

California Environmental Protection Agency
AIR RESOURCES BOARD

Final

CALIFORNIA 2026 AND SUBSEQUENT MODEL YEAR CRITERIA POLLUTANT
EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER
CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted: August 25, 2022

[Note: The entire text of these test procedures set forth below is new language in "normal type" final text to be incorporated by reference in title 13, California Code of Regulations.]

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NOTE: This document is incorporated by reference in title 13, California Code of Regulations (CCR), sections 1961.4(c). 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 CARB 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 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 Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in title 13, CCR, section 1961.2(d));
2. "California Test Procedures for 2026 and Subsequent Model Year Zero-Emission Vehicles and Plug-in Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in title 13, CCR, section 1962.4);
3. "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles" (incorporated by reference in title 13, CCR, section 1976(c));
4. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in title 13, CCR, section 1978(b));
5. OBD II (title 13, CCR, section 1968 et seq., as applicable);
6. "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 title 13, CCR, section 1965);
7. Warranty Requirements (title 13, CCR, sections 2037 and 2038);
8. "Specifications for Fill Pipes and Openings of 2015 and Subsequent Motor Vehicle Fuel Tanks" (incorporated by reference in title 13, CCR, section 2235);
9. "Guidelines for Certification of 2003 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by reference in title 13, CCR, section 1960.5);
10. "California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles," (incorporated by reference in title 13, CCR, section 1961.2(d));

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

The section numbering conventions for this document are set forth in Part I, section A.

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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 provisions of Subparts B, C, S, and T, Part 86, Title 40, Code of Federal Regulations (CFR), 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 the provisions of Part 1065 and 1066, Title 40, CFR, as last amended on the date set forth next to the 40 CFR Part 1065 or 40 CFR Part 1066 section title listed below, and to the extent they pertain to exhaust emission standards and test procedures, are hereby adopted as 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," with the following exceptions and additions.

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

§ 86.1 Incorporation by Reference. October 25, 2016.

A. General Applicability

1. § 86.1801 Applicability.

1.1. § 86.1801-12. October 25, 2016. Amend as follows:

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

1.1.1.1 Subparagraph (1): [No change.]

1.1.1.2 Delete subparagraph (2). Replace with the following: The provisions of this subpart apply for all medium-duty passenger vehicles and for all other medium-duty vehicles.

1.1.1.3 Delete subparagraph (3). Replace with the following: Incomplete heavy-duty vehicles above 14,000 pounds GVWR and complete vehicles

above 14,000 pounds GVWR are subject to the standards and incorporated test procedures in title 13, CCR, section 1956.8.

1.1.1.4 Subparagraph (4): [No change.]

1.1.2 Subparagraph (b): *Relationship to subpart A of this part.* [n/a]

1.1.3 Subparagraph (c): *Clean alternative fuel conversions.* [n/a]

1.1.4 Delete subparagraph (d). Replace with the following: *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 Part I, section G.12 of these test procedures.

1.1.5 Subparagraph (e): *You.* [n/a]

1.1.6 Subparagraph (f): *Vehicle.* [No change]

1.1.7 Subparagraph (g): *Complete and incomplete vehicles.* [No change.]

1.1.8 Subparagraph (h): [No change.]

1.1.9 Subparagraph (i): [No change.]

1.1.10 Subparagraph (j): [n/a]

1.1.11 Subparagraph (k): [n/a]

2. California Provisions.

2.1. 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.

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

- 2.3. Regulations concerning U.S. EPA hearings, U.S. EPA inspections, specific language on the Certificate of Conformity, evaporative emissions, high-altitude vehicles and testing, particulate and oxides of nitrogen averaging and test group standards applicable in such averaging, alternative useful life, selective enforcement audit, Certification Short Test, and heavy-duty engines and vehicles shall not be applicable to these procedures, except where specifically noted.
- 2.4. Regulations both herein, 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.
- 2.5. For engines used in medium-duty vehicles that are not distinctly diesel engines nor derived from such, the Executive Officer shall determine whether the engines shall be subject to diesel or Otto-cycle engine regulations, in consideration of the relative similarity of the engines' torque-speed characteristics and vehicle applications with those of Otto-cycle and diesel engines.
- 2.6. Regulations concerning federal OBD system requirements shall mean the California OBD requirements, except where specifically noted otherwise.

3. § 86.1802 Section Numbering; Construction.

- 3.1. § 86.1802-01. October 25, 2016. [No change.]
- 3.2. The section numbering convention employed in these test procedures, in order of priority, is Part I, section A.1.1.1. in order to distinguish California procedures and requirements from those of the U.S. EPA. References in these test procedures to specific sections of the Code of Federal Regulations maintain the same numbering system employed in the Code of Federal Regulations.
- 3.3. In cases where the entire CFR section is incorporated by reference with no modifications, the notation “[No change.]” is used. In cases where there are no changes to the CFR language but there are additional California requirements, the notation “[No change.]” is used and the additional California requirements are then noted in a separate subsection with the numbering convention set forth in Part I, section

A.3.2, above. For example, Part I, section B.1 incorporates all of the definitions in CFR section 86.1803-01 into these test procedures. Part I, section B.2 establishes additional California definitions for terms that are not included in CFR section 86.1803-01, but are applicable to these test procedures. In addition, Part I, section B.2 redefines terms that are included in CFR section 86.1803-01, if needed, to make the definitions more applicable to California's regulatory requirements.

- 3.4. The notation "[n/a]" indicates that the subject matter of the federal regulation does not apply to California passenger cars, light-duty trucks, or medium-duty vehicles. In some cases, the subject of the federal regulation is indicated in the bracket for clarity.
- 3.5. The notation "Delete" means that the section (including all subsections) does not apply. The notation "Delete; Replace with the following" means to delete the text of that section (and delete all subsections) and replace with language provided.
- 3.6. The notation "Amend as follows" means that the text set forth in these test procedures has been modified from the text that appears in the incorporated section of the CFR, as noted.

B. Definitions, Acronyms and Abbreviations

1. § 86.1803 Definitions.

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

2. California Definitions.

"AB 965 vehicle" means a vehicle certified pursuant to title 13, CCR, section 1960.5.

"Administrator" means the Executive Officer of the California Air Resources Board (CARB).

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

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

"Attestation" means a statement signed and dated by an individual, who is employed by a manufacturer and authorized to affirm the attested statement on behalf of the manufacturer, certifying under penalty of perjury under the laws of the State of California that the attested statement is true, accurate, and complete.

"Automatic active regeneration" is an approved auxiliary emission control device (AECD), as defined in 40 CFR § 86.1803-01, that is active during normal operation of the vehicle for the purpose of restoring emissions after-treatment component efficiency by raising exhaust temperature to manufacturer-specific targets and activating other controls. The regeneration is triggered automatically by the electronic control module without operator or service request based on the conditions of operation, design limits, and other approved parameters specified in AECD description, and is indicated by the electronic control module as "active" while the event is in progress. Common examples include diesel particulate filter regeneration to oxidize accumulated soot, and actions to recover selective catalytic reduction efficiency due to, for example, accumulation of diesel emission fluid deposits.

"Auxiliary power unit" or "APU" (also referred to as "engine") means a device that converts consumable fuel energy into mechanical or electrical energy. Some examples of auxiliary power units are internal combustion engines, gas turbines, or fuel cells. A fuel-fired heater does not qualify under this definition for an APU.

“Battery or Battery pack” means any electrical energy storage device consisting of any number of individual battery modules or cells that is used to propel a battery electric or hybrid electric vehicle. These terms may also generically refer to capacitor and flywheel energy storage devices in the context of hybrid electric vehicles.

“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.

“Battery state-of-charge” means the quantity of electrical energy remaining in the battery relative to the maximum rated capacity of the battery expressed in percent.

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

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

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

“Certification level” means the official exhaust or evaporative emission result from an emission data vehicle which has been adjusted by the applicable mass deterioration factor and is submitted to the Executive Officer for use in determining compliance with an emission standard for the purpose of certifying a particular test group.

“Cold-start UDDS” is defined as the first UDDS cycle in which the engine turns on.

“Consumable fuel” means any solid, liquid, or gaseous matter that releases energy when consumed by an auxiliary power unit.

“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 Mode” means the operating mode to which the vehicle automatically reverts after a vehicle is turned off and subsequently turned on. A vehicle with default mode would require the driver to select an alternative mode each time the vehicle is turned on if the driver chooses to use an alternative 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.

“Driver-Selectable Mode” means an operating mode that the vehicle driver can manually engage by means of an instrument panel button, switch, screen menu, etc., anytime the vehicle is activated (e.g., when the key is in the on position).

“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.

“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.

“Energy storage device” means a storage device able to provide the minimum power and energy storage capability to enable engine stop/start capability, traction boost, regenerative braking, and (nominal) charge sustaining operation.

“Ethanol” means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) and gasoline as specified in Part II, section A (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.

“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.

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

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

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

“Heavy-duty vehicle” means any motor vehicle having a manufacturer's gross vehicle weight rating greater than 8,500 pounds, except passenger cars.

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

“Highway Fuel Economy Driving Schedule” or **“HFEDS”** means highway fuel economy driving schedule. See 40 CFR Part 600 § 600.109(b).

“Highway Test Cycle” means the driving schedule as set forth in Part II, section E 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 E.

“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.

“Hybrid fuel cell vehicle” or **“HFCV”** means any vehicle that receives propulsion energy from both an onboard fuel cell power system and either a battery or a capacitor.

“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 IV” refers to the standards that are set forth in title 13, CCR, section 1961.4.

“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.

“Manual active regeneration” is an AECD that is active only while the vehicle is stationary for the purpose of restoring emissions after-treatment component efficiency by raising exhaust temperature to manufacturer-specific targets and activating other controls. The regeneration is triggered either by operator request (e.g., dash switch) in response to an electronic control module message, or by service request (e.g., dash switch or service tool), and is indicated by the electronic control module as “active” while the event is in progress.

“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.3.1 (California Certification Gasoline 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.

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

“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 nonoxygenated and oxygenated hydrocarbons contained in a gas sample as measured in accordance with “California Non-Methane Organic Gas Test Procedures for 2017 and Subsequent Model Year Vehicles.”

“Normal Mode” means the operating mode where the vehicle automatically optimizes engine, battery, transmission, and braking operation for the most common driving conditions as determined by the manufacturer. Normal mode would be equivalent to default mode if the vehicle has default mode.

“Organic material non-methane hydrocarbon equivalent” (or **“OMNMFHCE”**) for methanol-fueled vehicles means the sum of the carbon mass contribution of nonoxygenated 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 **“OMNMFHCE”**) means the sum of carbon mass contribution of nonoxygenated hydrocarbons (excluding methane), methanol, ethanol, formaldehyde and acetaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons.

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

“Plug-in hybrid electric vehicle” or **“PHEV”** 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 plug-in hybrid electric vehicle.

“Portable emission measurement system” or **“PEMS”** means a measurement system consisting of portable equipment that can be used to generate brake-specific emission measurements during field testing or laboratory testing.

“SAE J1711” means the “Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles, Including Plug-in Hybrid Vehicles,” as revised by SAE International in June, 2010.

“SAE J1979” means the “E/E Diagnostic Test Modes,” as revised by SAE International in February 2017.

“SAE J2807” means the “Performance Requirements for Determining Tow-Vehicle Gross Combination Weight Rating and Trailer Weight Rating,” as revised by SAE International in February 2020.

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

“State of Charge (SOC) Net Energy Change Tolerance” means the state-of-charge net energy change tolerance that is applied to the SOC Criterion for charge-sustaining hybrid electric vehicles when validating an emission test. See Part II, section H.5 of these procedures for tolerance specifications.

“State of Charge (SOC) Criterion” means the state-of-charge criterion that is applied to a charge-sustaining hybrid electric vehicle to validate an emission test. The SOC Criterion requires that no net change in battery energy occurs over a given test cycle, i.e., the final battery state-of-charge that is recorded at the end of the emission test must be equivalent to the initial battery state-of-charge that is set at the beginning of the emission test. The SOC Net Energy Change Tolerance shall be applied to the SOC Criterion.

“Super-ultra-low-emission vehicle” means any vehicle certified to super-ultra-low-emission vehicle standards.

“UDDS” means urban dynamometer driving schedule as set forth in Appendix I of 40 CFR Part 86.

“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 a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas, excluding emissions from air conditioning systems, under any possible operational modes or conditions

3. § 86.1804 Acronyms and Abbreviations.

3.1. § 86.1804-01 January 17, 2006. [No change.]

3.2. California Acronyms and Abbreviations.

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

"CCR" means California Code of Regulations.

"cc" means cubic centimeters.

"CFR" means Code of Federal Regulations.

"CH₄" means methane.

"DEF" means diesel exhaust fluid.

"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 III vehicle" means any vehicle certified to the LEV III exhaust standards in title 13, CCR, section 1961.2.

"LEV IV vehicle" means any vehicle certified to the LEV IV exhaust standards in title 13, CCR, section 1961.4.

"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.

“PHEV” means plug-in hybrid electric vehicle.

“SCR” means selective catalytic reduction.

“SOC” means state of charge.

“SULEV” means the vehicle emission category of super-ultra-low-emission vehicle.

“SULEV15” means the vehicle emission category of light-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 15 standards.

“SULEV20” means the vehicle emission category of light-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 20 standards.

“SULEV25” means the vehicle emission category of light-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 25 standards.

“SULEV30” means the vehicle emission category of light-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 30 standards.

“SULEV75” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 75 standards.

“SULEV85” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 85 standards.

“SULEV100” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 100 standards.

“SULEV125” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 125 standards.

“SULEV150” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 150 standards.

“SULEV170” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 170 standards.

“SULEV175” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 175 standards.

“SULEV200” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 200 standards.

“SULEV230” means the vehicle emission category of medium-duty vehicles certified to LEV IV super-ultra-low-emission vehicle 230 standards.

“UC” means Unified Cycle.

“ULEV” means ultra-low-emission vehicle.

“ULEV40” means the vehicle emission category of light-duty vehicles certified to LEV IV ultra-low-emission vehicle 40 standards.

“ULEV50” means the vehicle emission category of light-duty vehicles certified to LEV IV ultra-low-emission vehicle 50 standards.

“ULEV60” means the vehicle emission category of light-duty vehicles certified to LEV IV ultra-low-emission vehicle 60 standards.

“ULEV70” means the vehicle emission category of light-duty vehicles certified to LEV IV ultra-low-emission vehicle 70 standards.

“ULEV125” means the vehicle emission category of light-duty vehicles certified to LEV IV ultra-low-emission vehicle 125 standards.

“ULEV200” means the vehicle emission category of medium-duty vehicles certified to LEV IV ultra-low-emission vehicle 200 standards.

“ULEV250” means the vehicle emission category of medium-duty vehicles certified to LEV IV ultra-low-emission vehicle 250 standards.

“ULEV270” means the vehicle emission category of medium-duty vehicles certified to LEV IV ultra-low-emission vehicle 270 standards.

“ULEV400” means the vehicle emission category of medium-duty vehicles certified to LEV IV ultra-low-emission vehicle 400 standards.

C. General Requirements for Certification

1. § 86.1805 Useful Life.

1.1. § 86.1805-17. October 25, 2016. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV IV standards in title 13, CCR, section 1961.4 shall be 15 years or 150,000 miles, whichever occurs first. These full useful life values apply to all exhaust, evaporative, and refueling emission requirements except for standards which are specified to only be applicable at the time of certification.

