to cold temperature CO requirements; cold temperature NMHC requirements do not apply.]
    3. Subparagraph (d) [n/a]
    4. Subparagraph (e) [n/a]
    5. Subparagraph (f) [n/a]

# §86.1806 On-Board Diagnostics.

* 1. §86.1806-05. Delete.
  2. §86.1806-17. Delete.

# 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.

# §86.1807 Vehicle Labeling.

* 1. §86.1807-01. April 28, 2014. Amend as follows:
     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.
     2. Subparagraphs (a)(1) through (c)(1)(i). [No change.]
     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.

* + 1. Subparagraphs (c)(1)(iii) through (c)(3): [No change.]
    2. 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."

* + 1. Subparagraph (e): [No change.]
    2. Subparagraph (f): [No change.]
    3. 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.

* + 1. Subparagraph (h): [n/a]

# California Labeling Requirements.

* + 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 with either the “California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles” or the “California Environmental Performance Label Specifications for 2021 and Subsequent Model Year Medium-Duty Vehicles, Except Medium-Duty Passenger Vehicles,” as applicable, 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.
    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:
       1. “CA OBD II" or "OBD Exempt".
       2. 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 the current version of SAE J1930, March 2017, including the above nomenclature. The Executive Officer shall approve upon request use of abbreviations in 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 granted upon determining the proposed abbreviation is consistent with existing terminology used for the component in the applicable industry and distinguishes other similar components.

* + 1. 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."
    2. 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.

# §86.1808 Maintenance Instructions.

4.1 §86.1808-01. April 28, 2014. [No change.]

# §86.1809 Prohibition of Defeat Devices.

5.1 §86-1809-12. April 28, 2014. [No change.]

# §86.1810 General standards; increase in emissions; unsafe conditions; waivers

# §86.1810-09. October 15, 2012. Amend §86.1810-09 as follows:

This section applies to model year 2015 and 2016 passenger cars, 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.

* 1. Subparagraphs (a) through (d) [No change.]
  2. Subparagraph (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.

* 1. Subparagraph (f) Altitude Requirements. [No change, except that 50oF standards shall only apply at low altitude conditions and requirements for compliance with cold temperature NMHC emission standards shall not apply.]
  2. Subparagraph (g) [No change.]
  3. Subparagraph (h) [Delete; see D.3 below.]
  4. Subparagraph (i) **Supplemental FTP general provisions for California**. Amend as follows:
     1. Delete subparagraphs (1) through (3) [The implementation schedules for SFTP are set forth in section E.2.4 of these test procedures.]
     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.
     3. Subparagraph (5) [No change.]
     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.
     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 or §1066.210, must be used for all types of emission testing to determine compliance with the applicable emission standards.

* + 1. Delete subparagraph (8);
    2. Subparagraphs (9) through (12) [No change.]
    3. 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.]
    4. 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 to fuel ratio significantly greater than stoichiometry during the large majority of its operation.

* 1. Subparagraph (j) **Evaporative emissions general provisions**. [Delete. (The provisions of this section are contained the “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.”)]
  2. Subparagraph (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.”)]
  3. Subparagraph (o) [Delete. See D.3 below]
  4. Subparagraph (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. The adjustment factors that must be applied to the measured NMHC emission levels before comparing them with the applicable standards are as follows:
     1. *Compliance with the LEV II and LEV III exhaust standards in section E.1.1.1 and E.1.1.2, respectively.*

For LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II section 100.3.1.1 or using the federal E0 certification gasoline in 40 CFR §86.113-04(a)(1), manufacturers must either (1) multiply NMHC measurements by an adjustment factor of 1.04 before comparing with the NMOG standard to determine compliance with the standard or (2) calculate the NMHC to NMOG adjustment factor in accordance with 40 CFR §1066.635, as modified by these test procedures, and multiply NMHC measurements by that calculated adjustment factor before comparing 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 or using the federal E10 certification gasoline in 40 CFR §1065.710(b) (June 29, 2021), manufacturers must either (1) multiply NMHC measurements by an adjustment factor of 1.10 before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard in section E.1.1.2 or before comparing it to the NMOG standard in section E.1.1.1, as applicable, or (2) calculate the NMHC to NMOG adjustment factor in accordance with 40 CFR §1066.635, as modified by these test procedures, and multiply NMHC measurements by that calculated adjustment factor before comparing with the NMOG+NOx standard in section E.1.1.2 or before comparing it to the NMOG standard in section E.1.1.1, as applicable, to determine compliance with that standard.

For LEV III vehicles and LEV II vehicles that are certified using a gasoline fuel that contains an ethanol content greater than that allowed by the California Gasoline Fuel

Specifications set forth in Part II, section 100.3.1.2 and less than or equal to 25 percent ethanol, the adjustment factor that must be used to demonstrate compliance with the NMOG+NOx standard in section E.1.1.2 or the NMOG standard in section E.1.1.1, as applicable, is calculated using the following formula:

Adjustment factor = 1.0302 + 0.0071 x volume percent fuel ethanol where the value for the “volume percent fuel ethanol” used in this formula is 15 if the

gasoline contains 15 percent ethanol, the “volume percent fuel ethanol” used in this formula is 20 if the gasoline contains 20 percent ethanol, etc. Manufacturers must multiply NMHC measurements by this calculated adjustment factor before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard in section E.1.1.2 or the NMOG standard in section E.1.1.1, as applicable, 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 Executive Officer.

* + 1. *Compliance with the LEV II and LEV III SFTP standards in section E.1.2 and the Highway NMOG+NOx standard in section E.1.6.*

For LEV III vehicles and LEV II vehicles that are certified to the SFTP Exhaust Emission Standards in section E.1.2 and/or the Highway NMOG+NOx Standard in section

E.1.6 manufacturers must 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. This adjustment factor is not dependent on the certification gasoline.

* 1. **§86.1810-17.** February 19, 2015. Amend §86.1810-17 as follows:

This section applies to model year 2017 and later passenger cars, 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.

* 1. Subparagraphs (a) through (d) [No change.]
  2. Subparagraph (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.

* 1. Subparagraph (f) Altitude Requirements. [No change, except that 50oF standards and SFTP standards shall only apply at low altitude conditions.]
  2. Subparagraph (g) [No change to cold temperature CO requirements; cold temperature NMHC requirements do not apply.]
  3. Subparagraph (h) [No change.]
  4. Subparagraph (i) [n/a]

# Supplemental FTP General Provisions for California.

This section D.2.7 applies to all 2017 through 2025 model test groups, except for those using carryover emissions test data from 2016 and prior model years, which are subject to the requirements in section D.1.6.

* + 1. **Enrichment limits***.* The nominal air to fuel ratio throughout the US06 cycle may not be richer than the leanest air to fuel mixture required for lean best torque, except as allowed under section D.2.7.2. Unless the Executive Officer approves otherwise in advance, lean best torque is the leanest air to fuel ratio required at any speed and load point with a fixed spark advance to make peak torque. The allowable tolerance around the nominal value for any given speed and load point over the US06 cycle for a particular vehicle is 4 percent, which is calculated as the nominal mass-based air to fuel ratio for lean best torque divided by 1.04.
    2. **Engine protection***.* Auxiliary Emission Control Devices (AECD) may use commanded enrichment to protect the engine or emission control hardware but must not use enrichment more frequently or to a greater degree than is needed for this purpose. For purposes of this section, commanded enrichment includes intended engine operation at air to fuel ratios richer than the stoichiometric ratio, except for the following:
       1. Cycling back and forth in a narrow window between rich and lean operation as a result of feedback controls targeted to maintain overall engine operation at the stoichiometric ratio.
       2. Small changes in the target air to fuel ratio to optimize vehicle emissions or drivability. This may be called ‘‘closed-loop biasing.’’
       3. Temporary enrichment in response to rapid throttle motion.
       4. Enrichment during cold-start and warm-up conditions.
       5. Temporary enrichment for running OBD checks to comply with 40 CFR

§86.1806.

* + 1. **A/C-on specific calibrations.** A/ C-on specific calibrations (e.g., air to fuel ratio, spark timing, and exhaust gas recirculation) that differ from A/C-off calibrations may be used for a given set of engine operating conditions (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters). Such calibrations must not unnecessarily reduce emission control effectiveness during A/C-on operation when the vehicle is operated under conditions that may reasonably be expected during normal operation and use. If emission control effectiveness decreases as a result of such calibrations, the manufacturer must describe in the application for certification the circumstances under which this occurs and the reason for using these calibrations. For AECDs involving commanded enrichment, these AECDs must not operate differently for A/C-on operation than for A/C-off operation, except as provided under section D.2.7.2. This includes both the sensor inputs for triggering enrichment and the degree of enrichment employed.
    2. **‘‘Lean-on-cruise’’ calibration strategies.** Manufacturers may use ‘‘lean- on-cruise’’ strategies subject to the following specifications:
       1. A ‘‘lean-on-cruise’’ strategy is defined as the use of an air to fuel ratio significantly leaner than the stoichiometric ratio during non-deceleration conditions at speeds above 40 mph.
       2. A ‘‘lean-on-cruise’’ strategy must not be employed during vehicle operation in normal driving conditions, including A/C usage, unless at least one of the following conditions is met: (i) Such strategies are substantially employed during the FTP, US06, or SC03 duty cycle. (ii) Such strategies are demonstrated not to significantly reduce vehicle emission control effectiveness over the operating conditions in which they are employed. (iii) Such strategies are demonstrated to be necessary to protect the vehicle occupants, engine, or emission control hardware.
       3. A manufacturer that proposes to use a ‘‘lean-on-cruise’’ strategy, must describe in the application for certification the circumstances under which such a calibration would be used and the reasons for using it.
    3. For gasoline 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.

# Measurement of Hydrocarbon Emissions.

* 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 for 1993 through 2016 Model Year Vehicles” or the “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” as applicable.
  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 for 1993 through 2016 Model Year Vehicles” or the “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” as applicable.
  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 1993 through 2016 Model Year Vehicles” or the “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” as applicable. For alcohol-fueled vehicles certifying to the standards in section E.1.2, “Non-Methane Hydrocarbons” shall mean “Organic Material Non-Methane Hydrocarbon Equivalent.”

# 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 2019 model years, a manufacturer has the option of certifying 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). For the 2020 through 2025 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 2020 through 2025 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 or to the LEV IV chassis standards and test procedures set forth in section E of the “California 2026 and Subsequent Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.”

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 through 2025 Model Year Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes.”

# Exhaust Emission Standards.

* 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 Part 86, Subparts B and C, except as amended in these test procedures.

* + 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 through 2025 Model Year 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 150,000 mile NMOG+NOx emission standards 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 numerical values in section E.1.4.1; and LEV II ULEV vehicles may be certified to the 150,000 mile NMOG+NOx emission standards 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 numerical values in section E.1.4.1. 2015 – 2019 model-year LEV II SULEV vehicles that receive a partial ZEV allowance 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 2015 – 2016 model year vehicles that are allowed to certify to LEV II SULEV standards using “carryover” of emission test data under the provisions in section E.2.2 may be certified to the 150,000 mile NMOG+NOx emission standards 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 numerical values in section E.1.4.1.

LEV II SULEV vehicles that do not either (1) receive a partial ZEV allowance or (2) certify to LEV II SULEV standards in the 2015 – 2016 model years using “carryover” of emission test data may not certify to combined NMOG+NOx standards. LEV II vehicles that certify to combined NMOG+NOx standards will be treated as LEV II vehicles for purposes of the

fleet-wide phase-in requirements.

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| **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 |
| 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. **LEV III Exhaust Standards.** The following standards are the maximum exhaust emissions for the full useful life from new 2015 through 2025 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. All 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.1.1.2 in 2020 through 2025 model years.

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| **LEV III Exhaust Mass Emission Standards for New 2015 through 2025 Model**  **Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles3** | | | | | | |
| Vehicle Type | Durability Vehicle Basis (mi) | Vehicle Emission Category2 | NMOG +  Oxides of Nitrogen4 (g/mi) | Carbon Monoxide (g/mi) | Formaldehyde (mg/mi) | Particulates1 (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 | LEV3955,6 | 0.395 | 6.4 | 6 | 0.12 |
| ULEV3405,6 | 0.340 | 6.4 | 6 | 0.06 |
| ULEV250 | 0.250 | 6.4 | 6 | 0.06 |
| ULEV200 | 0.200 | 4.2 | 6 | 0.06 |
| SULEV170 | 0.170 | 4.2 | 6 | 0.06 |
| SULEV150 | 0.150 | 3.2 | 6 | 0.06 |
| MDVs  10,001-14,000 lbs. GVWR  Vehicles in this category are tested at their adjusted loaded vehicle weight | 150,000 | LEV6305,6 | 0.630 | 7.3 | 6 | 0.12 |
| ULEV5705,6 | 0.570 | 7.3 | 6 | 0.06 |
| ULEV400 | 0.400 | 7.3 | 6 | 0.06 |
| ULEV270 | 0.270 | 4.2 | 6 | 0.06 |
| SULEV230 | 0.230 | 4.2 | 6 | 0.06 |
| SULEV200 | 0.200 | 3.7 | 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.
3. These standards apply at both low altitude and high altitude except as noted in footnote 4.
4. The LEV III NMOG+NOx 150,000-mile exhaust mass emission standards for passenger cars and light-duty trucks that apply at high-altitude conditions are: 0.160 g/mi for LEV160 and ULEV125; 0.105 g/mi for ULEV70; 0.070 g/mi for ULEV50; and

0.050 g/mi for SULEV30 and SULEV20.