1.1.2 Subparagraph (b): [n/a]

1.1.3 Subparagraph (c): [No change to cold temperature CO requirements; cold temperature NMHC requirements do not apply.]

1.1.4 Subparagraph (d): [n/a]

1.1.5 Subparagraph (e): [n/a]

1.1.6 Subparagraph (f): [n/a]

2. § 86.1806 On-Board Diagnostics.

2.1. § 86.1806-17. [Delete.]

2.2. California On-Board Diagnostic System Requirements.

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

3. § 86.1807 Vehicle Labeling.

3.1. § 86.1807-01. April 28, 2014. Amend as follows:

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

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

3.1.3 Subparagraph (c)(1)(ii): Amend as follows: For passenger cars, light-duty trucks, and medium-duty vehicles, the statement: "This vehicle

conforms to California regulations applicable to XXX-fueled 20XX model-year new (specify ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, SULEV15, or ZEV, as applicable) (specify passenger cars, light-duty trucks, medium-duty vehicles)." For federally certified vehicles certified for sale in California the statement must include the phrase "conforms to U.S. EPA regulations and is certified for sale in California." Such statements shall not be used on labels placed on vehicles or engines which, in fact, do not comply with all applicable California regulations, including assembly-line test requirements, if any.

- 3.1.4 Subparagraphs (c)(1)(ii)(A) through (c)(1)(ii)(D): [n/a]
- 3.1.5 Subparagraphs (c)(1)(iii) through (c)(3): [No change.]
- 3.1.6 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 ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, or SULEV15, as applicable) medium-duty vehicles when it does not exceed XXX pounds in curb weight, XXX pounds in gross vehicle weight rating, and XXX square feet in frontal area."
 - 3.1.6.1 Subparagraphs (d)(1) and (d)(2): [n/a]
- 3.1.7 Subparagraph (e): [No change.]
- 3.1.8 Subparagraph (f): [No change.]
- 3.1.9 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 title 13, CCR, section 2109.

3.1.10 Subparagraph (h): [n/a]

3.1.11 Subparagraph (i): [No change.]

3.2. California Labeling Requirements.

3.2.1 In addition to the federal requirements set forth in 40 CFR § 86.1807, labeling shall conform with the requirements specified in title 13, CCR, section 1965 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 title 13, CCR, section 1965. In cases where there is conflict with the federal label specifications, the California requirements shall apply.

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

(a) "CA OBD II" or "OBD Exempt".

(b) Identification of the Exhaust Emission Control System, including:

- 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	- NO _x Adsorber Catalyst;
NH3OC	- Ammonia Slip Catalyst;
NH3S	- Ammonia Sensor;
NOXS	- NO _x 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.

Any other information necessary to identify the Exhaust Emission Control System.

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.

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

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

4. § 86.1808 Maintenance Instructions.

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

5. § 86.1809 Prohibition of Defeat Devices.

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

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

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

This section applies to model year 2026 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), including vehicles certifying with carryover data, shall comply with all requirements established when operating on either 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.

- 1.1. Subparagraphs (a) through (d): [No change.]
- 1.2. 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 title 13, CCR, section 1968 et seq., as applicable.
- 1.3. Subparagraph (f): **Altitude Requirements.** [No change.]
- 1.4. Subparagraph (g): [No change to cold temperature CO requirements; cold temperature NMHC requirements do not apply.]
- 1.5. Subparagraph (h): [No change.]
- 1.6. Subparagraph (i): [n/a]
- 1.7. **Supplemental FTP General Provisions for California.**
 - 1.7.1 **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. 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.
 - 1.7.2 **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:

- a. 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.
- b. Small changes in the target air to fuel ratio to optimize vehicle emissions or drivability. This may be called "closed-loop biasing."
- c. Temporary enrichment in response to rapid throttle motion.
- d. Enrichment during cold-start and warm-up conditions.
- e. Temporary enrichment for running OBD checks to comply with 40 CFR § 86.1806.

1.7.3 **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 AECs involving commanded enrichment, these AECs must not operate differently for A/C-on operation than for A/C-off operation. This includes both the sensor inputs for triggering enrichment and the degree of enrichment employed.

1.7.4 **"Lean-on-cruise" calibration strategies.** Manufacturers may use "lean-on-cruise" strategies subject to the following specifications:

- a. 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.
- b. 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.

- c. 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.

1.7.5 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 NO_x emissions and comparing with the NMOG+NO_x standard to determine compliance with that standard.

2. Measurement of Hydrocarbon Emissions.

- 2.1. Except as otherwise indicated in these test procedures, for vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas, 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 2017 and Subsequent Model Year Vehicles".
- 2.2. 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 2017 and Subsequent Model Year Vehicles".
- 2.3. For vehicles certifying to the SFTP standards set forth in title 13, CCR, section 1961.4(d)(3) or (e)(3), as applicable, 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 2017 and Subsequent Model Year Vehicles". For alcohol-fueled vehicles certifying to the standards in title 13, CCR, section 1961.4(d)(3) or (e)(3), as applicable, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

E. California Exhaust Emission Standards. Delete 40 CFR §§ 86.1811 through 86.1819. The manufacturer must demonstrate compliance with the exhaust emission standards in title 13, CCR, section 1961.4.

F. Requirements and Procedures for Durability Demonstration

1. § 86.1820 Durability group determination.

1.1. **§ 86.1820-01. October 25, 2016.** [No change.]

2. § 86.1821 Evaporative/refueling emission family determination.

[Delete. (The provisions of this section are set forth in the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles," and "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.")]

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

4. § 86.1823 Durability demonstration procedures for exhaust emissions.

4.1. § 86.1823-01. February 26, 2007.

4.2. § 86.1823-08. October 25, 2016. [No change, except that subparagraph (m) applies only to vehicles certifying to the HD GHG Phase 2 regulations.]

4.3. **SFTP.** [No change.]

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

4.5. Separate deterioration factors must be calculated and reported for NMOG emissions and for NO_x emissions for each durability group.

5. § 86.1824 Durability demonstration procedures for evaporative emissions.

[Delete. (The provisions of this section are set forth in the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles.")]

6. § 86.1825 Durability demonstration procedures for refueling emissions.

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

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

7.1. § 86.1826-01. April 28, 2014. [No change.]

G. Procedures for Demonstration of Compliance with Emission Standards

1. § 86.1827 Test Group Determination.

1.1. § 86.1827-01. May 7, 2010. [No change.]

2. § 86.1828 Emission data vehicle selection

2.1. § 86.1828-01. April 28, 2014. Amend as follows:

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

2.2. 50°F Requirements.

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

2.2.2 The same test group shall not be selected in the succeeding two years unless the manufacturer produces fewer than nine test groups. If the manufacturer produces more than three ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, or SULEV15 test groups per model year, the Executive Officer may request 50°F testing of specific test groups. If the manufacturer provides a list of the ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, or SULEV15 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 Part I, section G.2.2.1), the Executive Officer shall select the test groups subject to 50°F testing within a 30 day period after receiving such a list and description. The Executive Officer may revise the test groups selected after the 30 day period if the information provided by the manufacturer does not accurately reflect the test groups actually certified by the manufacturer.

2.3. LEV IV PM Requirements.

- 2.3.1 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 Part I, section G.3.4. 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.
- 2.3.2 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 IV PM standards. If the manufacturer produces more than four test groups that are certified to LEV IV PM standards per model year, the Executive Officer may request LEV IV PM testing of specific test groups. If the manufacturer provides a list of the test groups that it will certify to LEV IV PM standards for a model year and provides a description of the technologies used on each test group (including the information in Part I, section G.2.3.1), the Executive Officer shall select the test groups subject to LEV IV 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.

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

- 3.1. § 86.1829-15. February 19, 2015. Amend as follows:
- 3.1.1 Subparagraph (a) through (b): [No change.]
- 3.1.2 Subparagraph (c): [No change.]
- 3.1.3 Subparagraph (d): [Delete; see section Part I, section G.3.5 below, except as follows.]
- 3.1.4 Subparagraph (d)(4): [No change.]
- 3.1.5 Subparagraph (e): [Delete. (The provisions of this section that pertain to evaporative testing are contained the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles." 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.")]

3.1.6 Subparagraph (f): [No change.]

3.1.7 Delete subparagraph (g). Replace with the following: For zero-emission vehicles, manufacturers may provide a statement in the application for certification that vehicles comply with all the requirements of this subpart instead of submitting test data. Tailpipe emissions of regulated pollutants from vehicles powered solely by electricity are deemed to be zero.

3.2. 50°F Requirements.

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

3.3. Highway Fuel Economy Test.

The exhaust emissions, including non-methane organic gas emissions, shall be measured from all exhaust emission data vehicles tested in accordance with the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600 Subpart B 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+NO_x certification level, as required in title 13, CCR, sections 1961.4(d)(5) and (e)(5). 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 title 13, CCR, sections 1961.4(d)(5) or (e)(5), as applicable, the manufacturer may submit to the Executive Officer engineering data or other evidence showing that the system is capable of complying with the standard. If the Executive Officer finds, on the basis of an engineering evaluation, that the system can comply with the HWFET standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data.

3.4. LEV IV PM Testing Requirements.

For the 2026 and subsequent model years, a manufacturer must submit test data for test groups certifying to the LEV IV PM standards according to the following table. Once a test group has been used to meet the requirements of this Part I, section G.3.4 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 IV PM standards. For all test groups that are certified to LEV IV 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 IV PM standards.

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

4. § 86.1830 Acceptance of Vehicles for Testing.

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

5. § 86.1831 Mileage accumulation requirements for test vehicles.

5.1. § 86.1831-01. January 17, 2006. [No change.]

6. § 86.1832-01 Optional equipment and air conditioning. [No change.]

7. § 86.1833-01 Adjustable parameters. [No change.]

8. § 86.1834 Allowable maintenance.

8.1. § 86.1834-01. 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.]

9. § 86.1835 Confirmatory certification testing.

9.1. § 86.1835-01. May 7, 2010. [No change.]

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

11. § 86.1837 Rounding of emission measurements.

11.1. § 86.1837-01. April 28, 2014. [No change.]

11.2. Fleet average NMOG+NO_x 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+NO_x requirements.

12. § 86.1838 Small volume manufacturers certification procedures.

12.1. § 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.]

13. § 86.1839 Carryover of certification data.

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

14. § 86.1840 Special test procedures.

14.1. § 86.1840-01. June 8, 2012. [No change.]

H. Certification, Information and Reporting Requirements.

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

1.1. § 86.1841-01. July 6, 2011. [No Change.]

1.1.1 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 NO_x mass emission value. This result shall be compared to the NMOG+NO_x exhaust emission standards to determine compliance with the standards.

1.2. Scope of Certification.

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

1.3. SFTP.

For vehicles certified to the SFTP standards in title 13, CCR, section 1961.4(d)(3) or (e)(3), as applicable, full useful life shall mean 15 years or 150,000 miles, whichever occurs first.

1.4. Demonstration of Vehicle Model Equivalency.

1.4.1 For the purpose of demonstrating compliance with the requirements in title 13, CCR, section 1961.4(c)(5), a California vehicle model is to be treated as equivalent to a federal vehicle model if all of the following characteristics are identical.

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

The comparative stringency of the standards for the federal exhaust emissions bin and for the California vehicle emissions category shall be based on a comparison of the federal NMOG+NO_x standards to the LEV IV NMOG+NO_x standards.

1.4.2 Prior to certification of a 2026 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 Part I, section H.1.4. A manufacturer must specify the federal emission bin and the California emission category to which equivalent vehicle models will be certified as part of this information submittal.

1.4.3 The requirements in Part I, section H.1.4 do not apply in the case of a federally-certified vehicle model that meets the requirements of title 13, CCR, section 1961.4(c)(5)(B).

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

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

3. § 86.1843 General information requirements.

3.1. § 86.1843-01. April 28, 2014. [No change.]

3.2. Credit Reporting.

In order to verify the status of a manufacturer's compliance with the fleet average and phase-in requirements in title 13, CCR, sections 1961.4(d) and (e) for a given model year, and in order to confirm the accrual of credits or debits, each manufacturer shall submit an annual report to the Executive Officer which sets forth the production data used to establish compliance, by no later than March 1 of the calendar year following the close of the model year.

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

4.1. § 86.1844-01. October 25, 2016. Amend as follows:

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

4.1.2 § 86.1844-01 (a) through (c): [No change.]

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

4.1.3.1 Modify subparagraph (d)(7)(i) as follows: For vehicles certified to any LEV IV 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.

4.1.3.2 Delete subparagraph (d)(9).

- 4.1.3.3 Delete subparagraph (d)(11)(iii). Replace with: For vehicles with spark-ignition engines, describe how AECs are designed to comply with the requirements of Part I, section D.1.7. 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.
- 4.1.3.4 Delete subparagraph (d)(15)(ii) and replace it with the following: For vehicles with fuel-fired heaters, a manufacturer must include the information specified in Part I, section H.4.4.
- 4.1.4 Modify § 86.1844-01(e) as follows:
 - 4.1.4.1 Add the following requirements to § 86.1844-01(e):
 - 4.1.4.1.1 The information required in sections 2037, 2038 and 2039, title 13, CCR.
 - 4.1.4.1.2 The NMOG/NMHC and/or formaldehyde to NMHC ratios established according to Part I, section I.1.2 of these test procedures.
 - 4.1.4.2 Delete subparagraph (e)(4) and replace it with the following: Final California vehicle sales volumes for each test group, including each ZEV test group, and evaporative/refueling family combination organized in such a way to verify compliance with any applicable implementation schedules. Final sales are not required until the final update to the Part 2 Application at the end of the model year.
 - 4.1.4.2.1 Subparagraphs (e)(4)(i) and (e)(4)(ii): [No change.]
 - 4.1.4.3 Delete § 86.1844-01(e)(7).
- 4.1.5 Subparagraphs (f) through (i): [No change.]

4.2. OBD Requirements.

For 2026 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 title 13, CCR, section 1968, et seq., as applicable.

4.3. HEVs.

For HEVs, the information required in the "California Test Procedures for 2026 and Subsequent Model Year Zero-Emission Vehicles and Plug-in 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. This information must include the vehicle and battery break-in period, and the method used to determine them, as specified in Part II, section I.1.

4.4. Fuel-Fired Heaters.

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

- (a) a description of the control system logic of the fuel-fired heater, including an evaluation of the conditions under which the fuel-fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist;
- (b) the exhaust emissions value per mile produced by the auxiliary fuel-fired heater operated between 68°F and 86°F; and
- (c) the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

I. In-Use Compliance Requirements and Procedures

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

1.1. § 86.1845-04. October 25, 2016. Amend as follows:

1.1.1 Table S04-06 - California Small Volume Manufacturers and Small Volume Test Groups

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

¹ Total annual production of groups eligible for testing under small volume sampling plan is capped at a maximum of 4,500 California-only production volume per model year, per large volume manufacturer. All other remaining large volume manufacturers' small volume test groups shall meet the requirements in Table S04-07 below.

² Particulate emissions must be measured for one vehicle per test group that certifies to the LEV IV particulate standards to demonstrate compliance with the applicable FTP standard. The same vehicle must also be tested to demonstrate compliance with the LEV IV SFTP particulate standard in title 13, CCR, section 1961.4(d)(3)(A)1. or (e)(3)(A)1., as applicable.

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

¹ Particulate emissions must be measured for one vehicle per test group that certifies to the LEV IV particulate standards to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance with the LEV IV SFTP particulate standard in title 13, CCR, section 1961.4(d)(3)(A)1. or (e)(3)(A)1., as applicable.

² Particulate emissions must be measured for two vehicles per test group that certifies to the LEV IV particulate standards to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance with the LEV IV SFTP particulate standard in title 13, CCR, section 1961.4(d)(3)(A)1. or (e)(3)(A)1., as applicable.

³ Particulate emissions must be measured for three vehicles per test group that certifies to the LEV IV particulate standards to demonstrate compliance with the applicable FTP standard. Each vehicle must also be tested to demonstrate compliance

with the LEV IV SFTP particulate standard in section title 13, CCR, section 1961.4(d)(3)(A)1. or (e)(3)(A)1., as applicable.

1.1.3 High Mileage Testing. Amend subparagraph (c)(2) of 40 CFR § 86.1845-04 to read as follows: At least one vehicle of each test group certified to the emission standards in title 13, CCR, section 1961.4(d)(2)(A)1. or (e)(2)(A) must have a minimum odometer mileage of 105,000 miles or 75 percent of full useful life mileage. See 40 CFR § 86.1838-01(c)(2) for small volume manufacturer mileage requirements.

1.1.4 High Altitude Testing. Subparagraph (c)(5)(i) of 40 CFR § 86.1845-04: [No change.]

1.2. Test Ratios.

(a) As an alternative to measuring the NMOG content, the Executive Officer may approve, upon submission of supporting data by a manufacturer, the use of NMOG to NMHC ratios. To request the use of NMOG to NMHC ratios, a manufacturer shall establish during certification testing the ratio of measured NMOG exhaust emissions to measured NMHC exhaust emissions for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. A manufacturer may conduct in-use testing on the test group by measuring NMHC exhaust emissions rather than NMOG exhaust emissions. After approval by the Executive Officer, the measured NMHC exhaust emissions shall be multiplied by the NMOG to NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. The equivalent NMOG exhaust emission value shall be added to the measured NO_x exhaust emissions and compared to the NMOG+NO_x exhaust emission standard applicable to the vehicle emission category (ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, or SULEV15) in which the test group was certified.

(b) For fuel-flexible vehicles certified to NMOG standards or NMOG+NO_x standards, the manufacturer may request from the Executive Officer the use of a methanol (M85) or ethanol (E85) NMOG exhaust emission to gasoline NMHC exhaust emission ratio which shall be established during certification testing for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. After approval by the Executive Officer, the measured gasoline

NMHC exhaust emissions shall be multiplied by the M85 or E85 NMOG to gasoline NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. The equivalent NMOG exhaust emission value shall be added to the measured NO_x exhaust emissions and compared to the NMOG+NO_x exhaust emission standard applicable to the vehicle emission category (ULEV400, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV60, ULEV50, ULEV40, SULEV230, SULEV200, SULEV175, SULEV170, SULEV150, SULEV125, SULEV100, SULEV85, SULEV75, SULEV30, SULEV25, SULEV20, or SULEV15) in which the test group was certified.

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

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

2.1. § 86.1846-01. October 25, 2016. [No Change.]

2.2. If a gasoline vehicle test group that is certified according to the provisions of Part I, section D.1.7.5 fails in-use verification testing, as set forth in Part I, section I, NMOG and formaldehyde exhaust emissions must be measured for that test group in accordance with Part I, section D.2 for the purpose of in-use confirmatory testing.

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

3.1. § 86.1847-01. Amend as follows:

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

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

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

4. California Provisions: Certification and In-Use testing requirements for chassis certified Medium-Duty Vehicles (MDV) with a Gross Combination Weight Rating (GCWR) greater than 14,000 pounds, using the Moving Average Window (MAW).

The effective dates of the applicable sections in 40 CFR § 1065, subpart J that are incorporated at various parts of in this Part I, section I.4 are as follows wherever referenced below:

§ 1065.901 (June 30, 2008)

- § 1065.905 (June 29, 2021)
- § 1065.910 (June 29, 2021)
- § 1065.915 (June 29, 2021)
- § 1065.920 (April 28, 2014)
- § 1065.925 (September 15, 2011)
- § 1065.930 (July 13, 2005)
- § 1065.935 (June 30, 2008)
- § 1065.940 (November 8, 2010)

4.1. Test Procedures for Three Binned Moving Average Window (3B-MAW) and Moving Average Window (MAW). Applies to 2027 and subsequent model year diesel and Otto-cycle vehicles.

- 4.1.1 Medium-duty vehicles subject to the MAW in-use test requirements do not need to perform in-use dynamometer testing.
- 4.1.2 Manufacturer shall attest at time of certification that the vehicle being certified can meet the 3B-MAW (diesels) or MAW (Otto-cycle) standards.
- 4.1.3 Manufacturer shall perform in-use testing and reporting to CARB as indicated in this section.
- 4.1.4 A test sampling period with the 3B-MAW and MAW consists of a minimum of three hours of non-idle operation with engine on, during which continuous sampling is being carried out using a Portable Emission Measurement System (PEMS), subject to the calibration requirements of PEMS. The test sampling period must begin with a cold start, where the engine coolant is equal to or less than 86° F (30° C). The engine may be shut down and keyed on during the test sampling period, but the PEMS must remain active and recording throughout the test sampling period.
- 4.1.5 Moving Average Window principle: Mass emissions for the pollutants (NMHC, CO, NO_x, and PM) shall be evaluated using a moving average window method, based on a reference time of 300 seconds. Mass emissions are not calculated for the complete test sampling period, but for subsets equal to 300 seconds in length, and referred to as "windows". Windows will overlap each other with a time increment, Δt equal to the data sampling rate of 1 second. Start of windows begins every valid second in the data set.

- 4.1.6 At least 50% of non-idle operation during the manufacturer's test shall include operation with a minimum of 70% GCWR. If a trailer is used to achieve this GCWR, then the trailer must comply with requirements of SAE J2807, Section 4.4.1, Table 1, however the frontal area of the trailer shall not exceed the manufacturer-specified maximum frontal area for towing. For trailers that exceed 24,000 lbs. (10,886 kg), the minimum trailer frontal area is 75 ft² (6.97 m²) but must not exceed the manufacturer-specified maximum frontal area for towing.
- 4.1.6.1 If based on good engineering judgement the manufacturer chooses to use a trailer not meeting the SAE J2807 specifications, the manufacturer must provide an explanation for why it is using the trailer it selected in addition to the specifications of the alternate trailer as part of the test plan approval process in Part I, section I.4.3. As part of their review and approval of the test plan per Part I, section I.4.3.3, the Executive Officer shall review and approve the trailer for testing upon confirming the manufacturer's explanation and submitted documentation demonstrate the selected trailer is representative of common usage for the vehicle being tested and that a trailer meeting SAE J2807 specifications is not representative of common usage or is otherwise infeasible to use for testing.
- 4.1.7 Testing shall be conducted while driving on California paved roads, or on roads which are representative of conditions found on California's paved roads.
- 4.1.8 Exclusions. Only valid data, as described in this section, shall be considered in calculating window duration, work, CO₂ mass, and criteria emissions of the averaging window. If the window encounters invalid data, skip the invalid data, and include seconds of valid data to compensate at the end of the window to a total window of 300 seconds of valid data. For windows using the exclusions in this section, if the invalid data is continuous for a consecutive period greater than 600 seconds, the window ends and a new window would need to be generated once valid data is encountered again. In cases where invalid data is in excess of 600 seconds, a detailed explanation of the cause of invalid data conditions must be documented and reported to CARB. Data collected during any of the following conditions shall be considered invalid data and shall be excluded from compliance determination:
- 4.1.8.1 Zero drift check or conditioning of the PEMS instrumentation

- 4.1.8.2 Atmospheric pressure less than 82.5 kPa
- 4.1.8.3 Ambient air temperature less than 19° F (-7° C)
- 4.1.8.4 Altitudes greater than 5,500 feet above sea-level; or
- 4.1.8.5 For altitudes less than or equal to 5,500 feet above sea level, temperatures greater than the temperature determined by the following equation at the specified altitude shall be considered invalid data:

$$T_{invalid} > -0.00254^{\circ} \text{ F/ft} \times h + 100$$

Where:

$T_{invalid}$ is the ambient air temperature threshold where above this temperature the data is considered invalid at a specific altitude, in degrees Fahrenheit

h is the altitude above sea-level, in feet (h is negative for altitudes below sea-level)

- 4.1.8.6 For 2027 through 2029 model year vehicles, engine coolant temperature is less than 158° F (70° C) and engine coolant temperature is not stabilized within $\pm 3.6^{\circ} \text{ F}$ ($\pm 2^{\circ} \text{ C}$) over a period of five minutes
- 4.1.8.7 For diesel vehicles only: Vehicle operation during indicated manual active regeneration and automatic active regeneration
- 4.1.8.8 Vehicle operation where the engine is shut-off or keyed off while the engine rpm is equivalent to zero
- 4.1.8.9 Fuel Enrichment Exclusion for 2027 through 2029 MY Otto-Cycle Vehicles only. If the in-use test fails and fuel enrichment occurred during the test, the following procedure may be used for fuel enrichment operation observed during the test when calculating the SOS emissions. A percentage based on fuel enrichment operation will be used to determine the percentage of data to be excluded from the SOS calculation.
 - 4.1.8.9.1 The following procedure shall be used to determine the amount of fuel enrichment data to be excluded:
 - 4.1.8.9.1.1 Up to 5% of total test time for all pollutants may be excluded from the compliance calculation equal to the cumulative enrichment test time. Fuel

enrichment operation is determined using the OBD II data stream parameters as defined in SAE J1979 (i.e., air/fuel ratio, lambda, etc.) and the manufacturer shall provide in the test plan and final report how they determine fuel enrichment has occurred. CARB may review it and determine if the fuel enrichment exclusion can be used for the manufacturer's testing.

4.1.8.9.1.2 Determine the fraction of fuel enrichment operation by calculating the total fuel enrichment operation time and dividing by the total engine run time during the test.

4.1.8.9.1.3 If the test has less than 5% fuel enrichment operation, the percent of data to be invalidated is equal to the percent of fuel enrichment during the test. If the test has greater than or equal to 5% of fuel enrichment operation, the percent of data able to be invalidated is equal to 5%.

4.1.8.9.2 Identify the raw data (i.e., 1 Hz data) with enrichment operation. Order all the criteria pollutant data from lowest to greatest CO emissions rate. Exclude the percent of identified criteria pollutant data allowed based on the highest CO emissions rate ranking per Part I, section I.4.1.8.9.1. With the remaining non-excluded 1 Hz data, recalculate the window emissions for each pollutant for the test.

4.1.8.9.3 The SOS may be recalculated using the new windows calculated in Part I, section I.4.1.8.9.2 to determine if the vehicle passes or fails MAW in-use testing.

4.1.9 **Valid tests.** If all the valid test conditions in I.4.1.9 are not met, the test is invalid, and retesting must be conducted.

4.1.9.1 **Test start:** emissions sampling (NMHC, CO, NO_x, PM and CO₂), exhaust flowrate parameters, and sampling of relevant OBD parameters, and ambient temperature and humidity shall commence prior to starting the engine. The coolant temperature shall not exceed 86° F (30° C) at the beginning of the test. If the ambient temperature and the coolant

temperature exceeds 86° F (30° C) at the start of the test, the test is void and testing shall be rescheduled. If a manufacturer believes that conditions may be infeasible to meet the cold start requirements (for example, due to ambient temperatures that are too high), the manufacturer may request approval from the Executive Officer to begin the test sampling period without a cold start as part of the test plan approval process described in Part I, section I.4.3.

4.1.9.2 This step applies to diesel vehicles: Each bin will be required to have a minimum of 2,400 valid windows. If the 2,400 valid windows in any bin is not achieved, continue with additional testing and if needed testing on additional days to achieve the minimum window requirements for each bin. If testing fulfills the valid window requirements for the low load and the medium/high load bins but does not fulfill the valid window requirements of the idle bin, then the manufacturer may idle the vehicle at the end of the test sampling period for a minimum of forty minutes and a maximum of sixty minutes to satisfy the valid window requirement of the idle bin.

4.1.9.3 This step applies to Otto-cycle vehicles: The test will be required to have a minimum of 2,400 valid windows. If 2,400 valid windows are not achieved during the first test sampling period, continue with additional testing and, if needed, testing on additional days to achieve a minimum of 2,400 valid windows.

4.1.9.4 For 2027 through 2029 model year vehicles only, the average engine power over the test must be equal to or greater than 10% of the engine's peak power for a valid test. In the event of an invalid test, the manufacturer shall retest the vehicle additional days until a valid test is achieved.

4.1.10 For diesel vehicles only, Percent engine load: The percent engine load of a window will be used to bin the data in subsequent Window Binning section. Window percent engine load is calculated by dividing average CO₂ emission rate [g CO₂/hour] during the 300 second window by the product of the engine's FTP CO₂ family certification level (FCL) value and the maximum power output of the engine.

$$\text{Percent Engine Load}_{\text{window}} = \frac{3,600 \text{ sec/hr}}{\text{FCL} \times \text{HP}_{\text{max}}} \times \frac{\sum_{t=1}^{300} (\dot{m}_{\text{CO}_2} \times \Delta t)}{300 \text{ sec}}$$

Where,

Percent Engine Load_{window} is the percent engine load calculated with the average CO₂ emission rate and the FCL

\dot{m}_{CO_2} is mass emission rate of CO₂ [g CO₂/sec]

FCL is the family certification level calculated using the procedures in Part I, section I.4.1.14.

HPmax is the maximum rated engine horsepower [bhp]

Δt is equal to the data sampling rate [1 second]

4.1.11 For diesel vehicles only, the 3B-MAW requires window binning. Windows are categorized into one of three bins: idle, low load, and medium/high load, as determined by percent engine load over 300 seconds of operation.

4.1.11.1 Idle bin. The window's percent engine load is less than or equal to 6%

4.1.11.2 Low-load bin. The window's percent engine load is greater than 6% and less than or equal to 20%

4.1.11.3 Medium-/high-load bin the window's percent engine load is greater than 20%

4.1.12 For diesel vehicles only, emissions testing evaluation and vehicle pass criteria. Sum-over-Sum (SOS) Evaluation: To determine in-use compliance, the Bin emissions for each criteria pollutant (NMHC, CO, NO_x, and PM) shall be calculated for each of the three bins (idle, low, medium/high).

4.1.12.1 For the low-load and medium/high-load bins, SOS emissions are calculated for each pollutant using the equation:

$$e_{sos\ a,b} = \frac{\sum_{k=1}^{n_b} \sum_{t=1}^{300} (\dot{m}_a \times \Delta t)}{\sum_{k=1}^{n_b} \sum_{t=1}^{300} (\dot{m}_{CO_2} \times \Delta t)} \times FCL$$

Where:

$e_{sos\ a,b}$ is the SOS emissions [g/bhp-hr] of a pollutant in a bin, where subscript "a" is the pollutant (NMHC, CO, NO_x, and PM) and "b" refers to the low-load bin or medium/high-load bin

\dot{m}_a is the mass emission rate of pollutant a [g/sec]

m_{CO_2} is the mass emission rate of CO₂ emitted [g/sec]

n_b is the number of windows in a bin

Δt is equal to the data sampling rate [1 second]

FCL is the family certification level calculated using the procedures in Part I, section I.4.1.14.