1. These vehicle emission categories are only applicable for the 2015 through 2021 model years.
2. The following NOx standards also apply for certification testing with emission-data vehicles: 0.2 g/mi for LEV395 and ULEV340; 0.4 g/mi for LEV630 and ULEV570.

# LEV III Particulate Standards.

* + - * 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 passenger 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 at the specified fleet percentages. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2.

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| **LEV III Particulate Emission Standard Values and Phase-in for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles** | | | |
| **Model Year** | **Maximum % of vehicles certified to a 10 mg/mi standard** | **Minimum % of vehicles certified to a**  **3 mg/mi standard in MYs 2017-2024,**  **Maximum % of vehicles certified to a 3 mg/mi standard in MY 2025** | **Minimum % of vehicles certified to a**  **1 mg/mi standard** |
| 2017 | 90 | 10 | 0 |
| 2018 | 80 | 20 | 0 |
| 2019 | 60 | 40 | 0 |
| 2020 | 30 | 70 | 0 |
| 2021 | 0 | 100 | 0 |
| 2022 | 0 | 100 | 0 |
| 2023 | 0 | 100 | 0 |
| 2024 | 0 | 100 | 0 |
| 2025 | 0 | 75 | 25 |
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# Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.

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 Type1** | **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.

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 through 2025 | 100 |

* + - * 1. **Particulate Standards for Small Volume Manufacturers.** In the 2021 through 2025 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 2021 through 2025 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 through 2025 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.

# Alternative Phase-in Schedule for Particulate Standards.

**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: (1) the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in the 2019 model year is greater than or equal to the highest percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in the 2016, 2017, and 2018 model years individually; (2) the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in the 2020 model year is greater than or equal to the highest percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in the 2016, 2017, and 2018 model years individually; and (3) 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. In the 2021 model year, the cumulative total must be equal to or greater than 490, and 100 percent of the manufacturer’s passenger cars, light-duty trucks, and medium-duty passenger vehicles must be certified to the 3 mg/mi particulate standard, 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.

**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 the PM emission reductions that are achieved using the alternative phase-in schedule are equivalent to or greater than those that are achieved using the phase-in schedules in section E.1.1.2.1.1 for model years 2024-2025 and title 13, section 1961.4 subsection (d)(2)(A)2.a. for model years 2026-2028 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. or earlier model year would be multiplied by 4) to the cumulative total. In the 2028 model year, the cumulative total must be equal to or greater than 500, and 100 percent of the manufacturer’s passenger cars, light-duty trucks, and medium-duty passenger vehicles must be certified to the 1 mg/mi particulate standard, to be considered equivalent.

**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. In the 2021 model year, the cumulative total must be equal to or greater than 490, and 100 percent of the manufacturer’s MDVs must be certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, 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.

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

* + 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 2021 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 Weight3 (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.

1. 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.

1. 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).

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

* + - 1. **SFTP NMOG+NOx and CO Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** Manufacturers shall certify 2015 through 2025 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. **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 through 2025 model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. These standards only apply to 2015 through 2016 model year fuel-flexible vehicles ≤ 6,000 lbs. GVWR and 2015 through 2017 model year fuel-flexible vehicles > 6,000 lbs. GVWR when operating on the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. 2017 through 2025 model year multi-fueled vehicles (including bi-fueled, dual-fueled and fuel-flexible vehicles) ≤ 6,000 lbs. GVWR as well as 2018 through 2025 model year multi-fueled vehicles > 6,000 lbs. GVWR, including vehicles certifying with carryover data, shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of fuel-flexible vehicles).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards for 2015 through 2025 Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles** | | | | | | |
| *Vehicle Type* | *Durability Vehicle Basis (mi)* | *Vehicle Emission Category1* | *US06 Test (g/mi)* | | *SC03 Test (g/mi)* | |
| *NMOG + NOx* | *CO* | *NMOG + NOx* | *CO* |
| All PCs; |  | LEV | 0.140 | 9.6 | 0.100 | 3.2 |
| LDTs 0- 8,500 lbs. |  |
|  |  |  |  |  |
| GVWR; and  MDPVs |  | ULEV | 0.120 | 9.6 | 0.070 | 3.2 |
|  | 150,000 |  |  |  |  |  |
|  |  |  |  |  |
| Vehicles in these categories are tested at their loaded vehicle |  | SULEV  (Option A)2 | 0.060 | 9.6 | 0.020 | 3.2 |
|  |  |  |  |  |
| weight (curb weight plus 300 pounds). |  | 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. **SFTP NMOG+NOx and CO Composite Exhaust Emission Standards.** For the 2015 through 2025 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. These standards only apply to 2015 through 2016 model year fuel-flexible vehicles ≤ 6,000 lbs. GVWR and 2015 through 2017 model year fuel-flexible vehicles > 6,000 lbs. GVWR when operating on the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. 2017 through 2025 model year multi-fueled vehicles (including bi-fueled, dual-fueled and fuel-flexible vehicles) ≤ 6,000 lbs. GVWR as well as 2018 through 2025 model year multi-fueled vehicles > 6,000 lbs. GVWR, including vehicles certifying with carryover data, shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of fuel-flexible vehicles).

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 through 2025 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 | ***Sales-Weighted Fleet Average NMOG+NOx Composite Exhaust Emission Standards*2,**  **4,5,6** | | | | | | | | | | |
| lbs. GVWR |  | | | | | | | | | | |
| 0.140 | 0.110 | 0.103 | 0.097 | 0.090 | 0.083 | 0.077 | 0.070 | 0.063 | 0.057 | 0.050 |
| or less; and |
| MDPVs**3** |
| Vehicles in | ***CO Composite Exhaust Emission Standard*7** | | | | | | | | | | |
| this category |
|  | | | | | | | | | | |
| are tested at |  | | | | | | | | | | |
| their loaded |  | | | | | | | | | | |
| vehicle |  | | | | | | | | | | |
| weight (curb |  | | | | | | | | | | |
| weight plus |  | | | | | | | | | | |
| 300 pounds) |  | | | | | | | | | | |
| except LEV II  vehicles, | 4.2 | | | | | | | | | | |
| which are |  | | | | | | | | | | |
| subject to the |  | | | | | | | | | | |
| test weights |  | | | | | | | | | | |
| specified in |  | | | | | | | | | | |
| §1960.1(r), |  | | | | | | | | | | |
| title 13, CCR. |  | | | | | | | | | | |

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 and Cleaner Federal Vehicles.* For test groups certified to LEV II FTP emission standards, SFTP emission values shall be converted to NMOG+NOx and projected out to the same full useful life mileage as their LEV II FTP certification, 120,000 miles or 150,000 miles using deterioration factors or aged components. In lieu of deriving a deterioration factor specific to SFTP test cycles, carry-over LEV II 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 the LEV II SFTP 4k standards, that value may be used in the sales-weighted fleet-average without applying an additional deterioration factor. For federally-certified test groups certifying in California in accordance with Section H subparagraph 1.4, the full-useful life emission value used to comply with federal full-useful life SFTP requirements may be used in the sales-weighted fleet-average without applying an additional deterioration factor. For gasoline-fueled vehicles, 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. LEV II test groups that contain vehicles ≤ 6,000 lbs. GVWR shall certify to SFTP bins as described in footnote 4 at the same full useful life mileage as their LEV II FTP certification starting model year 2017 and in each subsequent model year, thereafter. LEV II test groups that only contain vehicles > 6,000 lbs. GVWR shall certify to SFTP bins as described in footnote 4 at the same full useful life mileage as their LEV II FTP certification starting model year 2018 and in each subsequent model year, thereafter. Test groups certifying to bins shall be subject to the in-use requirements in section I of these test procedures.

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 LEV III 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 and report to the Executive Officer, its sales-weighted fleet-average NMOG+NOx composite emission value as follows.

*n*

     

[Eq. 2]



 *i*1

*number of vehicles in the test group i*

*n*

*composite value of bin i* 



*number of*

*i*

*i*1

*vehicles in the test group*

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 2 of this table, for carry-over LEV II test groups. For each test group, the manufacturer shall  report to the Executive Officer the composite value of bin and the number of vehicles within the test group. |

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 may not comply with the 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 and federally-certified test groups certifying in California in accordance with Section H subparagraph 1.4 are not subject to this CO emission standard.

* + - 1. **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 through 2025 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. These standards only apply to 2015 through 2016 model year fuel-

flexible vehicles ≤ 6,000 lbs. GVWR and 2015 through 2017 model year fuel-flexible vehicles > 6,000 lbs. GVWR when operating on the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. 2017 through 2025 model year multi-fueled vehicles (including bi-fueled, dual-fueled and fuel-flexible vehicles) ≤ 6,000 lbs. GVWR and 2018 through 2025 model year multi-fueled vehicles > 6,000 lbs. GVWR, including vehicles certifying with carryover data, shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of fuel- flexible vehicles).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SFTP PM Exhaust Emission Standards for 2017 through 2025 Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles1** | | | | | |
| *Vehicle Type* | *Test Weight* | *Mileage for Compliance* | *Test Cycle* | *PM2 (mg/mi)* | |
| *2018 and Prior Model Years* | *2019  through 2025 Model Years* |
| All PCs and LDTs through 8,500 lbs GVWR; MDPVs | Loaded vehicle weight | 150,000 | US06 | 10 | 6 |

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.

2 *Relaxed Interim Certification Standard.* Manufacturers shall certify test groups to a relaxed interim certification standard of 10 mg/mi for 2018 and prior model years. However, all vehicles certifying to the LEV III PM standard, including those from carryover test groups, shall be subject to the 6 mg/mi US06 PM standard in 2019 through 2025 model years.

* + - 1. **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 through 2025 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 certified to LEV III FTP standards prior to model year 2018, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. 2018 through 2025 model year multi-fueled vehicles (including bi-fueled, dual-fueled and fuel- flexible vehicles), including vehicles certifying with carryover data, shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of fuel- flexible vehicles). 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 through 2025 Model ULEVs and SULEVs in the Medium-Duty Vehicle Class** | | | | | | |
| *Vehicle Type* | *Mileage for Compliance* | *HP/GVWR2* | *Test Cycle3,4,5* | *Vehicle Emission Category6* | *Composite Emission Standard1*  *(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) or

§1066.105, as applicable, 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 certified prior to the 2018 model year, 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. 2018 through 2025 model year MDVs 8,501-10,000 lbs. GVWR certifying to the FTP ULEV250 and ULEV200 emission categories, including vehicles certifying with carryover data, shall comply with the SFTP ULEV standards set forth in this section E.1.2.2.3, and those certifying to FTP SULEV170 and SULEV150, including vehicles certifying with carryover data, shall comply with the SFTP SULEV standards set forth in this section E.1.2.2.3. 2018 through 2025 model year MDVs 10,001-14,000 lbs. GVWR certifying to FTP ULEV400 and ULEV270 emission categories, including vehicles certifying with carryover data, shall comply with the SFTP ULEV standards set forth in this section E.1.2.2.3, and those certifying to SULEV230 and SULEV200, including vehicles certifying with carryover data, shall comply with the SFTP SULEV standards set forth in this section E.1.2.2.3.

* + - 1. **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 through 2025 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 certified to LEV III FTP standards prior to model year 2018, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. 2018 through 2025 model year multi-fueled vehicles (including bi-fueled, dual- fueled and fuel-flexible vehicles), including vehicles certifying with carryover data, shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of fuel-flexible vehicles). 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 through 2025 Model Medium-Duty Vehicles**1 | | | | | |
| *Vehicle Type* | *Test Weight* | *Mileage for Compliance* | *Hp/GVWR2* | *Test Cycle3,4,5* | *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) or §1066.105, as applicable, 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.

5 If a manufacturer provides an engineering evaluation for a test group demonstrating that SC03 PM emissions are equivalent to or lower than FTP PM emissions, the FTP PM emission value may be used in lieu of the SC03 PM emission value when determining the composite emission value for that test group.

# 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 50oF 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. 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. For the 2015 through 2025 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.