4.1.12.2 For idle bin emissions, the SOS emissions are calculated using the following equation:

$$e_{sos\ a, idle} = \frac{\sum_{k=1}^{n_{idle}} \sum_{t=1}^{300} (\dot{m}_a \times \Delta t)}{\sum_{k=1}^{n_{idle}} \sum_{t=1}^{300} (\Delta t)} \times \frac{3,600sec}{1hr}$$

Where:

$e_{sos\ a, idle}$ is the SOS emission for pollutant, a, in the idle bin [g/hr]

\dot{m}_a is the mass emission rate of pollutant a [g/sec]

n_{idle} is the number of windows in the idle bin

Δt is equal to the data sampling rate [1 second]

Since NO_x is the only pollutant with an idle standard, pollutant "a", in this equation represents only NO_x emissions.

4.1.12.3 The diesel vehicle pass criteria is determined by comparing each bin's SOS criteria emission for each of the three bins to the In-Use thresholds in the table below. The vehicle passes the test if the SOS emissions are less than the defined threshold for each and every bin and for each and every pollutant. The vehicle fails the test if any pollutant in any bin's SOS emissions exceeds the applicable threshold.

Bin Structure Definitions, Applicable Standards, and In-Use thresholds for diesel vehicles		
Bin	Percent Engine Load	SOS Emissions In-use Threshold
Idle	Percent Engine Load _{window} ≤ 6%	$e_{\text{SOS } a, \text{Idle}} \leq \text{CF}^B \times \text{Idle standard}^A$
Low	6% < Percent Engine Load _{window} ≤ 20%	$e_{\text{SOS } a, \text{Low}} \leq \text{CF}^B \times \text{LLC standard}^A$
Medium/High	20% < Percent Engine Load _{window}	$e_{\text{SOS } a, \text{MedHigh}} \leq \text{CF}^B \times \text{FTP/RMC standard}^A$

^A For 2027 and subsequent model year diesel vehicles, the following emission standards shall apply:

Pollutants	Diesel Idle Standard (g/hr)	Diesel LLC Standard (g/bhp-hr)	Diesel FTP/RMC Standard (g/bhp-hr)
NOx	5	0.05	0.02
NMHC		0.14	0.14
CO		15.5	15.5
PM		0.005	0.005

^B For 2027 through 2029 model year vehicles, the conformity factor, CF, is equal to 2.0. For 2030 and subsequent model year vehicles, the conformity factor, CF, is equal to 1.5.

4.1.13 For Otto-cycle vehicles only, emissions testing evaluation and vehicle pass criteria. Sum-over-Sum (SOS) Evaluation: To determine in-use compliance, the emissions for each criteria pollutant (NMHC, CO, NOx, and PM) shall be calculated.

4.1.13.1 The SOS emissions are calculated for each pollutant using the equation:

$$e_{\text{SOS } a} = \frac{\sum_{k=1}^{n_b} \sum_{t=1}^{300} (\dot{m}_a \times \Delta t)}{\sum_{k=1}^{n_b} \sum_{t=1}^{300} (\dot{m}_{\text{CO}_2} \times \Delta t)} \times FCL$$

Where:

$e_{\text{SOS } a}$ is the SOS emissions [g/bhp-hr] of a pollutant in a bin, where subscript "a" is the pollutant (NMHC, CO, NOx, and PM)

\dot{m}_a is the mass emission rate of criteria pollutant a [g/sec]

m_{CO_2} is the mass emission rate of CO₂ [g/sec]

FCL is the family certification level calculated using the procedures in Part I, section I.4.1.14.

n_b is the total number of valid windows

Δt is equal to the data sampling rate [1 second]

4.1.13.2 The vehicle pass criteria is determined by comparing SOS criteria emission to the In-Use threshold, defined as the applicable FTP standard multiplied by the conformity factor (CF).

4.1.13.3 The vehicle passes the test if the SOS emissions are less than or equal to the defined threshold for every pollutant fulfilling the equation:

$$e_{SOS\ a} \leq CF \times FTP\ standard$$

Where:

CF is the conformity factor equal to 2.0 for 2027 through 2029 model year vehicles. For 2030 and subsequent model year vehicles, the conformity factor is equal to 1.5.

For model year 2027 and subsequent Otto-cycle vehicles, the following standards shall apply:

<i>Pollutants</i>	<i>Otto-Cycle FTP Standard (g/bhp-hr)</i>
NO _x	0.02
NMHC	0.14
CO	14.4
PM	0.005

4.1.13.4 The vehicle fails the test if any pollutant's SOS emissions exceeds the defined threshold.

4.1.14 The FCL Value for Chassis-Certified MDVs shall be calculated using the following procedures.

$$FCL = \frac{FTP\ CO_2\ [g]}{FTP\ Work\ [bhp - hr]}$$

Where:

FTP CO₂ = Weighted 3-phase chassis FTP-75 CO₂ [g/mile] × chassis FTP-75 distance traveled [miles]

$$FTP\ Work\ [bhp - hr] = \sum_{t=1}^{1874} \frac{speed[rpm] \times Torque[lb - ft]}{5252} \times \Delta t \times \frac{hr}{3600\ sec}$$

Speed [rpm] = Engine RPM (PID \$0C) from the chassis FTP-75

Torque [lb-ft] = Torque from the chassis FTP-75 is calculated by subtracting Friction Torque (PID \$8E) from Indicated Torque (PID \$62) (both PIDs are percentages) and then multiplying by the reference torque (PID \$63), which is in units of Nm and will be converted to lb-ft. Set torque to zero if friction torque is greater than indicated torque.

Δt = OBD sampling rate [1 Hz]

- 4.1.14.1 Manufacturer shall select test data from the chassis FTP-75 test cycle as described in 40 CFR 1066.801(c)(1) to be used for the FCL from the applicable test group. Test data is collected using the chassis test procedures in 40 CFR subpart B and part 1066.
 - 4.1.14.1.1 The test data selected will be based on a sub configuration that is representative of that test group. The most representative is based on relatively high sales, median ALVW test weight, and most common frontal area/vehicle body size for that test group.
 - 4.1.14.1.2 In the case of multiple sub configurations (i.e., pickup trucks or vans) certified in the same test group, the test data will be based on the sub configuration that best represents the vehicle selected for in-use MAW testing. For example, if a pickup truck is selected for in-use MAW testing, then the FCL must be based on a sub configuration of a pickup truck meeting the requirement of Part I, section I.4.1.14.1.1.
 - 4.1.14.1.3 The FCL value(s) that are used to determine compliance with the in-use MAW standards in these test procedures must be submitted at time of certification and include documentation on how the FCL was determined and selected.

4.1.14.2 Manufacturer has the option to determine an FCL for the test group using the engine test procedures in 40 CFR § 1036.108 instead of using the chassis FTP-75 cycle. This FCL is based on the FTP engine cycle, and the FCL value must be submitted at time of certification with documentation.

4.2. PEMS Field Testing and Range Criteria

References to 40 CFR § 1065.550 mean 40 CFR § 1065.550 as adopted on April 28, 2014.

4.2.1 Measure emissions of THC, NMHC (by any method specified in 40 CFR § 1065, subpart J), CO, NO_x, PM (as appropriate), and CO₂. Measure or determine O₂ emissions using good engineering judgment. Measure these in-use emissions using the methods described in 40 CFR § 1065, subpart J for field testing.

4.2.2 Take the following steps after in-use emission sampling is complete for test intervals that do not meet the range criteria in 40 CFR § 1065.550.

4.2.2.1 For any test intervals, 3B-MAW or MAW described in these test procedures, that do not meet the range criteria in 40 CFR § 1065.550, use good engineering judgment to determine emission values of data collected during the test interval and over the range, and include the determined emission values for SOS Evaluation described in these test procedures. For example, twice the range can be used to estimate emission values of such data collected during the test interval and over the range. When 5% or more of test intervals during the test do not meet the range criteria in 40 CFR §1065.550 for a criteria pollutant, the test vehicle is deemed to be noncompliant for the test group for the criteria pollutant unless the manufacturer demonstrates compliance with the applicable emission standards.

4.2.2.2 Only for NO, NO₂, and NO_x, do not apply the drift validation criteria in 40 CFR § 1065.550(b)(3)(i) or (b)(4), only if the drift value is equal to or within +/-2.5 ppm criteria. If the zero drift check is equal to or within +/- 2.5 ppm, the data is valid and drift correction may be used. If the zero drift check is greater than +/- 2.5 ppm, data is invalidated and drift correction may not be used. In addition, for any windows of the 3B-MAW or MAW method containing any drift invalidated data described in this paragraph, these windows are also invalidated. For valid NO, NO₂, and NO_x data, subject to use drift readings within +/- 2.5 ppm for drift correction, the corrected values calculated from the drift correction equation, Eq. 1065-672-1, must be used for SOS emission calculations as described in these test procedures.

4.3. Test Plan Approval.

The manufacturer must send test plans for pre-approval by CARB's Executive Officer a minimum of 30 calendar days prior to testing for each vehicle tested. Test plans, notifications, and communications related to this subsection must be sent to: iuvp@arb.ca.gov.

4.3.1 Test plans must include the following vehicle, engine, OBD/MIL, maintenance, and PEMS system information:

- Vehicle Information
 - Manufacturer
 - Model
 - Model year
 - Test Group
 - Vehicle identification number (VIN)
 - Vehicle/fleet vocation
 - Percent of operation at highway speeds
 - Percent of operation on surface streets
 - Percent of operation idling
 - Trailer type, specifications, and weight if applicable
 - Mileage
- Engine Information
 - Engine model number
 - Displacement
 - Power rating
 - Model year
 - Engine serial number

- OBD/Malfunction Indicator Light (MIL)
 - History of OBD/MIL illuminating events
 - History of owner actions for OBD/MIL illumination
 - OBD/MIL codes experienced after accepting for in-use testing
 - Show how fuel enrichment operation will be determined if applicable
- Test Day
 - Expected date
 - Expected test time
- Vehicle Information
 - Expected duration
 - Test number
 - Number of test days
 - Location
 - Route
 - Expected weather
- PEMS
 - Make
 - Model
 - Certification

Some parameters may not be known exactly at the time of the test plan submission, especially in the Test Day category items. The manufacturer may use forecasted information as necessary and indicate when a parameter is forecasted.

- 4.3.2 The manufacturer must identify weather or logistical circumstances making the cold start requirements infeasible for the particular test. If a manufacturer believes that conditions may be infeasible to meet the cold start requirements (for example, due to ambient temperatures that are too high or fleet procedures), the manufacturer may request approval from the Executive Officer to begin the test sampling period without a cold start. The Executive Officer will approve said request if he or she determines that the identified circumstances will not allow the manufacturer to meet the cold start test requirements. In assessing the request, the Executive Officer will reply based on information provided by the manufacturer and his or her engineering judgment.
- 4.3.3 The manufacturer is required to electronically submit the test plans, a contact email and phone number a minimum of 30 calendar days prior to scheduled testing to iuvp@arb.ca.gov. CARB's Executive Officer will have 14 calendar days after test plan submission by the manufacturer to review and provide comments. CARB's Executive Officer will approve a submitted test plan if he or she determines the submitted test plan will

enable the manufacturer to collect a sufficient number of the data stream values and fulfills the guidelines for testing needed to determine if a vehicle meets the vehicle pass criterion. In making that determination, CARB's Executive Officer will consider the information provided by the manufacturer and his or her engineering judgment. If there are no comments by CARB's Executive Officer within the allotted review time, then the manufacturer may proceed with testing the vehicle.

4.4. Pass/fail criteria for 3B-MAW and MAW

4.4.1 If a test group is found to be in non-compliance as a result of 3B-MAW and MAW testing under this section, the manufacturer must notify the CARB Executive Officer within 15 days of the failure with the intent to submit a recall plan. The recall plan must be submitted within 45 days of notifying the CARB Executive Officer.

4.4.2 The test group is deemed to be noncompliant if the testing meets any of the following criteria:

4.4.2.1 The sum-over-sum emissions of the same pollutant and same bin exceed the in-use threshold for three or more vehicles.

4.4.2.2 Any of the average SOS values exceed the applicable in-use emission threshold defined in these test procedures. The average SOS value is calculated from the arithmetic mean of 10 vehicles from testing for each of pollutants (NMHC, CO, NO_x, and PM) and for each of the bins (idle, low, med./high for diesel vehicles whereas Otto-cycle vehicles have one bin).

4.4.3 Testing is considered complete if any of the following conditions are met:

4.4.3.1. A total of five valid vehicles were tested and analyzed with the methods and all five engines completely fulfilled the vehicle pass criteria.

4.4.3.2. A total of six valid vehicles were tested and analyzed and five of the six vehicles completely fulfilled the vehicle pass criteria.

4.4.3.3. A total of 10 valid vehicles were tested and analyzed and the arithmetic mean of the 10 vehicle's sum-over-sum values are less than the in-use thresholds for each bin and pollutant.

4.4.4 If the manufacturer declares the test group is in noncompliance the manufacturer shall begin discussions with the Executive Officer for corrective action.

4.5. CARB Authority to Test for In-use Compliance

4.5.1 The Executive Officer is authorized to conduct in-use compliance testing to identify vehicles that fail to conform to the applicable emission standards in this Part I, section I.4 of the MAW in-use test procedures, and to take corrective action against the manufacturers of such vehicles based on the results of this testing. The Executive Officer may conduct testing under any operating conditions where the emission standards apply as reasonably necessary to confirm compliance with any regulatory provision. Such testing imposes no additional responsibilities on the manufacturer and is undertaken solely by CARB for assessing compliance. Testing by the Executive Officer is not subject to the restrictions imposed on manufacturer self-testing under sections I.4.1.4, I.4.1.6, and I.4.1.9.1.

4.5.2 For purposes of determining compliance with the test procedures in Part I, section I.4.5.1, a test group is considered a failure if any of the following conditions occur:

4.5.2.1 For diesel or Otto-cycle vehicles, at least three vehicles tested exceed the three-bin moving average window (3B-MAW diesels) or moving average window (MAW Otto-cycle) in-use threshold for the same bin and pollutant

4.5.2.2 For diesel or Otto-cycle vehicles, the arithmetic mean of the Sum-Over-Sum emissions defined in Part I, section I.4.4, calculated across the 10 tested vehicles for each individual pollutant and bin, exceed the in-use threshold

4.6. Test group selection and MAW in-use program requirements

4.6.1 **§ 86.1905 How does this program work?** November 2, 2010. Amend as follows:

4.6.1.1 References to "engines" shall mean "vehicles". References to "engine families" shall mean "test groups". "Phase 1" and "Phase 2" testing shall mean testing required by Part I, section I.4 of these test procedures.

4.6.1.2 Subparagraph (a)

4.6.1.2.1 Delete subparagraph (a)(1). Replace with: The manufacturer must test in-use vehicles from the test groups CARB selects. CARB will select up to 25 percent of the manufacturer's test groups in any calendar year, calculated by dividing the number of test

groups the manufacturer certified in the model year corresponding to the calendar year by four and rounding to the nearest whole number. If the manufacturer has only three or fewer test groups, CARB will select one test group per calendar year for testing.

4.6.1.2.2 Subparagraph (a)(2): [No change.]

4.6.1.3 Subparagraph (b): [No change.]

4.6.1.4 Subparagraph (c): [n/a]

4.6.1.5 Subparagraphs (d) through (f): [No change.]

4.6.1.6 Delete subparagraph (g). Replace with: For any communication related to this Part I, section I.4.6, contact iuvp@arb.ca.gov.