# 50oF Exhaust Emission Standards.

* + 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 4,000-mile exhaust emission standards for NMOG and formaldehyde measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50oF, as modified by Part II, Section D 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.1.10 and section G.3.1.2, respectively, of these test procedures. Emissions of CO and NOx measured at 50oF at 4,000 miles 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 68o to 86oF. Natural gas and diesel-fueled vehicles are exempt from the 50oF 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 |

# 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 4,000- mile 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 50oF, as modified by Part II, Section D 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.1.10 and section G.3.1.2, respectively, of these test procedures. Emissions of CO measured at 50oF at 4,000 miles 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 68o to 86oF.

* + - 1. **Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles Certified to the LEV III Standards.**

|  |  |  |  |
| --- | --- | --- | --- |
| **50oF 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. **Standards for Medium-Duty Vehicles (Excluding MDPVs) Certified to the LEV III Standards.**

|  |  |  |  |
| --- | --- | --- | --- |
| **50oF 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 |
|  |  | |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **50oF 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 |
| 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. **Cold CO Standards.**

The following standards are the maximum 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2015 through 2025 model-year passenger cars, light-duty trucks, and medium-duty passenger vehicles:

|  |  |
| --- | --- |
| **2015 THROUGH 2025 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 20oF (-7oC).

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.

# Highway NMOG+NOx Standard.

The maximum emissions of NMOG+NOx measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B or 40 CFR §1066.840, which are incorporated herein by reference, as modified in Part II of these test procedures with the migration provisions of §600.111-08 introduction) 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.

# 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 through 2025 Model Year 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, except that the time period is to be 10 years for a zero emission energy storage device (such as battery, ultracapacitor, or other electric storage device).

# 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.”

# 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.

# 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:

1. 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;
2. an evaluation of the durability of the device for the full useful life of the vehicle; and
3. 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. This credit can only be used for determining compliance with the exhaust standards in section E.1.1.1 or E.1.1.2, as applicable.

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

* + 1. **Basic Requirement.** Whenever a manufacturer federally-certifies a 2015 through 2025 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. **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.

# 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 through 2025 Model Year 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 40oF, 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.

# 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.

# Emission Standards Phase-In Requirements for Manufacturers.

* 1. **Fleet Average NMOG+NOx Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.**
     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 |
| 20141 | 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 fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful life standards.

* + - 1. *Pooling Provision*.

1. 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 and any states or the District of Columbia 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).

1. 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.
2. 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.
3. 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 and any states or the District of Columbia 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).
4. 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.
   * + 1. **PZEVs Anti-Backsliding Requirement**. In the 2018 through 2025 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. The percentage of a manufacturer’s passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards averaged across the applicable model year and the two previous model years shall be used to determine compliance with this requirement, beginning with the 2020 model year.

# Calculation of Fleet Average NMOG+NOx Value.

* + - 1. **Basic Calculation.**

1. 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:

 [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +

 [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

1. 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:

 [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +

 [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

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Model Year** | **Emission Category** | **Emission Standard Value1 (g/mi)** | |
| **All PCs;**  **LDTs 0-3750 lbs. LVW** | **LDTs**  **3751-5750 lbs. LVW;**  **All MDPVs** |
| 2015  through 2025 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 | LEV II LEVs; | 0.160 | 0.160 |
| model year vehicles | LEV160s |  |  |
| certified to the “LEV | LEV II ULEVs; | 0.125 | 0.125 |
| II” standards in E.1.1.1; | LEV125s |  |  |
| 2015 | ULEV70s | 0.070 | 0.070 |
| through 2025 model | ULEV50s | 0.050 | 0.050 |
| year vehicles certified to the “LEV III” standards in E.1.1.2 |
| LEV II SULEVs; SULEV30s | 0.030 | 0.030 |
| SULEV20s | 0.020 | 0.020 |
|  | LEV II LEVs; | n/a | 0.395 |
|  | LEV395s |  |  |
|  | 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.

* + - 1. **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. For the purpose of applying this formula to light-duty off-vehicle charge capable hybrid electric vehicles that are certified to the LEV II standards set forth in section E.1.1.1, a LEV II LEV shall use the formula for LEV160, a LEV II ULEV shall use the formula for ULEV125, and a LEV II SULEV shall use the formula for SULEV30.

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]

The Zero-emission VMT Allowance for 2015 through 2017 model year 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.” For the 2018 through 2025 model years, the Zero-emission VMT Allowance is equal to the sum of the Zero-Emission Vehicles Miles Traveled TZEV Allowance and the Allowance for US06 Capability in section

C.3.3 of the “California Exhaust Emission Standards and Test Procedures for 2018 through 2025 Model Year Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as applicable. 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.

# Phase-in Requirements for Small Volume Manufacturers.

1. In the 2015 through 2016 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 the 2017 through 2021 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 2022 through 2025 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.051 g/mi for PCs and LDTs from 0-3750 lbs.

LVW or 0.051 g/mi for LDTs from 3751 lbs. LVW to 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 through 2025 model years must meet the LEV III exhaust standards in section E.1.1.2.

1. 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.
2. 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.
   * 1. **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 through 2025 Model Year Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” shall be included as LDT1s in the calculation of a fleet average NMOG+NOx value.

# 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 through 2025 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 through 2025 model years.

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

* + 1. **Requirements for Manufacturers Other Than Small Volume Manufacturers.** A manufacturer of MDVs, other than a small volume manufacturer, shall certify its MDV fleet according to the following phase-in schedule:

# LEV III Phase-in Requirements for Medium-Duty Vehicles Certified to Section E.1.1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Year** | **Vehicles Certified to Section E.1.11 (%)** | | | |
| 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 |
| 2015 | 40 | 60 | 0 | 0 |
| 2016 | 20 | 60 | 20 | 0 |
| 2017 | 10 | 50 | 40 | 0 |
| 2018 | 0 | 40 | 50 | 10 |
| 2019 | 0 | 30 | 40 | 30 |
| 2020 | 0 | 20 | 30 | 50 |
| 2021 | 0 | 10 | 20 | 70 |
| 2022 - 2025 | 0 | 0 | 10 | 90 |

1 The LEV II LEV and LEV II ULEV, emission categories are only applicable for the 2015 through 2019 model years. The LEV III LEV395, LEV630, ULEV340, and ULEV570 emission categories are only applicable for the 2015 through 2021 model years.

# LEV III Phase-in Requirements for Incomplete and Diesel Medium- Duty Vehicles Using Engines Certified to Title 13 CCR, Section 1956.8.

|  |  |  |
| --- | --- | --- |
| **Model Year** | **Vehicles Certified to title 13 CCR Subsection 1956.8(c)(1)(B) or (h)(2) (%)** | **Vehicles Certified to title 13 CCR Subsection 1956.8(c)(1)(C) or (h)(7) (%)** |
| 2015 - 2023 | 100% ULEV | 0 |
| 2024- 2025 | 0 | 100% |

* + 1. **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 through 2025 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.

# Alternate Phase-In Schedules for LEV III MDVs.

* + - 1. **Alternate Phase-In Schedules for LEV III MDVs for All Manufacturers.**
         1. For the 2016 through 2025 model years, the fleet average non methane organic gas plus oxides of nitrogen exhaust mass emission values from the medium-duty vehicles produced and delivered for sale in California each model year shall not exceed:

|  |  |  |
| --- | --- | --- |
| **FLEET AVERAGE NON-METHANE ORGANIC GAS PLUS OXIDES OF NITROGEN EXHAUST MASS EMISSION REQUIREMENTS FOR**  **MEDIUM-DUTY VEHICLES**  (150,000 mile Durability Vehicle Basis) | | |
| Model Year | Fleet Average NMOG + NOx (g/mi) | |
| MDVs 8,501 - 10,000 lbs.  GVWR | MDVs 10,001-14,000 lbs.  GVWR |
| 2016 | 0.333 | 0.548 |
| 2017 | 0.310 | 0.508 |
| 2018 | 0.278 | 0.451 |

|  |  |  |
| --- | --- | --- |
| **FLEET AVERAGE NON-METHANE ORGANIC GAS PLUS OXIDES OF NITROGEN EXHAUST MASS EMISSION REQUIREMENTS FOR**  **MEDIUM-DUTY VEHICLES**  (150,000 mile Durability Vehicle Basis) | | |
| Model Year | Fleet Average NMOG + NOx (g/mi) | |
| MDVs 8,501 - 10,000 lbs.  GVWR | MDVs 10,001-14,000 lbs.  GVWR |
| 2019 | 0.253 | 0.400 |
| 2020 | 0.228 | 0.349 |
| 2021 | 0.203 | 0.298 |
| 2022- 2025 | 0.178 | 0.247 |

* + - * 1. Each manufacturer's fleet average NMOG+NOx value for the total number of MDVs 8,501 to 10,000 lbs. GVWR produced and delivered for sale in California shall be calculated as follows:

 [Number of MDVs 8,501 - 10,000 lbs. GVWR in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +

 [Number of off-vehicle charge capable hybrid electric vehicles in a test group x

HEV NMOG+NOx contribution factor]) ÷

Total Number of MDVs 8,501 - 10,000 lbs. GVWR Produced and Delivered for sale in California, Including ZEVs and HEVs

* + - * 1. Each manufacturer's fleet average NMOG+NOx value for the total number of MDVs 10,001 to 14,000 lbs. GVWR produced and delivered for sale in California shall be calculated as follows:

 [Number of MDVs 10,001 - 14,000 lbs. GVWR in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +

 [Number of off-vehicle charge capable hybrid electric vehicles in a test group x

HEV NMOG+NOx contribution factor]) ÷

Total Number of MDVs 10,001 - 14,000 lbs. GVWR Produced and Delivered for sale in California, Including ZEVs and HEVs

* + - * 1. The applicable emission standards to be used in the above equations are as follows:

|  |  |  |
| --- | --- | --- |
| **Model Year** | **Emission Category** | **Emission Standard Value (g/mi)** |
| 2016 through 2025 model year federally-certified vehicles | All | Sum of the full useful life NMOG and NOx Federal Emission Standards or full useful life NMOG+NOx Federal Emission Standard to which Vehicle is  Certified |
| 2016 through 2019 model year vehicles  certified to the “LEV II” standards in E.1.1.1 | All | Sum of the full useful life NMOG and NOx LEV II Emission  Standards to which Vehicle is Certified |
| 2016 through 2025 model year vehicles certified to the “LEV III” standards in E.1.1.2 | All | Full useful life NMOG+NOx LEV III Emission Standards to which Vehicle is Certified |

* + - * 1. **NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs.** The HEV NMOG+NOx contribution factors for medium-duty off- vehicle charge capable hybrid electric vehicles are calculated as follows.

The Zero-emission VMT Allowance for 2016 and 2017 model year 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.” For the 2018 through 2025 model years, the Zero-emission VMT Allowance is equal to the sum of the Zero-Emission Vehicles Miles Traveled TZEV Allowance and the Allowance for US06 Capability in section C.3.3 of the “California Exhaust Emission Standards and Test Procedures for 2018 through 2025 Model Year Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as applicable. For the purposes of this section E.2.3.3.1.5, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0.

**NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs 8,501 to 10,000 lbs. GVWR.** The HEV NMOG+NOx contribution factors for medium-duty off-vehicle charge capable hybrid electric vehicles 8,501 to 10,000 lbs. GVWR are calculated as follows.

For the purpose of applying this formula to medium-duty off-vehicle charge capable hybrid electric vehicles 8,501 to 10,000 lbs. GVWR that are certified to the LEV II standards set forth in section E.1.1.1, a LEV II LEV shall use the formula

for LEV395, a LEV II ULEV shall use the formula for ULEV340, and a LEV II SULEV shall use the formula for ULEV200.

|  |  |  |
| --- | --- | --- |
| LEV395 HEV Contribution Factor | = | 0.395 - [(Zero-emission VMT Allowance) x 0.055] |
| ULEV340 HEV Contribution Factor | = | 0.340 - [(Zero-emission VMT Allowance) x 0.090] |
| ULEV250 HEV Contribution Factor | = | 0.250 - [(Zero-emission VMT Allowance) x 0.050] |
| ULEV200 HEV Contribution Factor | = | 0.200 - [(Zero-emission VMT Allowance) x 0.030] |
| SULEV170 HEV Contribution Factor | = | 0.170 - [(Zero-emission VMT Allowance) x 0.020] |
| SULEV150 HEV Contribution Factor | = | 0.150 - [(Zero-emission VMT Allowance) x 0.020] |

**NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs 10,001 to 14,000 lbs. GVWR.** The HEV NMOG+NOx contribution factors for medium-duty off-vehicle charge capable hybrid electric vehicles10,001 to 14,000 lbs. GVWR are calculated as follows.

For the purpose of applying this formula to medium-duty off-vehicle charge capable hybrid electric vehicles 10,001 to 14,000 lbs. GVWR that are certified to the LEV II standards set forth in section E.1.1.1, a LEV II LEV shall use the formula for LEV630, a LEV II ULEV shall use the formula for ULEV570, and a LEV II SULEV shall use the formula as follows.

|  |  |  |
| --- | --- | --- |
| LEV II SULEV HEV Contribution Factor | = | 0.327 - [(Zero-emission VMT Allowance) x 0.057] |
| LEV630 HEV Contribution Factor | = | 0.630 - [(Zero-emission VMT Allowance) x 0.060] |
| ULEV570 HEV Contribution Factor | = | 0.570 - [(Zero-emission VMT Allowance) x 0.170] |
| ULEV400 HEV Contribution Factor | = | 0.400 - [(Zero-emission VMT Allowance) x 0.130] |
| ULEV270 HEV Contribution Factor | = | 0.270 - [(Zero-emission VMT Allowance) x 0.040] |
| SULEV230 HEV Contribution Factor | = | 0.230 - [(Zero-emission VMT Allowance) x 0.030] |
| SULEV200 HEV Contribution Factor | = | 0.200 - [(Zero-emission VMT Allowance) x 0.030] |

* + - 1. **Alternate Phase-In Schedules for LEV III MDVs Certified to Section E.1.1 for Manufacturers with a Limited Number of Test Groups.** For the 2016 through 2025 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 certified to section E.1.1 may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles instead of section E.2.3.1.1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Year** | **Number of Test Groups Certified to Section E.1.1** | | | |
| 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 |
| 2016-2017 | 1 | 2 | 1 | 0 |
| 2018 | 0 | 2 | 2 | 0 |
| 2019 | 0 | 1 | 2 | 1 |
| 2020 | 0 | 1 | 1 | 2 |
| 2021 | 0 | 0 | 1 | 3 |
| 2022 - 2025 | 0 | 0 | 0 | 4 |

* + - * 1. A manufacturer that produces and delivers for sale in California three medium-duty test groups certified to section E.1.1 may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles instead of section E.2.3.1.1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Year** | **Number of Test Groups Certified to Section E.1.1** | | | |
| 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 |
| 2016 | 1 | 2 | 0 | 0 |
| 2017 | 0 | 2 | 1 | 0 |
| 2018 | 0 | 1 | 2 | 0 |
| 2019-2020 | 0 | 1 | 1 | 1 |
| 2021 | 0 | 0 | 1 | 2 |
| 2022 - 2025 | 0 | 0 | 0 | 3 |

* + - * 1. A manufacturer that produces and delivers for sale in California two medium-duty test groups certified to section E.1.1 may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles instead of section E.2.3.1.1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Year** | **Number of Test Groups Certified to Section E.1.1** | | | |
| 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 |
| 2016 | 1 | 1 | 0 | 0 |
| 2017-2019 | 0 | 1 | 1 | 0 |
| 2020-2021 | 0 | 0 | 1 | 1 |
| 2022- 2025 | 0 | 0 | 0 | 2 |

* + - * 1. A manufacturer that produces and delivers for sale in California one medium-duty test group~~s~~ certified to section E.1.1 may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles instead of section E.2.3.1.1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Year** | **Number of Test Groups Certified to Section E.1.1** | | | |
| 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 |
| 2016-2018 | 0 | 1 | 0 | 0 |
| 2019-2021 | 0 | 0 | 1 | 0 |
| 2022-2025 | 0 | 0 | 0 | 1 |

* + 1. **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. For the purpose of demonstrating compliance with the LEV III phase-in requirements in section E.2.3, each manufacturer’s MDV fleet must be divided into two separate groups of vehicles – “chassis-certified MDVs” that certify to section E.1.1 and “engine-certified MDVs” that use engines certified to the standards in §1956.8 , title 13 CCR. The phase-in percentages in section E.2.3 for vehicles certified to section E.1.1 shall be applied to the manufacturer’s total production of California chassis-certified medium-duty vehicles delivered for sale in California. The phase-in percentages in section E.2.3 for vehicles certified to title 13 CCR section 1956.8 shall be applied to the manufacturer’s total

production of California engine-certified medium-duty vehicles delivered for sale in California.

# Implementation Schedules for SFTP Emission Standards.

* + 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.

1. Under Option 1, for 2015 through 2025 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.
2. Under Option 2, for 2015 through 2025 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 and each test group’s CO composite emission value do not exceed the applicable composite emission standards in effect for that model year in accordance with section E.1.2.2.1.2.

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.

* + 1. **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 through 2025 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.

* + 1. **Identifying a Manufacturer's MDV Fleet**. For the 2016 through 2025 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 through 2025 model years, a manufacturer that elects to certify engines to the optional medium-duty engine emission standards in title 13, CCR, §1956.8 shall not count those engines in the manufacturer’s total production of California-certified medium-duty vehicles for purposes of this subparagraph.

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

* + 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 CO2 mass emissions standards for each model year is the sales-weighted average of the calculated CO2 exhaust mass emission target values for each manufacturer. For each model year, the sales-weighted fleet average CO2 mass emissions value shall not exceed the sales-weighted average of the calculated CO2 exhaust mass emission target values for that manufacturer.
       1. *Fleet Average Carbon Dioxide Target Values for Passenger Cars.* The fleet average CO2 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:
          1. For passenger cars with a footprint of less than or equal to 41 square feet, the gram per mile CO2 target value shall be selected for the appropriate model year from the following table:

|  |  |
| --- | --- |
| *Model Year* | *CO2 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 |
| 2024 | 137.0 |
| 2025 and subsequent | 131.0 |

* + - * 1. For passenger cars with a footprint of greater than 56 square feet, the gram per mile CO2 target value shall be selected for the appropriate model year from the following table:

|  |  |
| --- | --- |
| *Model Year* | *CO2 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 |
| 2024 | 188.0 |
| 2025 and subsequent | 179.0 |

* + - * 1. 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 CO2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

Target gCO2/mile = [*a* x *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 |

* + - 1. *Fleet Average Carbon Dioxide Target Values for Light-Duty Trucks and Medium-Duty Passenger Vehicles.* The fleet average CO2 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:

* + - * 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 CO2 target value shall be selected from the following table:

|  |  |
| --- | --- |
| *Model Year* | *CO2 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 |
| 2024 | 168.0 |
| 2025 and subsequent | 159.0 |

* + - * 1. 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 CO2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

Target gCO2/mile = [*a* x *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 |

* + - * 1. 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 CO2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

Target gCO2/mile = [*a* x *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 |

* + - * 1. 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 CO2 target value shall be selected for the applicable model year from the following table:

|  |  |  |
| --- | --- | --- |
| *Model year* | *Minimum Footprint* | *CO2 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 |

* + - 1. *Calculation of Fleet Average Carbon Dioxide Standards.* For each model year, a manufacturer must comply with its fleet average CO2 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 CO2 values for its passenger car fleet and for its combined light- duty truck plus medium-duty passenger vehicle fleet.
         1. A CO2 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. Each CO2 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.
         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 CO2 standard for the manufacturer’s passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.
         4. *Optional Compliance Via the 2017 through 2025 MY National Greenhouse Gas Program.*

The optional compliance approach provided by this section E.2.5.1.3.4 shall not be available for 2021 through 2025 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles if the “2017 through 2025 MY National Greenhouse

Gas Program” is altered via a final rule published in the *Federal Register* subsequent to October 25, 2016.

For the 2017 through 2025 model years, a manufacturer may elect to demonstrate compliance with section E.2.5 by demonstrating compliance with the 2017 through 2025 MY National greenhouse gas program as follows:

A manufacturer that selects compliance with this option must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with section E.2.5.5;

The manufacturer must submit to ARB all data that it submits to EPA in accordance with the reporting requirements as required under 40 CFR §86.1865-12, for demonstrating compliance with the 2017 through 2025 MY National greenhouse gas program and the EPA determination of compliance. All such data must be submitted within 30 days of receipt of the EPA determination of compliance for each model year that a manufacturer selects compliance with this option;

The manufacturer must provide to the Executive Officer separate values for the number of vehicles produced and delivered for sale in California, the District of Columbia, and each individual state that has 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), the applicable fleet average CO2 standards for each of these model types and footprint values, the calculated fleet average CO2 value for each of these model types and footprint values, and all values used in calculating the fleet average CO2 values.

* + 1. *Nitrous Oxide (N2O) and Methane (CH4) 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 N2O and CH4 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 N2O standard in section E.2.5.2.1 and an alternative CH4 standard determined under section E.2.5.2.3.
       1. *Standards Applicable to Each Test Group.*
          1. Exhaust emissions of N2O 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 N2O standard under section E.2.5.2.3.

* + - * 1. Exhaust emissions of CH4 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 CH4 standard under section E.2.5.2.3.
      1. *Including N2O and CH4 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 N2O and CH4 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 N2O emissions value by 298 and the measured CH4 emissions value by 25, and include both of these adjusted N2O and CH4 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. *Optional Use of Alternative N2O and/or CH4 Standards.* Manufacturers may select an alternative standard applicable to a test group, for either N2O or CH4, or both. For example, a manufacturer may choose to meet the N2O standard in section E.2.5.2.1.1 and an alternative CH4 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 N2O and CH4 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 N2O and/or CH4 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.
      3. *CO2-Equivalent Debits.* CO2-equivalent debits for test groups using an alternative N2O and/or CH4 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 | = | N2O or CH4 CO2-equivalent debits for a test group using an alternative N2O or CH4 standard; |
| GWP | = | 25 if calculating CH4 debits and 298 if calculating N2O debits; |
| Production | = | The number of vehicles of that test group produced and  delivered for sale in California; |

|  |  |  |
| --- | --- | --- |
| AltStd | = | The alternative standard (N2O or CH4) selected by the manufacturer under 1961.3(a)(2)(C); and |
| Std | = | The exhaust emission standard for N2O or CH4 specified in 1961.3(a)(2)(A). |

* + 1. *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 CO2 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.
       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.
          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. 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. *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:
          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. 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.
          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.
       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.
          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. 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.
          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.
          4. A manufacturer may elect to petition for alternative standards under this section E. 2.5.3.3 by submitting to ARB a copy of the data and information submitted to EPA as required under 40 CFR §86.1818-12 (g) (October 15, 2012), as incorporated by reference herein, and the EPA approval of the manufacturer’s request

for alternative fleet average standards for the 2017 through 2025 MY National Greenhouse Gas Program.

* + - 1. *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.
         1. *Vehicle Model and Fleet Information*.

1. The model years to which the requested alternative standards would apply, limited to five consecutive model years.
2. Vehicle models and projections of production volumes for each model

year.

1. Detailed description of each model, including the vehicle type, vehicle mass, power, footprint, and expected pricing.
2. The expected production cycle for each model, including new model introductions and redesign or refresh cycles.
   * + - 1. *Technology Evaluation Information*.
3. The CO2 reduction technologies employed by the manufacturer on each vehicle model, including information regarding the cost and CO2-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.
4. An evaluation of comparable models from other manufacturers, including CO2 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.
5. A discussion of the CO2-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 CO2 reductions for vehicles in the U.S. market.
6. 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.
   * + - 1. *Information Supporting Eligibility*.
7. U.S. sales for the three previous model years and projected sales for the model years for which the manufacturer is seeking alternative standards.
8. 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.
   * + 1. *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.
          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 CO2 per mile for each vehicle model type and footprint value that is approved. The ultra- small volume manufacturer shall calculate its fleet average CO2 standard in accordance with section E.2.5.1.3 based on these target grams CO2 per mile values provided by the Executive Officer.
          2. In the 2017 and subsequent model years, an ultra-small volume manufacturer shall either:
9. not exceed its fleet average CO2 standard calculated in accordance with section E.2.5.1.3 based on the target grams CO2 per mile values provided by the Executive Officer; or
10. 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.
    * + 1. *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.
      1. *Greenhouse Gas Emissions Values for Electric Vehicles, “Plug-In” Hybrid Electric Vehicles, and Fuel Cell Vehicles*.
         1. *Electric Vehicle Calculations*.
            1. For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO2 Value using the following formula:

*City CO2 Value = (270 gCO2e/kWh) \* EEV – 0.25 \* CO2 target*

Where EEV 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).

* + - * 1. For each unique combination of model type and footprint value, a manufacturer shall calculate the Highway CO2 Value using the following formula:

*Highway CO2 Value = (270 gCO2e/kWh) \* EEV – 0.25 \* CO2 target*

Where EEV 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).

* + - 1. *“Plug-In” Hybrid Electric Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO2 Value and the Highway CO2 Value using the following formulas:

*City CO2 Value = GHGurban*

and

*Highway CO2 Value = GHGhighway*

Where GHGurban and GHGhighway 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.

* + - 1. *Fuel Cell Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO2 Value and the Highway CO2 Value using the following formulas:

and

*City CO2 = GHGFCV = (9132 gCO2e/kg H2) \* HFCV – Gupstream Highway CO2 = GHGFCV = (9132 gCO2e/kg H2) \* HFCV – Gupstream*

Where HFCV 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.