4.7. MAW Vehicle Selection and Screening

4.7.1 § 86.1908 How must I select and screen my in-use engines? June 14, 2005. Amend as follows:

4.7.1.1 References to "engines" shall mean "vehicles". References to "engine families" shall mean "test groups".

4.7.1.2 Amend subparagraph (a) as follows: Once CARB directs the manufacturer to do testing under these sections, the manufacturer must select test vehicles that meet the following criteria:

4.7.1.2.1 Delete subparagraph (a)(1). Replace with: The vehicles must be representative of the test group. Select vehicles based on relatively high sales, median and higher frontal area/vehicle body size, median to higher tow capable vehicles in the test group.

4.7.1.2.2 Subparagraphs (a)(2) through (a)(5): [No change.]

4.7.1.2.3 Delete subparagraph (a)(6). Replace with the following: The vehicles have not been misfueled. The use of commercially available diesel and biofuel blends that meet California's fuel specifications in title 4, CCR, section 4148, will not be considered misfueled.

4.7.1.2.4 Delete subparagraph (a)(7). Replace with: The engines do not have an illuminated MIL or stored OBD trouble code that lead you to reject the vehicle from the test program as described in Part I, section I.4.8.1.3.1 of these test procedures.

4.7.1.2.5 Delete subparagraph (a)(8): Replace with: The vehicles are likely to operate for at least three hours (excluding idle) over a

complete test sampling period, as described in Part I, section I.4.1.4 of these test procedures.

4.7.1.2.6 Delete subparagraph (a)(9). Replace with: The vehicles have not exceeded the applicable useful life, in Part I, section C.1 of these test procedures; you may otherwise not exclude vehicles from testing based on their age or mileage.

4.7.1.2.7 Subparagraph (a)(10): [No change.]

4.7.1.3 Delete subparagraph (b). Replace with: The manufacturer must keep any records of a vehicle's maintenance and use history obtained from the owner or operator, as required by Part I, section I.4.10 of these test procedures. The manufacturer must report the engine's maintenance and use history and information related to the OBD system, as described in Part I, section I.4.9 of these test procedures.

4.7.1.4 Subparagraphs (c) and (d): [No change, except references to § 86.1920 shall mean section Part I, section I.4.9 of these test procedures.]

4.8. Vehicle Preparation for MAW In-use Testing

4.8.1 § 86.1910 How must I prepare and test my in-use engines?

October 25, 2016. Amend as follows:

4.8.1.1 References to "engines" shall mean "vehicles". References to "engine families" shall mean "test groups".

4.8.1.2 Delete subparagraph (a): [No change, except the reference to §§ 86.094-21(b)(1)(ii) and 86.094-22(e) shall mean 40 CFR § 86.1833-01, the reference to § 86.1925 shall mean Part I, section I.4.10 of these test procedures, and the reference to § 86.1920 (b)(3)(x) shall mean Part I, section I.4.9 of these test procedures.]

4.8.1.3 Subparagraph (b): Amend as follows:

4.8.1.3.1 Subparagraphs (b)(1) and (b)(2): [No change, except references to § 86.1920 shall mean Part I, section I.4.9 of these test procedures.]

4.8.1.3.2 Subparagraph (b)(3): Amend as follows:

4.8.1.3.2.1 Subparagraphs (b)(3)(i) and (b)(3)(iii): [No change, except references to § 86.1912 shall mean Part I, section I.4.4 of these test procedures and references to § 86.1920 shall mean Part I, section I.4.9 of these test procedures.]

4.8.1.3.2.2 Subparagraph (b)(3)(iv): [No change, except references to § 86.1920 shall mean Part I, section I.4.9 of these test procedures.]

4.8.1.4 Subparagraph (c): Use appropriate fuels for testing, as follows:

4.8.1.4.1 Delete subparagraph (c)(1). Replace with: For diesel vehicles, the manufacturer shall use any commercially available diesel fuel that meets the specifications for No. 2-D S15 in ASTM D 975 (incorporated by reference in 40 CFR § 86.1), as required in the calendar year that in-use testing occurs.

4.8.1.4.2 Delete subparagraph (c)(2). Replace with: The manufacturer may use any commercially available biodiesel fuel blend.

4.8.1.4.3 Delete subparagraph (c)(3). Replace with: For diesel vehicles, the manufacturer may drain a prospective test vehicle's fuel tank(s) and refill the tank(s) with diesel fuel conforming to ASTM D 975 specifications in Part I, section I.4.8.1.4.1 or commercially available biodiesel described in Part I, section I.4.8.1.4.2 of these test procedures. For gasoline vehicles, the manufacturer may drain and refill tank(s) with commercially available fuel described in Part I, section I.4.8.1.4.4 of these test procedures.

4.8.1.4.4 Add the following new requirement for gasoline vehicles: For gasoline vehicles, the manufacturer shall use commercially available fuel that meets the following California fuel specifications:

4.8.1.4.4.1 For conventional gasoline vehicles: California Reformulated Gasoline Phase 3 as indicated in title 13, CCR, § 2262.

4.8.1.4.4.2 For flex-fueled gasoline vehicles: E-85 Fuel Ethanol as indicated in title 13, CCR, § 2292.4.

4.8.1.4.5 Subparagraph (c)(4) and (c)(5): [No change.]

4.8.1.4.6 Delete subparagraph (c)(6). Replace with: The manufacturer may take fuel samples from test vehicles to ensure that appropriate fuels were used during in-use testing. If a vehicle fails the vehicle-pass criteria and the manufacturer can show through fuel sample testing that an inappropriate fuel was used during the failed test, that particular test may be voided, and then drain the vehicle's fuel tank(s) and refill the tank(s) with the appropriate fuel described in Part I, section I.4.8.1.4. The manufacturer must report any fuel tests that are the basis of voiding a test in the report under Part I, section I.4.9 of these test procedures.

- 4.8.1.5 Subparagraph (d): [Delete; See Part I, sections I.4.1 and I.4.2.]
- 4.8.1.6 Delete subparagraph (e). Replace with: The manufacturer must test the vehicle under conditions reasonably expected to be encountered during normal vehicle operation and use. For the purposes of Part I, section I.4 of these test procedures, normal operation and use would generally include consideration of the vehicle's normal routes and loads (including auxiliary loads such as air conditioning in the cab), normal ambient conditions.
- 4.8.1.7 Subparagraphs (f) through (i): [n/a]
- 4.8.1.8 Subparagraph (j): [No change.]

4.9. MAW In-use Reporting

4.9.1 § 86.1920 What in-use testing information must I report to EPA?

October 25, 2016. Amend as follows:

- 4.9.1.1 References to "engines" shall mean "vehicles". References to "engine families" shall mean "test groups". References to "EPA" shall mean "CARB".
- 4.9.1.2 Subparagraph (a): [No change, except replace the address where reports must be sent to with iuvp@arb.ca.gov.]
- 4.9.1.3 Subparagraph (b): Amend as follows:
 - 4.9.1.3.1 Subparagraph (b)(1): [No change.]
 - 4.9.1.3.2 Subparagraph (b)(2): [No change, except the reference to § 86.1908(a) shall mean Part I, section I.4.7 of these test procedures.]
 - 4.9.1.3.3 Subparagraph (b)(3): Amend as follows:
 - 4.9.1.3.3.1 Subparagraph (b)(3)(i): [No change.]
 - 4.9.1.3.3.2 Subparagraph (b)(3)(ii): [n/a]
 - 4.9.1.3.3.3 Subparagraphs (b)(3)(iii) through (b)(3)(v): [No change.]
 - 4.9.1.3.3.4 Delete subparagraph (b)(3)(vi). Replace with: The vehicle's type or application. Also, identify the type of trailer and weight loading.
 - 4.9.1.3.3.5 Subparagraphs (b)(3)(vii) through (b)(3)(x): [No change.]
 - 4.9.1.3.4 Subparagraph (b)(4): Amend as follows:
 - 4.9.1.3.4.1 Subparagraph (b)(4)(i): [No change.]

- 4.9.1.3.4.2 Delete subparagraph (b)(4)(ii). Replace with: Days of testing, duration of testing, and the total hours of operation.
- 4.9.1.3.4.3 Subparagraphs (b)(4)(iii): [No change.]
- 4.9.1.3.4.4 Subparagraph (b)(4)(iv): [No change, except the reference to § 86.1910 (e) shall mean Part I, section I.4.8.1.6 of these test procedures.]
- 4.9.1.3.4.5 Subparagraph (b)(4)(v): [No change, except the reference to § 86.1908 or § 86.1910 shall mean Part I, section I.4.7 or section I.4.8 of these test procedures.]
- 4.9.1.3.4.6 Subparagraphs (b)(4)(vi) and (b)(4)(vii): [No change, except replace the term "NTE event" with "window".]
- 4.9.1.3.4.7 Delete subparagraph (b)(4)(viii). Replace with: Total number of windows and the number of windows per bin.
- 4.9.1.3.4.8 Delete subparagraph (b)(4)(ix). Replace with: Describe the method used to determine NMHC as specified in 40 CFR § 1065, subpart J. Report the results of testing conducted per Part I, section I.4.1 of these test procedures.
- 4.9.1.3.4.9 Subparagraph (b)(4)(x): [No change.]
- 4.9.1.3.4.10 Subparagraph (b)(4)(xi): [n/a]
- 4.9.1.3.4.11 Delete subparagraph (b)(4)(xii). Replace with: The manufacturer shall collect at a minimum the following data stream values (if the vehicle is so-equipped) at 1 second intervals (i.e., 1 Hertz) and submit the data in a comma separated value file for each test.
- 4.9.1.3.4.11.1 Subparagraphs (b)(4)(xii)(A) through (b)(4)(xii)(G): [No change.]
- 4.9.1.3.4.11.2 Delete subparagraph (b)(4)(xii)(H). Replace with: Exhaust aftertreatment temperatures
- 4.9.1.3.4.11.3 Subparagraph (b)(4)(xii)(I) and (b)(4)(xii)(O): [No change.]
- 4.9.1.3.4.11.4 Add the following to the list of required data:
- actual engine torque
 - reference engine maximum torque
 - engine oil temperature
 - fuel rate
 - modeled exhaust flow

- intake air/manifold temperature
- air flow rate (from mass air flow sensor)
- fuel injection timing
- EGR mass flow rate
- commanded EGR valve duty cycle/position
- actual EGR valve duty cycle/position
- EGR error between actual and commanded
- boost pressure
- commanded/target boost pressure
- PM filter inlet temperature
- PM filter outlet temperature
- exhaust gas temperature sensor output
- variable geometry turbo position
- corrected NOx sensor output.
- DEF dosing mode
- stability of NOx sensor reading
- engine friction – percent torque
- commanded DEF dosing
- DEF usage for current driving cycle
- DEF dosing rate
- charge air cooler outlet temperature
- SCR intake temperature
- SCR outlet temperature
- modeled actual ammonia storage level on SCR
- target ammonia storage level on SCR
- NOx mass emission rate – engine out
- NOx mass emission rate – tailpipe
- Vehicle speed
- Engine run time
- Hydrocarbon doser flow rate

4.9.1.3.4.11.5 For in-use testing, the manufacturer shall additionally collect an OBD scan (i.e., snapshot of data) of all data stream parameters, all service mode data, and all tracked data (i.e., all data required in title 13, CCR sections 1968.2 g(4), g(5), and g(6)) at the beginning of the test sampling period, at any key-off events, and the end of each test sampling period during testing.

4.9.1.3.5 Subparagraph (b)(5): [n/a]

4.9.1.3.6 Subparagraph (b)(6): Amend as follows:

- 4.9.1.3.6.1 Add the following: For vehicles, identify the in-use thresholds for the 3B-MAW and MAW as described in Part I, section I.4.1 of these test procedures.
- 4.9.1.3.6.2 Subparagraph (b)(6)(i): [No change, except the reference to § 86.1912(f) shall mean Part I, section I.4.1 of these test procedures.]
- 4.9.1.3.6.3 Subparagraph (b)(6)(ii): [No change.]
- 4.9.1.3.6.4 Subparagraph (b)(6)(iii): [No change, except the reference to § 86.1912(f) shall mean Part I, section I.4.1 of these test procedures.]
- 4.9.1.3.6.5 Delete subparagraph (b)(6)(iv). Replace with: If possible, state the outcome of testing for the test group based on the criteria in Part I, section I.4.4 of these test procedures.
- 4.9.1.4 Subparagraph (c): Amend as follows:
 - 4.9.1.4.1 Subparagraph (c)(1) through (c)(6): [No change, except the reference to § 86.1912 shall mean Part I, section I.4.1 of these test procedures.]
 - 4.9.1.4.2 Add the following requirement: For gasoline vehicles, show how enrichment operation was determined and used for data exclusion.
- 4.9.1.5 Subparagraph (d): [No change, except that electronic notifications must be sent to CARB at iuvp@arb.ca.gov, and the reference to § 86.1905 shall mean Part I, section I.4.6 of these test procedures.]
- 4.9.1.6 Delete subparagraph (e). Replace with: Send CARB an electronic notification at iuvp@arb.ca.gov within 15 days after the manufacturer's initial review of the test data for a selected test group indicates that three vehicles have failed to comply with the vehicle-pass criteria.
- 4.9.1.7 Subparagraph (f): [No change.]
- 4.9.1.8 Delete subparagraph (g). Replace with: CARB may require the manufacturer to send more information to evaluate whether the test group meets the requirements of this part, or to help inform potential decisions concerning testing.

4.10. MAW In-use Records

- 4.10.1 **§ 86.1925 What records must I keep?** June 14, 2005. Amend as follows:

- 4.10.1.1 References to “engines” shall mean “vehicles”. References to “engine families” shall mean “test groups”. References to “EPA” shall mean “CARB”.
- 4.10.1.2 Subparagraph (a): [No change.]
- 4.10.1.3 Subparagraph (b): Amend as follows:
 - 4.10.1.3.1 Subparagraph (b)(1): [No change, except the reference to § 86.1920 shall mean Part I, section I.4.9 of these test procedures.]
 - 4.10.1.3.2 Subparagraph (b)(2): Amend as follows:
 - 4.10.1.3.2.1 Subparagraph (b)(2)(i): [No change, except the reference to § 86.1908 shall mean Part I, section I.4.7 of these test procedures.]
 - 4.10.1.3.2.2 Subparagraph (b)(2)(ii): [No change, except the reference to § 86.1910 shall mean Part I, section I.4.8 of these test procedures.]
 - 4.10.1.3.2.3 Subparagraph (b)(2)(iii): [No change, except the reference to § 86.1920 shall mean Part I, section I.4.9 of these test procedures.]
 - 4.10.1.3.2.4 Subparagraph (b)(2)(iv): [No change, except the reference to § 86.1912 shall mean Part I, section I.4.1 of these test procedures.]
 - 4.10.1.3.3 Subparagraph (b)(3): [No change, except delete reference to 40 CFR part 1065.]

Appendices I, II, and III to 40 CFR, Part 86, Subpart S: [No change.]

J. Procedural Requirements

1. **§ 86.1848-10 Compliance with emission standards for the purpose of certification. October 25, 2016.** Amend as follows:
 - 1.1. 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 standards. October 25, 2016.**
 - 13.1 Amend subparagraph (a) as follows: *Overview.* This section describes reporting and recordkeeping requirements for all vehicles subject to the emission standards in title 13, CCR, sections 1961.4, 1962.4, and 1976.
 - 13.2 Subparagraph (b): [No change.]

13.3 Amend subparagraph (c) as follows:

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

13.3.2 Delete subparagraph (c)(4). Replace with: Unless a manufacturer reports the data required by this section in the annual production report required under § 86.1844-01(e), a manufacturer must submit an annual report for each model year after production ends for all affected vehicles produced by the manufacturer subject to the provisions of this subpart and no later than March 1 of the calendar year following the given model year. Annual reports must be provided to the California Air Resources Board through the electronic Document Management System available through the website: <https://arb.ca.gov/certification-document-management-system>.

13.3.3 Subparagraph (c)(5): [n/a]

13.3.4 Subparagraph (c)(6): [Amend to replace references from "EPA" to "the Executive Officer of the California Air Resources Board."]

13.4 Subparagraph (d): [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. [n/a]

16. § 86.1866-12 CO₂ fleet average credit programs. October 25, 2016. [n/a]

17. § 86.1867-12 Optional early CO₂ credit programs. October 25, 2016. [n/a]

18. § 86.1868-12 CO₂ credits for improving the efficiency of air conditioning systems. October 25, 2016. [n/a]

19. § 86.1869-12 CO₂ credits for off-cycle CO₂-reducing technologies. October 25, 2016. [n/a]

20. § 86.1870-12 CO₂ credits for qualifying full-size light pickup trucks. October 25, 2016. [n/a]

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 on passenger cars, light-duty trucks, and medium-duty vehicles.

A. Certification Fuel Specifications.

1. **86.113-94 Fuel Specifications. April 28, 2014.**
2. **86.113-04 Fuel Specifications. June 29, 2021.**
3. **86.113-15 Fuel Specifications. April 28, 2014.**

3.1. California Certification Gasoline Specifications.

Add the following subparagraph to section 86.113-15, which reads: For all light-duty vehicles and medium-duty vehicles certifying to the LEV IV standards in title 13, CCR, section 1961.4, gasoline having the specifications listed below may be used in exhaust emission testing, as an option to the specifications set forth in 40 CFR section 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 section 1065.710(b) (June 29, 2021), the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications set forth in 40 CFR section 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 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles."

**California Certification Gasoline Specifications for
LEV IV 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 °F	
50% point	205-215 °F	
90% point	310-320 °F	
EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§ 2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§ 2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§ 2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§ 2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§ 2263, title 13 CCR
Benzene	0.6-0.8 vol. %	§ 2263, title 13 CCR
C7 Aromatics (toluene)	5.2-6.4 vol. %	D 5769
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
Gum, washed	3.0 mg/100 mL (max)	D 381-86

**California Certification Gasoline Specifications for
LEV IV Light-Duty Vehicles and Medium-Duty Vehicles**

Fuel Property^(a)	Limit	Test Method ^(b)
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report ^(e)	
Heat of Combustion	Report ^(e)	
Carbon	Report wt. % ^(e)	
Hydrogen	Report wt. % ^(e)	

^(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 title 13, CCR section 2263 refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

^(e) 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.

3.2. California Certification Diesel Fuel Specifications.

3.2.1 Amend subparagraph § 86.113-94(b)(2) 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 2D" 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 40 CFR § 86.113-94 (b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

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

^(a) ASTM specifications unless otherwise noted. A reference to a subsection of § 2282, title 13, CCR, means the test method identified in that subsection for the particular property. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results of the specified method.

3.2.2 Amend subparagraph § 86.113-94(b)(3) as follows:

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

3.3. **Alcohol Fuels.**

Amend § 86.113-94(c) as follows:

3.3.1 Delete subparagraph (c)(1); 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 title 13, CCR, section 2292.1 (Specifications for M-100 Fuel Methanol) or title 13, CCR, section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

Specification	Limit
M-100 Fuel Methanol	
Methanol	98.0 ± 0.5 vol. percent
Ethanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of Part II, section A.3.1.	1.0 ± 0.1 vol. percent
E-100 Fuel Ethanol	
Ethanol	98.0 ± 0.5 vol. percent
Methanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of Part II, section A.3.1.	1.0 ± 0.1 vol. percent

3.3.2 Delete subparagraph (c)(2); replace with:

(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 title 13, CCR, section 2292.1 (Specifications for M-100 Fuel Methanol) or title 13, CCR, section 2292.3 (Specification for E-100 Fuel Ethanol).

3.3.3 Subparagraph (c)(3): [No Change.]

3.3.4 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. 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.

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

3.4.1 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 title 13, CCR, section 2292.2 (Specifications for M-85 Fuel Methanol) or title 13, CCR 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).

Specification	Limit
M-85 Fuel Methanol	
Petroleum fuel meeting the specifications of Part II, section A.3.1.	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

E-85 Fuel Ethanol	
Petroleum fuel meeting the specifications of Part II, section A.3.1.	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

3.4.2 Mileage accumulation fuel. For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel shall meet the applicable specifications in Part II, section A.3.1. and methanol or ethanol fuel shall meet the applicable specifications set forth in title 13, CCR, section 2292.2 (Specifications for M-85 Fuel Methanol) or title 13, CCR, 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.

3.4.3 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.3.1. 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 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles." 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."

3.4.4 **Additive requirements.** Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. 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.

3.5. **Natural Gas Fuels.**

Amend § 86.113-94(e) as follows:

3.5.1 Delete subparagraph (e)(1); 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 title 13, CCR, section 2292.5, (Specifications for Compressed Natural Gas) as modified by the following:

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

3.5.2 Delete subparagraph (e)(2); replace with:

(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 title 13, CCR, section 2292.5, (Specifications for Compressed Natural Gas).

3.5.3 Delete subparagraph (e)(3).

3.6. **Liquefied Petroleum Gas Fuels.**

Amend § 86.113-94(f) as follows:

3.6.1 Delete subparagraph (f)(1); 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 title 13, CCR, section 2292.6, (Specifications for Liquefied Petroleum Gas) as modified by the following:

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

3.6.2 Delete subparagraph (f)(2); replace with:

(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 title 13, CCR, section 2292.6, (Specifications for Liquefied Petroleum Gas).

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

3.7. **§ 86.113-94(g).** [No Change.]

3.8. **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 § 86.11394, § 86.11304, § 86.11315, 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 title 13, CCR, section 2137(b) establishing by regulation specifications for the fuel as it is sold commercially to the public.

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

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG, NO_x, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years." In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

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

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

B. 40 CFR Part 1066 – Vehicle-Testing Procedures.

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

1. Subpart A – Applicability and General Provisions.

- 1066.1 Applicability. June 29, 2021.
- 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.

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

- 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.
 - 2.2. Subparagraphs (b) through (e). [No change.]
- 1066.150 Analyzer interference and quench verification limit. April 28, 2014.

3. Subpart C – Dynamometer Specifications.

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.

4. Subpart D – Coastdown.

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.

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

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.

1066.425 Test preparation. June 29, 2021.

1066.425 Performing emission tests. October 25, 2016.

6. 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 Part II, section I or with the "California Test Procedures for 2026 and Subsequent Model Year Zero-Emission Vehicles and Plug-in Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," as applicable.]

7. 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 NO_x 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, except as noted in "California NMOG Determination," below.]

California NMOG Determination. The provisions of Part I, section D.2 shall apply. A manufacturer may use the conversion factors in section 1066.635 as an alternative to the conversion factors in Part I, section D.1.7.5.

1066.695 Data requirements. October 25, 2016.

8. 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.

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

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.

9.1. Exhaust emission test procedures for Partial Soak FTP testing.

Amend § 1066.815 as follows:

9.1.1 Amend subparagraph (a) as follows: *General*. The Partial Soak FTP exhaust emission test sequence consists of an FTP emission test as described in § 1066.801 followed by one, or a consecutive sequence of, partial soak cold-start test(s).

9.1.2 Subparagraph (b): *PM sampling options*. [n/a]

9.1.3 Subparagraph (c): *Gaseous sampling options*. [No change.]

9.1.4 Amend subparagraph (d) as follows: *Test sequence*. Follow the exhaust emission measurement procedures specified in § 1066.410 through 1066.425, subject to the following exceptions and additional provisions:

9.1.4.1 Amend subparagraph (1) as follows: Take the following steps for the Partial Soak FTP exhaust emission test sequence:

9.1.4.1.1 Amend subparagraph (i) as follows: Conduct an FTP emission test as described in § 1066.815.

9.1.4.1.2 Amend subparagraph (ii) as follows: After the FTP emission test is complete, the vehicle shall be soaked for 10 minutes to 12 hours. Throughout the soak period, the vehicle shall remain shut off, the engine compartment cover (i.e. hood) shall be closed, and cooling of any vehicle components is not permitted, except by ambient air. The ambient air temperature must remain between 68 to 86° F throughout the soak period. Following the 10 minute to 12 hour soak period, initiate the partial soak cold-start test by operating the vehicle over the first 505 seconds of the UDDS test

cycle. Start sampling and recording simultaneously with starting the vehicle. Place the vehicle in gear 15 seconds after engine starting, which is 5 seconds before the first acceleration.

9.1.4.1.3 Subparagraph (iii): [n/a].

9.1.4.1.4 Amend subparagraph (iv) as follows: Turn off the engine and simultaneously stop all sampling and recording, including background sampling, and any integrating devices at the end of the deceleration scheduled to occur 505 seconds into the UDDS test cycle.

9.1.4.2 Subparagraph (2): [n/a]

9.1.4.3 Amend subparagraph (3) as follows: This completes the procedure for measuring Partial Soak FTP exhaust emissions. To determine compliance with the Partial Soak emission standards, the test sequence outlined in Part II, sections B.9.1.4.1.2 to B.9.1.4.1.4 may be repeated to measure Partial Soak FTP exhaust emissions on additional Partial Soak FTP tests.

9.2. Exhaust emission test procedures for Quick Drive-Away FTP testing.

Amend § 1066.815 as follows:

9.2.1 Amend subparagraph (a) as follows: *General*. The Quick DriveAway FTP exhaust emission test sequence consists of a cold-start Quick Drive-Away FTP Test and an FTP emission test as described in § 1066.801.

9.2.2 Subparagraph (b): *PM sampling options*. [n/a]

9.2.3 Subparagraph (c): *Gaseous sampling options*. [No change.]

9.2.4 Amend subparagraph (d) as follows: *Test sequence*. Follow the exhaust emission measurement procedures specified in §§ 1066.410 through 1066.425, subject to the following exceptions and additional provisions:

9.2.4.1 Amend subparagraph (1) as follows: Take the following steps for the cold-start Quick Drive-Away FTP Test:

- 9.2.4.1.1 Amend subparagraph (i) as follows: Precondition the vehicle as described in § 1066.816. Following the 12 to 36 hour soak period, initiate the cold-start Quick Drive-Away FTP Test by operating the vehicle over the first 505 seconds of the Quick Drive-Away UDDS described in Part II, section H of this test procedure.
- 9.2.4.1.2 Amend subparagraph (ii) as follows: Start sampling and recording simultaneously with starting the vehicle. Place the vehicle in gear 6 seconds after engine starting, which is 2 seconds before the first acceleration.
- 9.2.4.1.3 Subparagraph (iii): [n/a].
- 9.2.4.1.4 Amend subparagraph (iv) as follows: At the end of the cold-start Quick Drive-Away FTP Test (i.e. 505 seconds into the Quick Drive-Away UDDS), turn off the engine and simultaneously stop all sampling and recording, including background sampling, and any integrating devices.

9.2.4.2 Subparagraph (2): [n/a]

9.2.4.3 Amend subparagraph (3) as follows: This completes the procedure for measuring cold-start Quick Drive-Away FTP exhaust emissions. Conduct an FTP emission test as described in § 1066.815 to determine stabilized and hot transient emissions.

1066.816 Vehicle preconditioning for FTP testing. April 28, 2014.

1066.820 Composite calculations for FTP exhaust emissions. October 25, 2016.

9.3. **Composite calculations for Partial Soak FTP exhaust emissions.**

Amend § 1066.820 as follows:

9.3.1 Amend subparagraph (a) as follows: Determine the mass of exhaust emissions of each pollutant for each test interval in Part II, section B.9.3.2 as described in § 1066.605.

9.3.2 Amend Subparagraph (b) as follows: Calculate the final composite gaseous test results as a mass-weighted value, $e_{\text{partial_soak}}$, in grams per mile, using the following equation:

$$e_{\text{partial_soak}} = 0.43 \left(\frac{m_{ps} + m_{cs}}{D_{ps} + D_{cs}} \right) + 0.57 \left(\frac{m_{ht} + m_{hs}}{D_{ht} + D_{hs}} \right)$$

Where:

- mps = the mass emissions determined from the partial soak cold-start test in Part II, sections B.9.1.4.1.2 to B.9.1.4.1.4, in grams.
- mcs = the mass emissions determined from the cold stabilized portion (i.e., bag 2) of the FTP test conducted in Part II, section B.9.1.4.1.1, in grams.
- mht = the mass emissions determined from the hot transient portion (i.e., bag 3) of the FTP test conducted in Part II, section B.9.1.4.1.1, in grams.
- mhs = the mass emissions determined from the hot stabilized portion (i.e., bag 4 or bag 2 if bag 4 was not measured) of the FTP test conducted in Part II, section B.9.1.4.1.1, in grams.
- Dps = the measured driving distance from the partial soak cold-start test in Part II, sections B.9.1.4.1.2 to B.9.1.4.1.4, in miles.
- Dcs = the measured driving distance from the cold stabilized portion (i.e., bag 2) of the FTP test conducted in Part II, section B.9.1.4.1.1, in miles.
- Dht = the measured driving distance from the hot transient portion (i.e., bag 3) of the FTP test conducted in Part II, section B.9.1.4.1.1, in miles.
- Dhs = the measured driving distance from the hot stabilized portion (i.e., bag 4 or bag 2 if bag 4 was not measured) of the FTP test conducted in Part II, section B.9.1.4.1.1, in miles.

9.3.3 Subparagraph (c). [n/a]

9.4. Composite calculations for Quick Drive-Away FTP exhaust emissions.

Amend § 1066.820 as follows:

- 9.4.1 Amend subparagraph (a) as follows: Determine the mass of exhaust emissions of each pollutant for each test interval in Part II, section B.9.4.2 as described in § 1066.605.

9.4.2 Amend Subparagraph (b) as follows: Calculate the final composite gaseous test results as a mass-weighted value, $e_{\text{quick_drive_away}}$, in grams per mile, using the following equation:

$$e_{\text{quick_drive_away}} = 0.43 \left(\frac{m_{qd} + m_{cs}}{D_{qd} + D_{cs}} \right) + 0.57 \left(\frac{m_{ht} + m_{hs}}{D_{ht} + D_{hs}} \right)$$

Where:

m_{qd} = the mass emissions determined from the cold-start Quick Drive-Away Test in Part II, sections B.9.2.4.1.1 to B.9.2.4.1.4, in grams.

m_{cs} = the mass emissions determined from the cold stabilized portion (i.e., bag 2) of the FTP test conducted in Part II, section B.9.2.4.3, in grams.

m_{ht} = the mass emissions determined from the hot transient portion (i.e., bag 3) of the FTP test conducted in Part II, section B.9.2.4.3, in grams.

m_{hs} = the mass emissions determined from the hot stabilized portion (i.e., bag 4 or bag 2 if bag 4 was not measured) of the FTP test conducted in Part II, section B.9.2.4.3, in grams.

D_{qd} = the measured driving distance from the cold-start Quick Drive-Away Test in Part II, sections B.9.2.4.1.1 to B.9.2.4.1.4, in miles.

D_{cs} = the measured driving distance from the cold stabilized portion (i.e., bag 2) of the FTP test conducted in Part II, section B.9.2.4.3, in miles.