* + 1. *Calculation of Fleet Average Carbon Dioxide Value*.
       1. For each unique combination of model type and footprint value, a manufacturer shall calculate a combined city/highway CO2 exhaust emission value as follows:

*0.55 x City CO2 Value + 0.45 x Highway CO2 Value*

“City” CO2 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” CO2 exhaust emission shall be measured using the using the Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B).

* + - 1. Each combined city/highway CO2 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. 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 CO2 value for the manufacturer’s

passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

* + - 1. 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 CO2 Value and Highway CO2 exhaust emission values that apply to each model type and footprint value.
   * 1. *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.
        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.

* + - 1. 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 CO2-equivalent per mile (gCO2e/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 CO2- equivalent per mile (gCO2e/mi).

* + - 1. 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

1. 2.5.6.3.3.
   * + - 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 equals the Direct Credit Baseline times Value 1.  Value 1 is equal to 1 minus the fraction LR divided by Avg LR. 

Where:

|  |  |  |
| --- | --- | --- |
| *Direct Credit Baseline* | = | 12.6 gCO2e/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 February 2012)  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 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 February 2012 version of SAE J2727 does.

* + - * 1. Low-GWP vapor compression systems

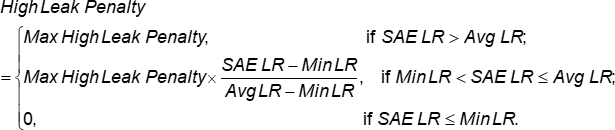
For A/C systems that use a refrigerant having a GWP of 150 or less, the A/C Direct Emissions Credit shall be calculated using the following formula:

*A/C Direct Credit = Low GWP Credit – High Leak Penalty*

Where:

Low GWP Credit equals Max Low GWP Credit times the difference when GWP is divided by 1,430 and that value is subtracted from 1. 

and



Where:

|  |  |  |
| --- | --- | --- |
| *Max Low GWP Credit* | = | 13.8 gCO2e/mi for passenger cars; |
| *Max Low GWP Credit* | = | 17.2 gCO2e/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 gCO2e/mi for passenger cars; |
| *Max High Leak Penalty* | = | 2.1 gCO2e/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 February 2012); |
| *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 that the update or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the February 2012 version of SAE J2727 does.

* + - * 1. 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 gCO2e/mi for passenger cars and 17.2 gCO2e/mi for light- duty trucks and medium-duty passenger vehicles.

* + - 1. 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 × 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. |

* + - 1. 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. 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 |
| CO2 | 1 |

* + 1. *Credits for Improving Air Conditioning System Efficiency.* Manufacturers may generate CO2 credits by implementing specific air conditioning system technologies designed to reduce air conditioning-related CO2 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 CO2 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.
       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 |

* + - 1. 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.

* + - 1. 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 CO2 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. |

* + - 1. 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. 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 40 CFR

§86.167-17, as amended by these test procedures.

* + - * 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. Using good engineering judgment, the manufacturer must select the vehicle configuration to be tested that is expected to result in the greatest increased CO2 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 CO2 emissions.
        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:

1. Perform the AC17 test on a vehicle that incorporates the air conditioning system with the credit-generating technologies.
2. 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.
3. Subtract the CO2 emissions determined from testing under section E.2.5.7.5.3.a from the CO2 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 CO2 emissions determined from testing under section E.2.5.7.5.3.a from the CO2 emissions determined from testing under section E.2.5.7.5.3.b and rounding to the nearest 0.1 grams/mile.
   * + - 1. 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:
4. 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;
5. 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
6. 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.
   * + - 1. 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.
     1. *Off-Cycle Credits.* Manufacturers may generate credits for CO2-reducing technologies where the CO2 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 CO2 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 CO2 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.
        1. *Credit available for certain off-cycle technologies*.
           1. The manufacturer may generate a CO2 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 |

1. 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 |

1. 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.
2. Glass or glazing credits are calculated using the following equation:

To calculate Credits, multiply Z times the sum of the quotients of Ti times Gi divided by G. 

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; |
| Gi | = | 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: |

Ti equals the difference of Tts base minus Tts new times 0.3987. 

Where:

|  |  |  |
| --- | --- | --- |
| Ttsnew | = | 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). |
| Ttsbase | = | 62 for the windshield, side-front, side-rear, rear-quarter, and backlite  locations, and 40 for rooflite locations. |

* + - * 1. The maximum allowable decrease in the manufacturer’s combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet average CO2 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 CO2 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 CO2 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.

1. 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:

To calculate Decrease, use the following formula.  The numerator equals Credits times 1,000,000.  The denominator contains two terms.  Add the first term. which is Prodc times 195,264 to the second term, which is Prodt 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. |
| ProdC | = | The number of passenger cars produced by the manufacturer  and delivered for sale in the U.S. |
| ProdT | = | The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in  the U.S. |

1. 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:

Calculate Credits (in megagrams) using this formula.  The numerator has two terms, which are added together.  The first term equals 10 times Prodc times 195,264.  The second term equals 10 times Prodt times 225,865.  The denominator equals 1,000,000. 

Where:

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

1. 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.
2. 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.
   * + - 1. 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.
       1. *Technology demonstration using EPA 5-cycle methodology.* To demonstrate an off-cycle technology and to determine a CO2 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.
          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.

* + - * 1. 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. 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.
        3. 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.
      1. *Review and approval process for off-cycle credits*.
         1. *Initial steps required*.

1. 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.
2. 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.
   * + - 1. *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:
3. A detailed description of the off-cycle technology and how it functions to reduce CO2 emissions under conditions not represented on the FTP and HWFET.
4. A list of the vehicle model(s) which will be equipped with the technology.
5. A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.
6. 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.
7. 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.
8. 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.
   * + - 1. R*eview of the off-cycle credit application*. Upon receipt of an application from a manufacturer, the Executive Officer will do the following:
9. Review the application for completeness and notify the manufacturer within 30 days if additional information is required.
10. Review the data and information provided in the application to determine if the application supports the level of credits estimated by the manufacturer.
    * + - 1. *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.
        1. *Calculation of total off-cycle credits.* Total off-cycle credits in grams per mile of CO2 (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. |

* + 1. *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.
       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.
          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% |

* + - * 1. 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.
      1. *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.
         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% |

* + - * 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 0.80 (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.

* + - 1. *Calculation of total full-size pickup truck credits*. Total credits in grams per mile of CO2 (rounded to the nearest whole gram per mile) shall be calculated for qualifying full-size pickup trucks according to the following formula:

Total Credits (in grams per mile) equal (10 times Production10) + (20 times Production20) 

Where:

Production10 equals 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.

Production20 equals 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.

* + 1. *Mid-Term Review of the 2022 through 2025 MY Standards.* The Executive Officer shall conduct a mid-term review to re-evaluate the state of vehicle technology to determine whether any adjustments to the stringency of the 2022 through 2025 model year standards are appropriate. California’s mid-term review will be coordinated with its planned full participation in EPA’s mid-term evaluation as set forth in 40 CFR §86.1818-12 (h).

# Greenhouse Gas Requirements for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.

Medium-duty vehicles other than MDPVs must meet the greenhouse gas requirements in section 1956.8, title 13, CCR and sections 95660 through 95664, title 17, CCR.

# Calculation of Credits/Debits

* 1. **Calculation of NMOG+NOx Credits/Debits**
     1. **Calculation of NMOG+NOx Credits and Debits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.**
        1. In 2015 through 2025 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).

* + - 1. In 2015 through 2025 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 through 2025 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, and for LDTs 3751 lbs. LVW to 8500 lbs. GVWR, and MDPVs 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.

# Calculation of NMOG+NOx Credits and Debits for Medium-Duty Vehicles Other than MDPVs.

A manufacturer that elects to comply with the phase-in requirements for LEV III medium- duty vehicles other than MDPVs in section E.2.3.1 or section E.2.3.2 shall calculate vehicle- equivalent NMOG+NOx credits in accordance with section E.3.1.2.1. A manufacturer that elects to comply with the alternative phase-in schedule for LEV III medium-duty vehicles other than MDPVs in section E.2.3.3 shall calculate fleet average NMOG+NOx credits in accordance with section E.3.1.2.2.

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

* + - * 1. In 2016 through 2025 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:

For ULEV200s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV200 standard minus the SULEV170 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV200 standard. 

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| --- |
| (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)]. |

* + - * 1. For LEV395s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "LEV395 standard minus the ULEV340 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the LEV395 standard.   For ULEV340s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV340 standard minus the ULEV250 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV340 standard. For ULEV250s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV250 standard minus the ULEV200 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV250 standard. The MDV HEV VEC factor is calculated as follows:

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| For LEV395s: |
| For ULEV340s: |
| For ULEV250s: |
| For ULEV200s: |

For SULEV170s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "SULEV170 standard minus the SULEV150 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the SULEV170 standard. For SULEV150s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "SULEV150 standard minus the ZEV standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the SULEV150 standard. For LEV630s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "LEV630 standard minus the ULEV570 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the LEV630 standard. For ULEV570s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV570 standard minus the ULEV400 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV570 standard. For ULEV400s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV400 standard minus the ULEV270 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV400 standard. 

|  |
| --- |
| For SULEV170s: |
| For SULEV150s: |
| For LEV630s: |
| For ULEV570s: |
| For ULEV400s: |
| For ULEV270s: |
| For SULEV230s: |
| For SULEV200s: |

For ULEV270s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "ULEV270 standard minus the SULEV230 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the ULEV270 standard. For SULEV230s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "SULEV230 standard minus the SULEV200 standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the SULEV230 standard.  For SULEV200s, the MDV HEV VEC factor equals 1 plus the quotient of a division formula, where the numerator equals the "SULEV200 standard minus the ZEV standard" with the difference multiplied by the "Zero-emission VMT Allowance", and the denominator equals the SULEV200 standard. 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 through 2025 Model Year 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.

* + - * 1. 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.

# Calculation of Fleet Average NMOG+NOx Credits and Debits for Medium-Duty Vehicles Other than MDPVs.

* + - * 1. In 2016 through 2025 model years, a manufacturer shall calculate its medium-duty vehicle fleet average 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)

* + - * 1. In 2016 through 2025 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 2016 through 2025 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 MDVs 8,501-10,000 lbs. GVWR excluding MDPVs, and for MDVs 10,001-14,000 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. Medium-duty fleet average credits and debits earned in accordance with section

E.3.1.2.2 may not be summed together with fleet average credits and debits earned for passenger cars, light-duty trucks, and medium-duty passenger vehicles in accordance with section E.3.1.1.

* + - 1. Only ZEVs certified as MDVs and not used to meet the ZEV requirement shall be included in the calculation of VECs or the calculation of NMOG+NOx credits and debits.
      2. 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.

# Procedure for Offsetting NMOG+NOx Debits.

* + - 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 or NMOG+NOx debits, as applicable, 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 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. 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 NMOG+NOx 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 section 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 to 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 or 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 MDVs 8,501-10,000 lbs. GVW and for MDVs 10,001 lbs. – 14,000 lbs. GVW applicable for the model year in which the debits were first incurred.

* + - 1. For the 2015 through 2025 model years, 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.
    1. **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.
    2. **Changing Vehicle-Equivalent Credits and Debits to NMOG+NOx Fleet Average Credits and Debits.** The value of any vehicle-equivalent credits and debits earned in accordance with section E.3.1.2.1 or title 13, CCR §1961(c)(2) shall be converted to NMOG+NOx fleet average credits and debits using the provisions in section E.3.1.2.2, for

each model year in which the credits or debits are accrued. For the purpose of applying the formula in section E.3.1.2.2.1, for credits and debits earned in accordance with title 13, CCR

§1961(c)(2), the Fleet Average NMOG+NOx Requirement is 0.364 g/mi for MDVs between 8,501-10,000 lbs. GVWR and 0.592 g/mi for MDVs between 10,001-14,000 lbs. GVWR. These credits and debits are subject to the provisions in section E.3.1.3 or title 13, CCR

§1961(c)(3), as applicable, based on the model year in which they are first earned as vehicle- equivalent credits or debits.

# 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.

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

* + - 1. A manufacturer that achieves fleet average CO2 values lower than the fleet average CO2 requirement for the corresponding model year shall receive credits for each model year in units of g/mi. A manufacturer that achieves fleet average CO2 values higher than the fleet average CO2 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:

CO2 Credits or Debits = (CO2 Standard - Manufacturer’s Fleet Average CO2 Value)

× (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

Where:

|  |  |  |
| --- | --- | --- |
| CO2 Standard | = | the applicable standard for the model year as determined in section E.2.5.1.3; |
| Manufacturer’s Fleet Average CO2 Value | = | average calculated according to section E.2.5.5; |

* + - 1. A manufacturer’s total Greenhouse Gas credits or debits generated in a model year shall be the sum of its CO2 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.
         1. Air conditioning leakage credits earned according to the provisions of section E.2.5.6;
         2. Air conditioning efficiency credits earned according to the provisions of section E.2.5.7;
         3. Off-cycle technology credits earned according to the provisions of section E.2.5.8;
         4. CO2-equivalent debits earned according to the provisions of section E.2.5.2.4.
    1. A manufacturer with 2017 and subsequent model year fleet average Greenhouse Gas values greater than the fleet average CO2 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.

# Procedure for Offsetting Greenhouse Gas Debits.

* + - 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.

* + - 1. 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.

# Use of Greenhouse Gas Emission Credits to Offset a Manufacturer’s ZEV Obligations*.*

* + - 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 2018 through 2025 Model Year 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.
      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.
    1. 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.

# 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 LEV III standards that are more stringent than the standards to which the test group was certified in a prior model year, except as noted in section E.4.3.2.

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

* + 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.

|  |  |  |
| --- | --- | --- |
|  | Durability | LEV III PCs, |
| Emission | Vehicle | LDTs, and MDPVs |
| Category | Basis | NMOG + NOx |
|  | (miles) | (g/mi) |
| LEV160 | 150,000 | n/a |
| ULEV125 | 150,000 | n/a |

|  |  |  |
| --- | --- | --- |
| Emission Category | Durability Vehicle Basis (miles) | LEV III PCs,  LDTs, and MDPVs |
| NMOG + NOx  (g/mi) |
| ULEV70 | 150,000 | 0.098 |
| ULEV50 | 150,000 | 0.070 |
| SULEV30 | 150,000 | 0.0421 |
| SULEV20 | 150,000 | 0.0281 |

1not applicable to test groups that receive PZEV credits

* + 1. **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.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | LEV III MDVs | LEV III MDVs |
|  | Durability | (excluding MDPVs) | 10,001 - 14,000 lbs. |
| Emission | Vehicle | 8,501 - 10,000 lbs. | GVW |
| Category | Basis | GVW |  |
|  | (miles) | NMOG + NOx | NMOG + NOx |
|  |  | (g/mi) | (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 |

# LEV III Particulate Interim In-Use Compliance Standards.

* + 1. **LEV III Particulate Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2017 through 2020 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.
    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.

# SFTP Interim In-Use Compliance Emission Standards.

* + 1. 2016 and prior model year light-duty and medium-duty passenger vehicle test groups that contain vehicles at or below 6,000 lbs. GVWR, 2017 and prior model year light-duty and medium-duty passenger vehicle test groups with only vehicles above 6,000 lbs. GVWR, and 2019 and prior model year medium-duty vehicle test groups may use an in- use compliance standard for NMOG+NOx for the first two model years that they are certified to LEV III NMOG+NOx standards or a LEV III SFTP NMOG+NOx bin.
       1. 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.
       2. 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.
       3. 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.
    2. 2023 and prior model year light-duty and medium-duty passenger vehicle test groups that certify to a LEV III SFTP PM exhaust emission standard in section E.1.2.2.2 may use an in-use compliance standard for SFTP PM regardless of the model year that the test groups first certified to that LEV III SFTP PM standard. 2022 and prior model year medium-duty vehicle test groups may use an in-use compliance standard for PM for the first two model years that they are certified to a LEV III SFTP PM exhaust emission standard in section E.1.2.2.4.
       1. 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 10 mg/mi.
       2. 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.

# LEV III Greenhouse Gas In-Use Compliance Standards.

The in-use exhaust CO2 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.

# 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.

# Requirements and Procedures for Durability Demonstration

# §86.1820 Durability group determination.

* + 1. §86.1820-01. October 25, 2016. [No change.]

# §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 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles,” and “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”)]

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

# §86.1823 Durability demonstration procedures for exhaust emissions.

* + 1. §86.1823-01. February 26, 2007.
    2. §86.1823-08. October 25, 2016. [No change, except that subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program and to the HD GHG Phase 2 regulations.]
    3. **SFTP**. These procedures are not applicable to vehicles certified to the SFTP standards set forth in section E.1.2.1.
    4. **HEVs**. A manufacturer shall consider expected customer usage as well as emissions deterioration when developing its durability demonstration for HEVs.
    5. Separate deterioration factors must be calculated and reported for NMOG emissions and for NOx emissions for each durability group.

# §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 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.”)]

# §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.”)]

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

* + 1. §86.1826-01. April 28, 2014. [No change.]

# Procedures for Demonstration of Compliance with Emission Standards

# §86.1827 Test Group Determination.

* + 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.]

# §86.1828 Emission data vehicle selection

* + 1. §86.1828-01. . Amend as follows:
       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.

# 50oF Requirements.

* + - 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. 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 50oF 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.2.2.1), the Executive Officer shall select the test groups subject to 50oF 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.

# LEV III PM Requirements.

* + - 1. Vehicle Selection. A manufacturer shall select emission data and/or engineering development vehicles each year from PC or LDT test groups and separate emission data and/or engineering development vehicles from MDV test groups according to the requirements in section G.3.6. Within each test group, the vehicle configuration shall be selected which is expected to be worst-case for FTP PM exhaust emission compliance on candidate in-use vehicles.
      2. The same test group shall not be selected in the succeeding two years unless the manufacturer produces fewer than four test groups that are certified to LEV III PM standards in section E.1.1.2.1. If the manufacturer produces more than four test groups that

are certified to LEV III PM standards per model year, the Executive Officer may request LEV III PM testing of specific test groups. If the manufacturer provides a list of the test groups that it will certify to LEV III PM standards 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 LEV III PM 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.

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

* + 1. §86.1829-01. April 28, 2014. Amend as follows:
       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.
       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. (b)(1)(iii)(G) [n/a]
       4. Delete (b)(5). Idle CO Testing.
    2. §86.1829-15. February 19, 2015. Amend as follows:
       1. Subparagraph (a) through (b) [No change.]
       2. Subparagraph (c) Add the following: 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.

* + - 1. Subparagraph (d) [Delete; see G.3.6 below, except as follows.]
         1. Subparagraph (d)(4) [No change.]
      2. Subparagraph (e) [Delete. (The provisions of this section that pertain to evaporative testing are contained the “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium- Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.” The provisions of this section that pertain to refueling testing are contained the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”)]
      3. Subparagraph (f) [No change.]

# 50oF Requirements.

A manufacturer shall demonstrate compliance with the 50oF requirement each year by testing at least three PC or LDT and three MDV emission data and/or engineering development vehicles (with at least 4000 miles) as determined under the provisions of section G.2.2 of these test procedures. It is not necessary to apply deterioration factors (DFs) to the 50oF test results to comply with this requirement.

# 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 or 40 CFR §1066.840, as modified in Part II of these test procedures with the migration provisions of §600.111-08 introduction). 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 emission 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.

# 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.

# LEV III PM Testing Requirements.

For the 2017 through 2025 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.3.6 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 |

# §86.1830 Acceptance of Vehicles for Testing.

* + 1. §86.1830-01. January 17, 2006. [No change.]

# §86.1831 Mileage accumulation requirements for test vehicles.

* + 1. §86.1831-01. January 17, 2006. [No change.]

# §86.1832-01 Optional equipment and air conditioning. [No change.]

# §86.1833-01 Adjustable parameters. [No change.]

# §86.1834 Allowable maintenance.

* + 1. §86.1834-01. August 8, 2014. [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.]

# 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.

# §86.1835 Confirmatory certification testing.

* + 1. §86.1835-01. May 7, 2010. [No change.]

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

# §86.1837 Rounding of emission measurements.

* + 1. §86.1837-01. April 28, 2014. [No change.]
    2. Fleet average NMOG+NOx value calculations shall be rounded, in accordance with 40 CFR 1065.20 (April 28, 2014), to four significant figures before comparing with fleet average NMOG+NOx requirements.

# §86.1838 Small volume manufacturers certification procedures.

* + 1. §86.1838-01. June 29, 2021. [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.]

# §86.1839 Carryover of certification data.

* + 1. §86.1839-01. January 17, 2006. [No change.]

# §86.1840 Special test procedures.

* + 1. §86.1840-01. June 8, 2012. [No change.]

# Certification, Information and Reporting Requirements.

# §86.1841 Compliance with emission standards for the purpose of certification

* + 1. §86.1841-01. July 6, 2011. [No Change.]
       1. For vehicles operating on natural gas, the methane mass emission value shall be multiplied by 0.0047 (the methane reactivity adjustment factor) and added to the NMOG mass emission value and the NOx mass emission value. This result shall be compared to the NMOG+NOx exhaust emission standards to determine compliance with the standards.
    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. **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.
    2. **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, and in Table 2 of 40 CFR §86.1811.17(b), as adopted April 28, 2014. A California vehicle model is to be treated as equivalent to a federal vehicle model if all of the following characteristics are identical. A federal vehicle shall not qualify as an alternative to a LEV III vehicle.

1. Vehicle make and model;
2. Cylinder block configuration (e.g., L-6, V-8);
3. Displacement;
4. Combustion cycle;
5. Transmission class;
6. Aspiration method (e.g., naturally aspirated, turbocharged); and
7. 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. Except as noted in H.1.4.1.1 and H.1.4.1.2, 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, 50oF exhaust emissions, highway NMOG+NOx emissions, greenhouse gas emissions, and emissions warranty.
         1. A vehicle certified to federal Tier II emission Bin 3, Bin 4, or Bin 8 or to federal Tier III emission Bin 85 or Bin 110 is not required to meet California 50oF exhaust emissions requirements.
         2. If a federally-certified vehicle model is certified in California in accordance with subparagraph 1.4 based on a comparison of the sum of the 120,000 mile federal standards to the sum of the 120,000 mile LEV II NMOG and NOx standards, that federally-certified vehicle model shall be subject to the federal requirements for highway NOx and is not required to meet California highway NMOG+NOx emissions requirements.
      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 1.4.
      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:

1. 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 50oF exhaust emissions, California OBD II requirements, California highway NMOG+NOx emissions, and California greenhouse gas requirements.
2. 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. 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. 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.
      2. 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+NOx purposes.
      3. 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.

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

* + 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.

# §86.1843 General information requirements

* + 1. §86.1843-01. April 28, 2014. [No change.]

# Alternative Fuel Information.

For passenger cars, light-duty trucks, and medium-duty vehicles that use hydrogen fuel, the manufacturer shall submit fuel economy data, vehicle fuel pressure rating, fuel tank capacity, vehicle type, vehicle range, vehicle name, and number of vehicles projected to be delivered to each county, thirty-three months prior to January 1 of the model year for which the vehicles are certified.

For battery electric vehicles and grid-connected hybrid electric vehicles, the manufacturer shall submit projected California sales and leases, vehicle name, fuel economy data (kW per 100 miles), battery energy capacity (kWh), onboard charger rating (kW), and presence of Direct Current (DC) fast charge port, thirty-three months prior to January 1 of the model year for which the vehicles are certified.

# 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.

# 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.

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

* + 1. §86.1844-01. October 25, 2016. Amend as follows:
       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.
       2. Modify §86.1844-01(d) as follows:

1. Modify §86.1844-01 (d)(7)(i) as follows: For vehicles certified to any LEV III emission standards, include a comparison of drive-cycle metrics as specified in 40 CFR 1066.425(j) for each drive cycle or test phase, as appropriate.
2. Delete §86.1844-01(d)(9).
3. §86.1844-01(d)(11)(iii). Delete; Replace with: For 2017 and subsequent model vehicles with spark-ignition engines, describe how AECDs are designed to comply with the requirements of section D.2.7. Identify which components need protection through enrichment strategies; describe the temperature limitations for those components; and describe how the enrichment strategy corresponds to those temperature limitations.
4. 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.
   * + 1. Add the following requirements to §86.1844-01(e):
5. The information required in sections 2037, 2038 and 2039, title 13, CCR.
6. The NMOG/NMHC and/or formaldehyde to NMHC ratios established according to section I.1.2 of these test procedures.
   * + 1. Delete §86.1844-01(e)(7).

# 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.

# 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 through 2025 Model Year 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.

# Fuel-Fired Heaters.

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

1. 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;
2. the exhaust emissions value per mile produced by the auxiliary fuel-fired heater operated between 68oF and 86oF; and
3. the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

# Greenhouse Gas Reporting Requirements.

1. 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:
   1. all data in accordance with the reporting requirements as required under 40 CFR §86.1865-12; and
   2. 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).
2. 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.

# In-Use Compliance Requirements and Procedures

# §86.1845 Manufacturer in-use verification testing requirements.

* + 1. §86.1845-04. October 25, 2016. Amend as follows:

# Table S04-06 – California Small Volume Manufacturers and Small Volume Test Groups

|  |  |  |
| --- | --- | --- |
| California only test group annual sales1 | 1-1,500 | 1,501-4,500 |
| Low Mileage | Voluntary | 0 |
| High Mileage | Voluntary | 22 |

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 S04-07 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 to demonstrate compliance with the applicable FTP standard. The same vehicle must also be tested to demonstrate compliance with the LEV III SFTP particulate standard in section E.1.2.2.2 or E.1.2.2.4, as applicable.

# Table S04-07 – California Large Volume Manufacturers

|  |  |  |  |
| --- | --- | --- | --- |
| California only test groups - annual sales | 4,500-  15,000 | 15,001-  25,000 | >25,000 |
| Low Mileage | 21 | 32 | 42 |
| High Mileage | 42 | 53 | 63 |

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 to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance with the LEV III SFTP particulate standard in section E.1.2.2.2 or E.1.2.2.4, as applicable.

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 to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance with the LEV III SFTP particulate standard in section E.1.2.2.2 or E.1.2.2.4, as applicable.

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 to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance with the LEV III SFTP particulate standard in section E.1.2.2.2 or E.1.2.2.4, as applicable.

* + - 1. **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 odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. At least one vehicle of each test group certified to the emission standards in Part I, section E.1.1.2 of these test procedures must

have a minimum odometer mileage of 105,000 miles or 75 percent of full useful life mileage. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

* + - 1. **High Altitude Testing.** Amend subparagraph (c)(5)(i) of 40 CFR §86.1845- 04 by adding the following sentence: High altitude testing shall not apply at 50oF.

# Test Ratios.

1. 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.

1. 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.

1. 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.

# §86.1846 Manufacturer in-use confirmatory testing requirements.

* + 1. §86.1846-01. October 25, 2016. [No Change.]
    2. If a gasoline vehicle test group that is certified according to the provisions of section D.1.10 and/or D.2.7.5 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.3 for the purpose of in-use confirmatory testing.

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

* + 1. §86.1847-01. Amend as follows:
       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.
       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. 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 Subpart S [No change.]

# Procedural Requirements

* 1. §86.1848-10 Compliance with emission standards for the purpose of certification. October 25, 2016. Amend as follows:
     1. Amend (c)(5) as follows: The manufacturer must meet the in-use testing and reporting requirements contained in §§86.1845-04, 86.1846-01, and 86.1847-01, as applicable. Failure to meet the in-use testing or reporting requirements shall be considered a failure to satisfy a condition upon which the certificate was issued. A vehicle or truck is considered to be covered by the certificate only if the manufacturer fulfills this condition upon which the certificate was issued.
  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. §86.1853-01 Certification hearings. October 25, 2016. [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. §86.1860-17 How to comply with the Tier 3 fleet average standards. [n/a]
  11. §86.1861-04 How do the Tier 2 and interim Tier 2 NOx averaging, banking and trading programs work? [n/a]
  12. §86.1861-17 How do the NMOG+NOx and evaporative emission credit programs work? [n/a]
  13. §86.1862-04 Maintenance of records and submittal of information relevant to compliance with fleet average NOx standards. [n/a]
  14. §86.1863-07 Optional Chassis Certification for Diesel Vehicles. [n/a]
  15. §86.1865-12 How to comply with the fleet average CO2 standards. October 25, 2016. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program, the 2017 through 2025 MY National greenhouse gas program, and the HD GHG Phase 2 regulations.]
  16. §86.1866-12 CO2 fleet average credit programs. October 25, 2016. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program, and the 2017 through 2025 MY National greenhouse gas program.]
  17. §86.1867-12 Optional early CO2 credit programs. October 25, 2016. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program, the 2017 through 2025 MY National greenhouse gas program, and the HD GHG Phase 2 regulations.]
  18. §86.1868-12 CO2 credits for improving the efficiency of air conditioning systems. October 25, 2016. [No change, except that this section shall only apply to vehicles

certifying under the 2012 through 2016 MY National greenhouse gas program or the 2017 through 2025 MY National greenhouse gas program.]

* 1. §86.1869-12 CO2 credits for off-cycle CO2-reducing technologies. October 25, 2016. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program, the 2017 through 2025 MY National greenhouse gas program, and the HD GHG Phase 2 regulations.]
  2. §86.1870-12 CO2 credits for qualifying full-size light pickup trucks. October 25, 2016. [No change, except that this section shall only apply to vehicles certifying under the 2017 through 2025 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 and 40 CFR Part 1066); cold temperature test procedures (40 CFR Part 86, Subpart C); the California 50oF test procedure; and the supplemental federal test procedure (40 CFR Part 86, Subpart B and 40 CFR Part 1066) on passenger cars, light-duty trucks and medium-duty vehicles.

# 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.

# General applicability.

* 1. **General applicability.** February 19, 2015. No change except as follows.

For 2017 and subsequent model passenger cars, light-duty trucks, and medium-duty vehicles, Part II Subpart A may not be used to demonstrate compliance with the LEV III particulate standards in section E.1.1.2.1. 100 percent of 2017 and subsequent model passenger cars, light-duty trucks, and medium-duty vehicles certifying to the LEV III particulate standards in section E.1.1.2.1 must be tested using the equipment specifications and measurement procedures that are specific to PM emissions in Part II, Subpart C of these test procedures to demonstrate compliance with the applicable particulate emission standards.

References to Tier 3 emission standards in subsection (b)(2) shall mean LEV III emission standards.

Part II, Subpart A may not be used for 2022 and subsequent model passenger cars, light-duty trucks, and medium-duty vehicles to demonstrate compliance with applicable emission standards.

* 1. Definitions. April 28, 2014.
  2. Abbreviations. March 5, 1980.
  3. Section numbering, construction. September 21, 1994.
  4. Introduction; structure of subpart. September 21, 1994.

# Equipment and Facility Requirements.

|  |  |
| --- | --- |
| 86.106-96 | Equipment required; overview. April 28, 2014. |
| 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. April 28, 2014. |
| 86.111-94 | Exhaust gas analytical system. April 28, 2014. |
| 86.112-91 | Weighing chamber (or room) and microgram balance specifications. |
|  | June 5, 1991. |

# Certification Fuel Specifications.

|  |  |  |
| --- | --- | --- |
| 86.113-94 | Fuel Specifications. | April 28, 2014. |
| 86.113-04 | Fuel Specifications. | June 29, 2021. |
| 86.113-15 | Fuel Specifications. | April 28, 2014. |

* + 1. **California Certification Gasoline Specification.**
       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 or gasoline having the specifications in 40 CFR §1065.710(b) (June 29, 2021) 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. If a manufacturer elects to utilize gasoline having the specifications in 40 CFR

§1065.710(b) (June 29, 2021), exhaust emission testing shall be conducted by the manufacturer with gasoline having the specifications in 40 CFR §1065.710(b) (June 29, 2021), and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications in section 40 CFR §1065.710(b) (June 29, 2021). Use of these fuels for evaporative emission testing shall be required as specified in the “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.”

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| **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 oF |  |
| 50% point (d) | 200-210 oF |  |
| 90% point (e) | 290-300 oF |  |
| EP, maximum | 390 oF |  |

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| **California Certification Gasoline Specifications for LEV II Light-Duty Vehicles and Medium-Duty Vehicles** | | |
| **Fuel Property(a)** | **Limit** | **Test Method (b)** |
| 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 195-215o F.

(e) The range for interlaboratory testing is 285-305o 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.

* + - 1. 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 may be used in exhaust emission testing, as an option to the specifications set forth in 40 CFR §1065.710(b) (June 29, 2021). If a

manufacturer elects to utilize gasoline having the specifications listed below, 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 set forth in 40 CFR

§1065.710(b) (June 29, 2021), the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications set forth in 40 CFR §1065.710(b) (June 29, 2021). Use of these fuels for evaporative emission testing shall be required as specified in the “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.”

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| **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 oF |  |
| 50% point | 205-215 oF |  |
| 90% point | 310-320 oF |  |
| EP, maximum | 390 oF |  |
| 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 | 9.2-10.0 vol. % | §2263, title 13 CCR |
| 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 |

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| **California Certification Gasoline Specifications for LEV III Light-Duty Vehicles and Medium-Duty Vehicles** | | |
| **Fuel Property(a)** | **Limit** | **Test Method (b)** |
| 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.

# Certification Diesel Fuel Specifications.

* + - 1. Certification Diesel Fuel Specifications for the 2015 through 2025 Model Years.

Amend subparagraphs §86.113-94(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 §86.113-94 (b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as “Type 2-D” grade diesel, shall be used. The petroleum fuel used in exhaust emission testing may meet the specifications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in 40 CFR §86.113-94 (b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of §86.113-94 (b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

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| **California Certification Diesel Fuel Specifications For the 2015 through 2025 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 oF |  |
| 10% point | 400-490 oF |  |
| 50% point | 470-560 oF |  |
| 90% point | 550-610 oF |  |
| EP | 580-660 oF |  |
| API Gravity | 33-39o | 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 oF (max) | D 93-80 |
| Viscosity @ 40oF | 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.

# 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:

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| --- | --- |
| **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).

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

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

* + - 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.: E-85 that meets the specifications in 40 CFR §1065.725 (December 4, 2020) may be used in exhaust and evaporative emission testing as an option to the E-85 Fuel Ethanol specifications in this subparagraph. If a manufacturer elects to utilize E-85 Fuel Ethanol having the specifications listed below, the Executive Officer shall conduct exhaust emission testing with E-85 Fuel Ethanol having the specifications listed below. If a manufacturer elects to utilize E-85 Fuel Ethanol having the specifications set forth in 40 CFR §1065.725 (December 4, 2020), the Executive Officer shall conduct exhaust emission testing with E-85 Fuel Ethanol having the specifications set forth in 40 CFR §1065.725 (December 4, 2020).

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| --- | --- |
| **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. |

* + - 1. **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.

* + - 1. **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. A manufacturer may alternatively demonstrate compliance with the applicable evaporative emission standards using gasoline test fuel meeting the specifications set forth in 40 CFR §1065.710(b) (June 29, 2021) if the manufacturer also uses the evaporative emission test procedures set forth in 40 CFR

§§86.107-96 through 86.143-96 in place of the test procedures set forth in the “California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles.” 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. For refueling testing, the test fuel shall be the fuel specified in the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

* + - 1. **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.

# 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 |
| C3 and higher hydrocarbon content | 2.0 ± 0.3 mole percent |
| Oxygen | 0.5 mole percent maximum |
| Inert gases (CO2 + N2) | 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).

# 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).

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

# §86.113-94(g). [No Change.]

* + 1. **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 40 CFR §86.113-94, §86.113-04, §86.113-15, or §1065.710 (June 29, 2021), 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 considers adopting specifications for a new clean fuel for certification testing, it shall also consider under section 2137(b) establishing by regulation specifications for the fuel as it is sold commercially to the public.

1. 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.
2. 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.

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| 86.114-94 | Analytical gases. June 30, 1995. |
| 86.115-78 | EPA urban dynamometer driving schedules. April 28, 2014. |
| **100.4** | **Calibration methods and frequency.** |
| 86.116-94 | Calibrations, frequency and overview. June 30, 1995. |
| 86.117-96 | Evaporative emission enclosure calibrations. April 28, 2014. |
| 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 |
| 86.121-90 | formaldehyde measurement. June 30, 1995.  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. |

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| **100.5** | **Test Procedures and Data Requirements.** |
| 86.127-12 | Test procedures; overview. May 7, 2010. |
| 86.128-79 | Transmissions. April 28, 2014. |
| 86.129-00 | Road load power, test weight, inertia weight class determination, and fuel  temperature profile. June 29, 2021. |

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

* + - 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.
   1. 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)(V2 )/(32.2ft/s2 ))+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/s2 | = | gravitational acceleration |
| P | = | protuberance power (horsepower) |

* 1. The protuberance power, P shall be determined per subparagraph 86.129-80(c)(2)(i).
  2. The dynamometer power absorber setting for medium-duty vehicles shall be rounded to the nearest 0.1 horsepower.

1. 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.
2. 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.

86.130-96 Test sequence; general requirements. June 29, 2021.

# California test sequence; general requirements.

* + - 1. Delete subparagraph (a) of §86.130-96 and replace with:

For purposes of determining conformity with 50oF test requirements, the procedures set forth in Part II, Section D. For all hybrid electric vehicles and all 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 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 and Subsequent Model Year Motorcycles” as incorporated by reference in section 1976, title 13, CCR shall apply.

* + - 1. 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. If a manufacturer desires to conduct an alternative SC03 test simulation, the simulation test procedure must be approved in advance by the Executive Officer (see paragraph 86.162-03).

* + - 1. Greenhouse Gas Requirements.

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

86.131-96 Vehicle preparation. April 28, 2014.

86.132-00 Vehicle preconditioning. November 25, 2009.

# California Vehicle Preconditioning Requirements.

* + - 1. Add the following subparagraph: For all hybrid electric vehicles and all 2015 through 2025 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 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001and Subsequent Model Year Motorcycles” shall apply. In

addition, the preconditioning sequence for the SFTP described in subparagraphs (n) and (o) of paragraph 86.132-00 shall apply.

* + - 1. 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 68oF – 86oF, without additional preconditioning required.

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| 86.133-96 | Diurnal breathing loss test. April 28, 2014. |
| 86.134-96 | Running loss test. April 28, 2014. |
| 86.135-12 | Dynamometer procedure. October 15, 2012. [No change.] |
| 86.136-90 | Engine starting and restarting. September 21, 1994. |
| 86.137-94 | Dynamometer test run, gaseous and particulate emissions. April 28, 2014. |
| 86.138-96 | Hot soak test. April 30, 2010. |
| 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. April 28, 2014. |
| 86.143-96 | Calculations; evaporative emissions. October 25, 2016. |
| 86.144-94 | Calculations; exhaust emissions. September 15, 2011. |

# Calculations; exhaust emissions.

* + - 1. The exhaust emission calculations for California are set forth in the “California Non-Methane Organic Gas Test Procedures for 1993 through 2016 Model Year Vehicles” or the “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles,” as applicable.
      2. Add the following calculation:

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

OMNMHCEmass = NMHCmass + (13.8756/32.042) x (CH3OH)mass + (13.8756/23.035) x (CH3CH2OH)mass + (13.8756/30.0262) x (HCHO)mass + (13.8756/22.027) x (CH3CHO)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. November 25, 2009.

# California exhaust emission test procedures for Supplemental Federal Test Procedures.

This section applies to passenger cars, light-duty trucks, and medium-duty vehicles fueled by gasoline, diesel, methanol, ethanol, natural gas and liquefied petroleum gas fuels.

This section also applies to hybrid electric vehicles. The procedures of this subpart apply to both certification and in-use vehicles unless otherwise indicated. For model year 2015 and 2016 vehicles, a manufacturer may use either the exhaust emission test procedures in this section or the exhaust emission test procedures set forth in 40 CFR §1066.831 for the US06, US06 Bag 2, and Hot 1435 LA92 test cycles. For 2017 through 2025 model years, these vehicles shall be subject to the exhaust emission test procedures in 40 CFR

§1066.831 for US06, US06 Bag 2, and Hot 1435 LA92 test cycles.

# US06 Test Procedure

Amend §86.159-08 as follows:

* + - * 1. 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.
        2. Delete subparagraph (b)(9) of §86.159-08 and replace with:

During dynamometer operation, a fixed speed cooling fan with a maximum discharge velocity of 15,000 cubic feet per minute 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.

# 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.

* + - * 1. Amend 40 CFR 86.159-08 as follows:

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.

Paragraph (b)

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

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

During dynamometer operation, a fixed speed cooling fan with a maximum discharge velocity of 15,000 cubic feet per minute 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.

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

# 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:

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

The dynamometer operation consists of a single, 365 second test starting as shown in Part II, Section G. 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.

Paragraph (b)

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

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

During dynamometer operation, a fixed speed cooling fan with a maximum discharge velocity of 15,000 cubic feet per minute 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.

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

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| 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. |
| 86.162-03 | 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. November 25, 2009. |
| 86.165-12 | Air Conditioning idle test procedure. October 15, 2012. [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.] |

# 40 CFR Part 86, 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 General applicability. February 19, 2015.

# California applicability.

No change to §86.201, except as follows.

Amend subparagraph 86.201(a) as follows: This subpart describes procedures for determining the cold temperature carbon monoxide (CO) emissions from 2015 through 2021 model year new passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas, diesel-fueled, and zero-emission vehicles).

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| 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.

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| 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 | Fuel specifications. June 29, 2021. |
| 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. |

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| 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 –Dynamometer Schedules. October 25, 2016.

# 40 CFR Part 1066 – Vehicle-Testing Procedures.

The Certification Fuel Specifications in Part II, Subpart A, section 100.3 shall apply to vehicles tested using Part II, Subpart C.

# Subpart A – Applicability and General Provisions.

1066.1 Applicability. June 29, 2021. Amend as follows: Delete §1066.1(a) and replace it with the following:

All 2022 and subsequent model passenger cars, light-duty trucks, and medium-duty vehicles must be tested in accordance with Part II, Subpart C to demonstrate compliance with all applicable emission standards.

In the 2017 and subsequent model years, a manufacturer must test 100 percent of its passenger cars, light-duty trucks, and medium-duty vehicles certifying to the LEV III particulate standards in section E.1.1.2.1 using the equipment specifications and measurement procedures that are specific to PM emissions in Part II, Subpart C of these test procedures to demonstrate compliance with the applicable particulate emission standards.

Except as noted above, for the 2015 through 2021 model years, a manufacturer may test LEV III passenger cars, light-duty trucks, and medium-duty vehicles and LEV II passenger cars, light-duty trucks, and medium-duty vehicles certifying to the exhaust standards in section E.1.1.1 using either Part II, Subpart A or Part II, Subpart C of these test procedures to demonstrate compliance with applicable emission standards.

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| 1066.2 | Submitting information to EPA under this part. April 28, 2014. |
| 1066.5 | Overview of this part 1066 and its relationship to the standard-setting part. |
|  | April 28, 2014. |
| 1066.10 | Other procedures. February 19, 2015. |
| 1066.15 | Overview of test procedures. April 28, 2014. |
| 1066.20 | Units of measure and overview of calculations. April 28, 2014. |
| 1066.25 | Recordkeeping. April 28, 2014. |

# Subpart B – Equipment, Measurement Instruments, Fuel, and Analytical Gas Specifications.

|  |  |
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| 1066.101 | Overview. April 28, 2014. |
| 1066.105 | Ambient controls and vehicle cooling fans. October 25, 2016. |
| 1066.110 | Equipment specifications for emission sampling systems. October 25, 2016. |
| 1066.120 | Measurement instruments. April 28, 2014. |
| 1066.125 | Data updating, recording, and control. February 19, 2015. |
| 1066.130 | Measurement instrument calibrations and verifications. April 28, 2014 |
| 1066.135 | Linearity verification. June 29, 2021. |
| 1066.140 | Diluted exhaust flow calibration. October 25, 2016. |
| 1066.145 | Engine fluids, test fuels, analytical gases, and other calibration standards. |
|  | April 28, 2014. Amend as follows: |
| 2.1 | Delete subparagraph (a) and replace with: |
|  | **California Test Fuel**. Use test fuel as specified in Part II, section A.100.3. |

2.2 Subparagraphs (b) through (e). [No change.]

1066.150 Analyzer interference and quench verification limit. April 28, 2014.

# Subpart C – Dynamometer Specifications.

|  |  |
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| 1066.201 | Dynamometer Overview. April 28, 2014. |
| 1066.210 | Dynamometers. June 29, 2021. |
| 1066.215 | Summary of verification and calibration procedures for chassis |
|  | dynamometers. April 28, 2014. |
| 1066.220 | Linearity verification for chassis dynamometer systems. April 28, 2014. |
| 1066.225 | Roll runout and diameter verification procedure. April 28, 2014. |
| 1066.230 | Time verification procedure. April 28, 2014. |
| 1066.235 | Speed verification procedure. October 25, 2016. |
| 1066.240 | Torque transducer calibration. April 28, 2014. |
| 1066.245 | Response time verification. October 25, 2016. |
| 1066.250 | Base inertia verification. October 25, 2016. |
| 1066.255 | Parasitic loss verification. June 29, 2021. |
| 1066.260 | Parasitic friction compensation evaluation. June 29, 2021. |
| 1066.265 | Acceleration and deceleration verification. June 29, 2021. |
| 1066.270 | Unloaded coastdown verification. June 29, 2021. |
| 1066.275 | Daily dynamometer readiness verification. June 29, 2021. |
| 1066.290 | Driver’s aid. April 28, 2014. |

# Subpart D – Coastdown.

|  |  |
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| 1066.301 | Overview of road-load determination procedures. October 25, 2016. |
| 1066.305 | Procedures for specifying road-load forces for motor vehicles at or below |
|  | 14,000 pounds GVWR. October 25, 2016. |
| 1066.310 | Coastdown procedures for motor vehicles above 14,000 pounds GVWR. |
|  | October 25, 2016. |
| 1066.315 | Dynamometer road-load setting. April 28, 2014. |

# Subpart E – Preparing Vehicles and Running an Exhaust Emission Test.

|  |  |
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| 1066.401 | Overview. April 28, 2014. |
| 1066.405 | Vehicle preparation and preconditioning. April 28, 2014. |
| 1066.410 | Dynamometer test procedure. October 25, 2016. |
| 1066.415 | Vehicle operation. October 25, 2016. |
| 1066.420 | Test preparation. June 29, 2021. |
| 1066.425 | Performing emission tests. October 25, 2016. |

# Subpart F – Hybrids and Electric Vehicles.

[n/a; All zero-emission vehicles and hybrid electric vehicles must demonstrate compliance with all applicable exhaust emission standards 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 through 2025 Model Year Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” as applicable.]

# Subpart G – Calculations.

|  |  |
| --- | --- |
| 1066.601 | Overview. April 28, 2014. |
| 1066.605 | Mass-based and molar-based exhaust emission calculations. June 29, 2021 . |
| 1066.610 | Dilution air background correction. April 28, 2014. |
| 1066.615 | NOx intake-air humidity correction. October 25, 2016. |
| 1066.620 | Removed water correction. April 28, 2014. |
| 1066.625 | Flow meter calibration calculations. October 25, 2016. |
| 1066.630 | PDP, SSV, and CFV flow rate calculations. October 25, 2016. |
| 1066.635 | NMOG determination. October 25, 2016. [n/a] |
|  | California NMOG Determination. The provisions of section D.3 shall apply. |

A manufacturer may use the conversion factors in sections D.1.10 and D.2.7.5 as alternatives to those set forth in this section §1066.635.

1066.695 Data requirements. October 25, 2016.

# Subpart H – Cold-Temperature Test Procedures.

1066.701 Applicability and general provisions. February 19, 2015.

1066.710 Cold temperature testing procedures for measuring CO and NMHC emissions and determining fuel economy. June 29, 2021.

# Subpart I – Exhaust Emission Test Procedures for Motor Vehicles.

|  |  |
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| 1066.801 | Applicability and general provisions. June 29, 2021. |
| 1066.805 | Road load power, test weight, and inertia weight class determination. October |
|  | 25, 2016. |
| 1066.810 | Vehicle preparation. April 28, 2014. |
| 1066.815 | Exhaust emission test procedures for FTP testing. October 25, 2016. |
| 1066.816 | Vehicle preconditioning for FTP testing. April 28, 2014. |
| 1066.820 | Composite calculations for FTP exhaust emissions. October 25, 2016. |
| 1066.830 | Supplementary Federal Test Procedures; overview. April 28, 2014. |
| 1066.831 | Exhaust emission test procedures for aggressive driving. February 19, 2015.  Amend §1066.831 as follows: |

* + 1. Replace all references to “US06 Highway” with “US06 Bag 2.” Where

§1066.831 references another section of 40 CFR part 1066, replace all mentions of “US06 Highway” with “US06 Bag 2” in referenced sections.

* + 1. Replace all references to “Hot LA-92” with “Hot 1435 Unified Cycle.” The cycle herein referred to as “Hot 1435 Unified cycle” consists of a single test

starting from second 0 and ending at second 1435 in the driving schedule shown in Part II, Section H.

1066.835 Exhaust emission test procedures for SC03 emissions. June 29, 2021.

1066.840 Highway fuel economy test procedure. April 28, 2014.

1066.845 AC17 Air conditioning efficiency test procedure. February 19, 2015.

# Subpart K – Definitions and Other Reference Material.

1066.1001 Definitions. February 19, 2015.

1066.1005 Symbols, abbreviations, acronyms, and units of measure. June 29, 2021 .

1066.1010 Incorporation by reference. October 25, 2016.

# 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 50oF with the following modifications:

# Test Procedure.

* 1. The test vehicles shall not be subject to a diurnal heat build prior to the cold start exhaust test or evaporative emission testing.
  2. Following a 12 to 36 hour cold soak at a nominal temperature of 50oF, the nominal preconditioning, soak, and test temperatures shall be maintained within 3oF of the nominal temperature on an average basis and within 5oF 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.
  3. The test site temperature shall be measured at the inlet of the vehicle cooling fan used for testing.
  4. The test vehicle may be fueled before the preconditioning procedure in a fueling area maintained within a temperature range of 68 to 86oF. The requirement to saturate the evaporative control canister(s) shall not apply.
  5. 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 86oF during a time interval not to exceed 10 minutes. In such cases, the vehicle shall be restabilized to 50oF by soaking the vehicle in the nominal 50oF test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.
  6. The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.

# Unified Cycle Driving Schedule.

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# Unified Test Cycle

**(Speed vs Time Sequence)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 |

As Amended: August 25, 2022

II-25

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 |  |  |

# Highway Driving Schedule.

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# Highway Test Cycle

**(Speed vs Time Sequence)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 |  |  |

# 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 |

# Hot 1435 Unified Cycle Driving Schedule.

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**Hot 1435 Unified Test Cycle (Speed vs Time Sequence)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed | Time | Speed |
| (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (mph) | (sec.) | (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 |  |  |