D_{ht} = the measured driving distance from the hot transient portion (i.e., bag 3) of the FTP test conducted in Part II, section B.9.2.4.3, in miles.

D_{hs} = the measured driving distance from the hot stabilized portion (i.e., bag 4 or bag 2 if bag 4 was not measured) of the FTP test conducted in Part II, section B.9.2.4.3, in miles.

9.4.3 Subparagraph (c). [n/a]

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.
 2. 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 G.
- 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.

10.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.

C. 50°F Emission Test Procedure.

The NMOG, CO, NO_x, and formaldehyde emissions from all light- and medium-duty vehicles shall be measured according to the Federal Test Procedure as set forth in 40 CFR Part 1066 at a nominal temperature of 50°F with the following modifications:

(1) **Test Procedure.**

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

(b) Following a 12 to 36 hour cold soak at a nominal temperature of 50°F, the nominal preconditioning, soak, and test temperatures shall be maintained within 3°F of the nominal temperature on an average basis and within 5°F of the nominal temperature on a continuous basis. The temperature shall be sampled at least once every 15 seconds during the preconditioning and test periods and at least once each 5 minutes during the soak period. A continuous strip chart recording of the temperature with these minimum time resolutions is an acceptable alternative to employing a data acquisition system.

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

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

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

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

D. Unified Cycle Driving Schedule.

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Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	32	11.1	63	1.2	94	21.9	125	28	156	36.9	187	38	218	0
2	0	33	11.1	64	3.5	95	16.5	126	24.2	157	37.2	188	38.4	219	0
3	0	34	11.1	65	7.7	96	10	127	20	158	37.6	189	39.2	220	0
4	0	35	13.1	66	11.1	97	4.6	128	16.1	159	37.6	190	39.6	221	0
5	0	36	15	67	13.8	98	1.5	129	11.5	160	37.6	191	39.9	222	0
6	0	37	16.9	68	16.5	99	0.4	130	8.1	161	37.2	192	40.7	223	0
7	0	38	16.9	69	18.4	100	0	131	5	162	37.2	193	40.3	224	0
8	0	39	16.1	70	20.4	101	0	132	3.5	163	36.9	194	41.1	225	0
9	0	40	15.7	71	20.7	102	0	133	1.9	164	36.5	195	41.1	226	0
10	0	41	15.4	72	19.6	103	0	134	0	165	36.5	196	40.7	227	0
11	0	42	15	73	17.3	104	0	135	0	166	34.9	197	31.9	228	0
12	0	43	13.8	74	12.3	105	0	136	0	167	33.4	198	23.9	229	0
13	0	44	10.8	75	8.1	106	0	137	0	168	31.9	199	15.9	230	0
14	0	45	8.4	76	6.1	107	0	138	0	169	29.2	200	7.9	231	0
15	0	46	6.1	77	9.6	108	0.4	139	0	170	25	201	2.7	232	0
16	0	47	4.2	78	12.7	109	1.2	140	0	171	25	202	0.4	233	0
17	0	48	3.5	79	15.7	110	1.9	141	0	172	26.1	203	0.4	234	0
18	0	49	3.5	80	18	111	3.8	142	0	173	27.6	204	2.7	235	0
19	0	50	1.5	81	20.4	112	7.7	143	1.5	174	29.2	205	3.8	236	0
20	0	51	0	82	21.9	113	11.5	144	6.9	175	31.1	206	3.8	237	0
21	1.2	52	0	83	23.4	114	14.6	145	12.7	176	32.3	207	1.5	238	1.5
22	4.2	53	0	84	23.8	115	18	146	16.5	177	34.2	208	0	239	5
23	7.3	54	0	85	24.6	116	21.5	147	20	178	34.9	209	0	240	8.8
24	8.8	55	0	86	25	117	25	148	23	179	35.7	210	0	241	11.5
25	10.8	56	0	87	26.1	118	28.4	149	25.7	180	36.5	211	0	242	14.2
26	12.3	57	0	88	26.1	119	30.7	150	28	181	36.9	212	0	243	15.4
27	13.1	58	0	89	26.9	120	31.9	151	30.7	182	36.9	213	0	244	16.1
28	12.3	59	0	90	26.9	121	32.3	152	32.6	183	37.2	214	0	245	16.1
29	12.3	60	0	91	26.9	122	32.3	153	34.2	184	37.6	215	0	246	16.9
30	11.5	61	0	92	26.5	123	31.9	154	35.3	185	37.2	216	0	247	16.5
31	11.5	62	0	93	25.7	124	30.3	155	36.9	186	37.6	217	0	248	16.9

Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
249	18	280	20.7	311	0	342	40.7	373	49.9	404	59.1	435	61.8
250	19.2	281	20.7	312	0	343	40.3	374	49.5	405	58.8	436	61.8
251	20.4	282	19.6	313	0.4	344	41.1	375	49.5	406	58.8	437	61.1
252	20.4	283	16.5	314	2.7	345	41.5	376	48.8	407	58	438	60.7
253	21.1	284	13.1	315	7.3	346	42.6	377	48.8	408	58	439	60.3
254	21.1	285	9.6	316	11.5	347	43.4	378	48.8	409	57.6	440	60.3
255	22.3	286	7.3	317	15.4	348	44.2	379	48.4	410	57.6	441	60.3
256	23	287	3.8	318	18.4	349	44.9	380	48.8	411	57.6	442	59.5
257	23.8	288	0.8	319	20.7	350	45.7	381	49.5	412	57.6	443	58.8
258	24.2	289	0	320	24.2	351	46.5	382	50.3	413	57.6	444	59.1
259	24.6	290	0	321	26.9	352	46.8	383	50.7	414	59.1	445	58.8
260	25	291	0	322	29.6	353	47.2	384	51.8	415	59.5	446	58.8
261	25.7	292	0	323	31.1	354	48	385	52.6	416	59.9	447	58.8
262	25.7	293	0	324	32.6	355	47.6	386	53.4	417	60.3	448	58.4
263	26.5	294	0	325	33.8	356	48.4	387	54.1	418	60.3	449	58
264	27.6	295	0	326	34.9	357	48	388	55.3	419	61.1	450	58
265	28.4	296	0	327	36.9	358	47.2	389	55.3	420	60.3	451	58
266	29.2	297	0	328	39.2	359	46.1	390	56.1	421	59.9	452	58.4
267	30.3	298	0	329	41.1	360	45.7	391	56.4	422	59.5	453	59.1
268	31.1	299	0	330	43	361	44.9	392	56.4	423	59.1	454	59.5
269	31.1	300	0	331	43.8	362	44.2	393	56.4	424	59.1	455	59.9
270	30.7	301	0	332	44.5	363	43.8	394	57.2	425	59.5	456	59.9
271	31.1	302	0	333	45.3	364	44.5	395	56.8	426	59.5	457	60.3
272	29.6	303	0	334	45.3	365	44.9	396	57.6	427	59.5	458	61.1
273	29.2	304	0	335	44.9	366	45.3	397	57.6	428	59.9	459	61.1
274	29.2	305	0	336	44.5	367	46.5	398	57.6	429	60.3	460	61.1
275	28.8	306	0	337	43.8	368	48	399	58	430	60.7	461	61.4
276	28	307	0	338	43.4	369	48.8	400	58	431	60.7	462	61.4
277	23	308	0	339	42.6	370	49.5	401	58.4	432	61.4	463	61.1
278	21.1	309	0	340	41.9	371	49.9	402	58.4	433	61.8	464	60.7
279	21.5	310	0	341	41.5	372	49.9	403	58.8	434	61.8	465	59.9

Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
497	30.3	528	0	559	0	590	18.4	621	20	652	25	683	35.7
498	30	529	0	560	0	591	21.1	622	21.5	653	26.5	684	34.9
499	30	530	0	561	0	592	23.4	623	22.3	654	28	685	34.6
500	29.6	531	0.8	562	0	593	25.3	624	22.3	655	29.6	686	34.2
501	30	532	1.9	563	0	594	27.6	625	22.3	656	30.7	687	33.8
502	28.8	533	3.8	564	0	595	28.8	626	22.3	657	32.3	688	33.4
503	28.8	534	6.9	565	0	596	30.3	627	23	658	33	689	33
504	28	535	9.6	566	0	597	30.7	628	23	659	34.2	690	30.3
505	28.4	536	11.1	567	0	598	31.5	629	22.7	660	34.6	691	29.2
506	28	537	11.1	568	0	599	31.1	630	22.3	661	35.3	692	28.4
507	28.4	538	10.4	569	0	600	31.1	631	21.9	662	36.1	693	25
508	28.4	539	8.8	570	0	601	30.3	632	22.7	663	36.1	694	21.1
509	28.8	540	9.2	571	0	602	30.3	633	23.8	664	36.9	695	16.9
510	28.4	541	10	572	0.4	603	30.3	634	25	665	36.9	696	13.4
511	28.4	542	10.4	573	1.5	604	30.7	635	25.3	666	37.6	697	13.1
512	28	543	10.4	574	3.5	605	31.1	636	25.7	667	37.6	698	12.3
513	26.5	544	5.4	575	6.1	606	32.3	637	26.5	668	38.4	699	12.7
514	24.2	545	1.9	576	10.4	607	32.6	638	26.9	669	38	700	15.7
515	22.7	546	0	577	14.2	608	32.6	639	27.3	670	37.6	701	19.2
516	20.4	547	0	578	16.9	609	32.6	640	28	671	37.6	702	22.3
517	17.7	548	0	579	19.2	610	31.1	641	29.2	672	37.2	703	24.6
518	15.7	549	0	580	20	611	26.9	642	30	673	36.9	704	25.7
519	13.1	550	0	581	21.5	612	22.3	643	30	674	36.1	705	26.5
520	10.8	551	0	582	23.4	613	18	644	29.6	675	35.7	706	26.5
521	8.4	552	0	583	24.6	614	13.8	645	29.6	676	36.1	707	26.9
522	7.3	553	0	584	24.2	615	9.6	646	28.8	677	35.7	708	27.3
523	5	554	0	585	20	616	4.6	647	28.4	678	35.7	709	27.3
524	3.8	555	0	586	16.9	617	6.1	648	28	679	35.7	710	27.6
525	3.5	556	0	587	13.4	618	10	649	27.3	680	36.1	711	28.4
526	1.9	557	0	588	13.4	619	14.2	650	25.7	681	36.1	712	28.8
527	0.8	558	0	589	15.7	620	17.3	651	24.6	682	35.7	713	28.8

Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
745	0	776	16.9	807	15	838	0.8	869	61.8	900	64.5	931	65.3
746	0	777	16.5	808	13.1	839	3.5	870	62.6	901	64.1	932	64.9
747	0	778	16.9	809	9.2	840	3.8	871	63.4	902	63.7	933	63.7
748	0	779	16.9	810	6.9	841	2.3	872	63	903	63.7	934	63
749	0	780	16.9	811	4.6	842	0	873	63	904	63.7	935	59.9
750	0	781	17.3	812	4.6	843	1.2	874	62.6	905	64.5	936	55.3
751	0	782	19.2	813	4.6	844	6.9	875	61.8	906	64.5	937	50.7
752	0	783	20.4	814	4.2	845	13.8	876	61.8	907	64.9	938	49.2
753	0	784	21.1	815	5.4	846	18.8	877	62.2	908	64.5	939	48
754	0	785	22.3	816	4.6	847	23.8	878	62.2	909	64.1	940	46.1
755	0	786	22.3	817	3.5	848	27.3	879	62.6	910	64.9	941	44.2
756	0	787	22.7	818	2.3	849	30.7	880	63.7	911	65.3	942	41.1
757	0	788	22.3	819	2.3	850	33.8	881	64.5	912	65.3	943	39.9
758	0	789	22.7	820	1.9	851	37.6	882	64.9	913	65.3	944	36.1
759	0	790	22.3	821	3.1	852	40.7	883	66	914	64.1	945	32.6
760	0	791	23.8	822	6.1	853	43.8	884	66	915	63.4	946	29.2
761	0	792	25.7	823	4.6	854	46.1	885	66.8	916	63	947	24.6
762	0	793	27.6	824	2.7	855	48	886	66.4	917	63.4	948	20.7
763	1.5	794	29.6	825	2.3	856	49.5	887	66.8	918	64.1	949	19.2
764	5.4	795	30	826	2.3	857	51.5	888	67.2	919	64.9	950	16.5
765	9.2	796	29.2	827	3.1	858	53	889	66.4	920	65.3	951	15
766	11.5	797	27.6	828	4.2	859	54.5	890	66.4	921	64.5	952	11.9
767	14.6	798	25	829	3.5	860	55.7	891	66	922	64.1	953	9.6
768	17.3	799	23.8	830	3.8	861	56.8	892	65.7	923	63.4	954	8.4
769	19.2	800	23.4	831	4.2	862	58	893	65.7	924	63.7	955	5.8
770	21.1	801	24.2	832	3.5	863	59.1	894	66.4	925	63.4	956	1.2
771	20.7	802	23.4	833	3.5	864	60.3	895	66	926	63.4	957	0
772	20.7	803	23	834	3.5	865	61.1	896	65.7	927	63.4	958	0
773	19.6	804	20.4	835	4.6	866	61.8	897	65.3	928	63.4	959	0
774	18.4	805	18.8	836	5.8	867	61.8	898	65.3	929	63.7	960	1.2
775	16.9	806	17.3	837	3.5	868	61.8	899	64.5	930	64.5	961	3.1
												962	5
												963	8.4
												964	11.5
												965	14.6
												966	16.9
												967	18.8
												968	21.1
												969	23.8
												970	26.5
												971	28
												972	29.6
												973	30.7
												974	32.6
												975	34.2
												976	35.3
												977	36.1
												978	36.9
												979	38
												980	38
												981	38
												982	38
												983	38
												984	37.2
												985	36.9
												986	36.1
												987	35.7
												988	34.9
												989	34.9
												990	33.8
												991	31.5
												992	28.8

Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
993	25.7	1024	2.7	1055	8.1	1086	10.8	1117	35.7	1148	40.7	1179	15.7
994	24.6	1025	6.1	1056	10.4	1087	13.8	1118	36.9	1149	36.9	1180	15.7
995	23.4	1026	9.2	1057	13.1	1088	16.1	1119	38.8	1150	32.6	1181	14.6
996	22.3	1027	11.5	1058	15.4	1089	18.4	1120	40.3	1151	28	1182	13.1
997	21.5	1028	14.2	1059	18	1090	20.4	1121	41.5	1152	23.4	1183	10
998	20	1029	16.1	1060	20.4	1091	21.9	1122	42.2	1153	18.4	1184	7.3
999	20	1030	18	1061	23	1092	21.9	1123	43	1154	14.6	1185	3.5
1000	19.2	1031	20	1062	25.3	1093	20.7	1124	43.8	1155	12.3	1186	0.8
1001	19.2	1032	21.5	1063	27.3	1094	17.3	1125	43.8	1156	9.2	1187	0
1002	18	1033	23	1064	28.8	1095	13.1	1126	43.4	1157	5.8	1188	0
1003	11.9	1034	24.2	1065	30.3	1096	9.6	1127	43	1158	1.9	1189	0
1004	6.9	1035	25	1066	31.1	1097	8.8	1128	42.2	1159	0.4	1190	0
1005	2.7	1036	25.7	1067	32.3	1098	10.8	1129	41.9	1160	0	1191	0.4
1006	0.8	1037	26.9	1068	31.9	1099	12.7	1130	41.5	1161	0	1192	2.7
1007	0.4	1038	27.6	1069	32.3	1100	14.2	1131	41.9	1162	0	1193	7.3
1008	0	1039	27.6	1070	31.9	1101	14.6	1132	41.9	1163	0	1194	11.5
1009	0	1040	28.4	1071	31.1	1102	13.1	1133	41.9	1164	0	1195	15.4
1010	0	1041	29.2	1072	28.8	1103	11.1	1134	42.2	1165	0.4	1196	19.2
1011	0	1042	29.2	1073	25	1104	11.1	1135	42.6	1166	4.2	1197	21.9
1012	0	1043	30	1074	22.7	1105	11.1	1136	42.6	1167	9.2	1198	23.8
1013	0	1044	29.6	1075	18.8	1106	13.1	1137	42.6	1168	11.9	1199	25
1014	0	1045	29.6	1076	15.4	1107	15.7	1138	42.6	1169	14.2	1200	26.1
1015	0	1046	28.8	1077	13.4	1108	18.4	1139	42.6	1170	15.7	1201	27.3
1016	0	1047	28	1078	11.9	1109	20.7	1140	42.6	1171	15	1202	28.8
1017	0	1048	23.8	1079	8.8	1110	23.8	1141	42.6	1172	14.2	1203	30
1018	0	1049	18.8	1080	5	1111	25.7	1142	42.2	1173	13.4	1204	29.6
1019	0	1050	11.9	1081	1.9	1112	28	1143	43	1174	13.8	1205	29.6
1020	0	1051	6.1	1082	2.3	1113	30	1144	43.4	1175	14.6	1206	28.8
1021	0	1052	1.5	1083	2.7	1114	31.1	1145	43	1176	14.6	1207	26.1
1022	0	1053	1.5	1084	3.5	1115	32.3	1146	42.6	1177	14.2	1208	22.3
1023	0.4	1054	4.2	1085	6.5	1116	34.2	1147	41.9	1178	16.1	1209	19.2
		1240	3.5										

Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1241	10.4	1272	40.3	1303	48.8	1334	25.3	1365	23	1396	11.5	1427	0
1242	15.4	1273	38	1304	48.4	1335	25	1366	23	1397	11.5	1428	0
1243	17.3	1274	36.1	1305	47.6	1336	24.6	1367	22.3	1398	11.1	1429	0
1244	17.3	1275	36.5	1306	46.5	1337	24.6	1368	20.4	1399	11.1	1430	0
1245	18.4	1276	38	1307	44.2	1338	25.3	1369	18.8	1400	11.1	1431	0
1246	21.5	1277	39.2	1308	42.2	1339	26.1	1370	17.7	1401	13.1	1432	0
1247	24.6	1278	40.7	1309	41.5	1340	27.3	1371	16.1	1402	15	1433	0
1248	27.3	1279	42.2	1310	41.1	1341	28.4	1372	14.6	1403	16.9	1434	0
1249	30	1280	43.4	1311	40.7	1342	29.2	1373	12.7	1404	16.9	1435	0
1250	31.5	1281	44.9	1312	40.3	1343	29.2	1374	11.1	1405	16.1	1436	0
1251	31.9	1282	45.7	1313	39.6	1344	29.6	1375	9.2	1406	15.7	1437	0
1252	32.6	1283	46.1	1314	39.2	1345	30	1376	8.8	1407	15.4	1438	0
1253	33.4	1284	46.8	1315	38.8	1346	31.1	1377	7.3	1408	15	1439	0
1254	34.9	1285	46.5	1316	38	1347	32.6	1378	6.1	1409	13.8	1440	0
1255	36.5	1286	46.5	1317	37.6	1348	33.8	1379	5	1410	10.8	1441	0
1256	37.6	1287	46.5	1318	37.2	1349	34.6	1380	4.2	1411	8.4	1442	0
1257	39.2	1288	46.1	1319	36.5	1350	34.9	1381	3.5	1412	6.1	1443	0
1258	40.3	1289	46.1	1320	34.6	1351	34.6	1382	2.7	1413	4.2	1444	0
1259	40.7	1290	46.1	1321	31.5	1352	34.9	1383	2.3	1414	3.5	1445	0
1260	41.1	1291	46.8	1322	29.6	1353	34.6	1384	1.5	1415	3.5	1446	0
1261	40.7	1292	47.6	1323	29.2	1354	34.9	1385	1.2	1416	1.5	1447	0
1262	40.7	1293	48	1324	28.8	1355	34.9	1386	0	1417	0	1448	0
1263	40.7	1294	48.4	1325	28.8	1356	34.9	1387	1.2	1418	0	1449	0
1264	41.5	1295	48	1326	28	1357	34.2	1388	4.2	1419	0	1450	0
1265	42.6	1296	48	1327	28	1358	33.8	1389	7.3	1420	0	1451	0
1266	43	1297	47.2	1328	28.4	1359	32.6	1390	8.8	1421	0	1452	0
1267	44.5	1298	46.5	1329	29.6	1360	31.5	1391	10.8	1422	0	1453	0
1268	45.3	1299	46.8	1330	30	1361	30	1392	12.3	1423	0	1454	0
1269	45.3	1300	47.2	1331	30.3	1362	28.8	1393	13.1	1424	0	1455	0
1270	44.9	1301	48.4	1332	29.2	1363	27.3	1394	12.3	1425	0	1456	1.2
1271	43.4	1302	48.4	1333	26.5	1364	23.8	1395	12.3	1426	0	1457	4.2

Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1489	0	1520	24.6	1551	21.5	1582	20	1613	34.9	1644	0	1675	8.8
1490	0	1521	25	1552	25	1583	23	1614	35.7	1645	0	1676	11.5
1491	0	1522	26.1	1553	28.4	1584	25.7	1615	36.5	1646	0	1677	14.2
1492	0	1523	26.1	1554	30.7	1585	28	1616	36.9	1647	0	1678	15.4
1493	0	1524	26.9	1555	31.9	1586	30.7	1617	36.9	1648	0	1679	16.1
1494	0	1525	26.9	1556	32.3	1587	32.6	1618	37.2	1649	0	1680	16.1
1495	0	1526	26.9	1557	32.3	1588	34.2	1619	37.6	1650	0	1681	16.9
1496	0	1527	26.5	1558	31.9	1589	35.3	1620	37.2	1651	0	1682	16.5
1497	0	1528	25.7	1559	30.3	1590	36.9	1621	37.6	1652	0	1683	16.9
1498	1.2	1529	21.9	1560	28	1591	36.9	1622	38	1653	0	1684	18
1499	3.5	1530	16.5	1561	24.2	1592	37.2	1623	38.4	1654	0	1685	19.2
1500	7.7	1531	10	1562	20	1593	37.6	1624	39.2	1655	0	1686	20.4
1501	11.1	1532	4.6	1563	16.1	1594	37.6	1625	39.6	1656	0	1687	20.4
1502	13.8	1533	1.5	1564	11.5	1595	37.6	1626	39.9	1657	0	1688	21.1
1503	16.5	1534	0.4	1565	8.1	1596	37.2	1627	40.7	1658	0	1689	21.1
1504	18.4	1535	0	1566	5	1597	37.2	1628	40.3	1659	0	1690	22.3
1505	20.4	1536	0	1567	3.5	1598	36.9	1629	41.1	1660	0	1691	23
1506	20.7	1537	0	1568	1.9	1599	36.5	1630	41.1	1661	0	1692	23.8
1507	19.6	1538	0	1569	0	1600	36.5	1631	40.7	1662	0	1693	24.2
1508	17.3	1539	0	1570	0	1601	34.9	1632	31.9	1663	0	1694	24.6
1509	12.3	1540	0	1571	0	1602	33.4	1633	23.9	1664	0	1695	25
1510	8.1	1541	0	1572	0	1603	31.9	1634	15.9	1665	0	1696	25.7
1511	6.1	1542	0	1573	0	1604	29.2	1635	7.9	1666	0	1697	25.7
1512	9.6	1543	0.4	1574	0	1605	25	1636	2.7	1667	0	1698	26.5
1513	12.7	1544	1.2	1575	0	1606	25	1637	0.4	1668	0	1699	27.6
1514	15.7	1545	1.9	1576	0	1607	26.1	1638	0.4	1669	0	1700	28.4
1515	18	1546	3.8	1577	0	1608	27.6	1639	2.7	1670	0	1701	29.2
1516	20.4	1547	7.7	1578	1.5	1609	29.2	1640	3.8	1671	0	1702	30.3
1517	21.9	1548	11.5	1579	6.9	1610	31.1	1641	3.8	1672	0	1703	31.1
1518	23.4	1549	14.6	1580	12.7	1611	32.3	1642	1.5	1673	1.5	1704	31.1
1519	23.8	1550	18	1581	16.5	1612	34.2	1643	0	1674	5	1705	30.7

E. Highway Driving Schedule.

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Highway Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)		
1	0	33	34.8	65	45.4	97	47.7	129	47.9	161	46.9	193	43.9	225	44.7
2	0	34	35.1	66	45.7	98	48	130	47.9	162	47	194	44.3	226	45.1
3	2.0	35	35.7	67	46	99	48.2	131	48	163	47.1	195	44.6	227	45.4
4	4.9	36	36.1	68	46.3	100	48.5	132	48	164	47.6	196	44.9	228	45.8
5	8.1	37	36.2	69	46.5	101	48.8	133	48	165	47.9	197	44.8	229	46.5
6	11.3	38	36.5	70	46.8	102	49.1	134	47.9	166	48	198	44.4	230	46.9
7	14.5	39	36.7	71	46.9	103	49.2	135	47.3	167	48	199	43.9	231	47.2
8	17.3	40	36.9	72	47	104	49.1	136	46	168	47.9	200	43.4	232	47.4
9	19.6	41	37	73	47.1	105	49.1	137	43.3	169	47.8	201	43.2	233	47.3
10	21.8	42	37	74	47.2	106	49	138	41.2	170	47.3	202	43.2	234	47.3
11	24	43	37	75	47.3	107	49	139	39.5	171	46.7	203	43.1	235	47.2
12	25.8	44	37	76	47.2	108	49.1	140	39.2	172	46.2	204	43	236	47.2
13	27.1	45	37	77	47.1	109	49.2	141	39	173	45.9	205	43	237	47.2
14	28	46	37	78	47	110	49.3	142	39	174	45.7	206	43.1	238	47.1
15	29	47	37.1	79	46.9	111	49.4	143	39.1	175	45.5	207	43.4	239	47
16	30	48	37.3	80	46.9	112	49.5	144	39.5	176	45.4	208	43.9	240	47
17	30.7	49	37.8	81	46.9	113	49.5	145	40.1	177	45.3	209	44	241	46.9
18	31.5	50	38.6	82	47	114	49.5	146	41	178	45	210	43.5	242	46.8
19	32.2	51	39.3	83	47.1	115	49.4	147	42	179	44	211	42.6	243	46.9
20	32.9	52	40	84	47.1	116	49.1	148	43.1	180	43.1	212	41.5	244	47
21	33.5	53	40.7	85	47.2	117	48.9	149	43.7	181	42.2	213	40.7	245	47.2
22	34.1	54	41.4	86	47.1	118	48.6	150	44.1	182	41.5	214	40	246	47.5
23	34.6	55	42.2	87	47	119	48.4	151	44.3	183	41.5	215	40	247	47.9
24	34.9	56	42.9	88	46.9	120	48.1	152	44.4	184	42.1	216	40.3	248	48
25	35.1	57	43.5	89	46.5	121	47.7	153	44.6	185	42.9	217	41	249	48
26	35.7	58	44	90	46.3	122	47.4	154	44.7	186	43.5	218	42	250	48
27	35.9	59	44.3	91	46.2	123	47.3	155	44.9	187	43.9	219	42.7	251	48
28	35.8	60	44.5	92	46.3	124	47.5	156	45.2	188	43.6	220	43.1	252	48
29	35.3	61	44.8	93	46.5	125	47.8	157	45.7	189	43.3	221	43.2	253	48.1
30	34.9	62	44.9	94	46.9	126	47.9	158	45.9	190	43	222	43.4	254	48.2
31	34.5	63	45	95	47.1	127	48	159	46.3	191	43.1	223	43.9	255	48.2
32	34.6	64	45.1	96	47.4	128	47.9	160	46.8	192	43.4	224	44.3	256	48.1

Highway Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
257	48.6	289	34	321	46.8	353	58.6	385	56.4	417	58.4	449	58.2
258	48.9	290	33.3	322	47.1	354	58.4	386	56.7	418	58.9	450	58.2
259	49.1	291	32.5	323	47.7	355	58.2	387	56.9	419	59.1	451	58.1
260	49.1	292	31.7	324	48.3	356	58.1	388	57.1	420	59.4	452	58
261	49.1	293	30.6	325	49	357	58	389	57.3	421	59.8	453	58
262	49.1	294	29.6	326	49.7	358	57.9	390	57.4	422	59.9	454	58
263	49.1	295	28.8	327	50.3	359	57.6	391	57.4	423	59.9	455	58
264	49	296	28.4	328	51	360	57.4	392	57.2	424	59.8	456	58
265	48.9	297	28.6	329	51.7	361	57.2	393	57	425	59.6	457	58
266	48.2	298	29.5	330	52.4	362	57.1	394	56.9	426	59.4	458	57.9
267	47.7	299	31.4	331	53.1	363	57	395	56.6	427	59.2	459	57.9
268	47.5	300	33.4	332	53.8	364	57	396	56.3	428	59.1	460	58
269	47.2	301	35.6	333	54.5	365	56.9	397	56.1	429	59	461	58.1
270	46.7	302	37.5	334	55.2	366	56.9	398	56.4	430	58.9	462	58.1
271	46.2	303	39.1	335	55.8	367	56.9	399	56.7	431	58.7	463	58.2
272	46	304	40.2	336	56.4	368	57	400	57.1	432	58.6	464	58.3
273	45.8	305	41.1	337	56.9	369	57	401	57.5	433	58.5	465	58.3
274	45.6	306	41.8	338	57	370	57	402	57.8	434	58.4	466	58.3
275	45.4	307	42.4	339	57.1	371	57	403	58	435	58.4	467	58.2
276	45.2	308	42.8	340	57.3	372	57	404	58	436	58.3	468	58.1
277	45	309	43.3	341	57.6	373	57	405	58	437	58.2	469	58
278	44.7	310	43.8	342	57.8	374	57	406	58	438	58.1	470	57.8
279	44.5	311	44.3	343	58	375	57	407	58	439	58	471	57.5
280	44.2	312	44.7	344	58.1	376	57	408	58	440	57.9	472	57.1
281	43.5	313	45	345	58.4	377	56.9	409	57.9	441	57.9	473	57
282	42.8	314	45.2	346	58.7	378	56.8	410	57.8	442	57.9	474	56.6
283	42	315	45.4	347	58.8	379	56.5	411	57.7	443	57.9	475	56.1
284	40.1	316	45.5	348	58.9	380	56.2	412	57.7	444	57.9	476	56
285	38.6	317	45.8	349	59	381	56	413	57.8	445	58	477	55.8
286	37.5	318	46	350	59	382	56	414	57.9	446	58.1	478	55.5
287	35.8	319	46.1	351	58.9	383	56	415	58	447	58.1	479	55.2
288	34.7	320	46.5	352	58.8	384	56.1	416	58.1	448	58.2	480	55.1

Highway Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
513	54	545	56	577	51.9	609	49	641	46.2	673	52.5	705	55.9
514	54	546	56	578	51.6	610	48.9	642	46	674	52.7	706	56.1
515	54	547	55.9	579	51.4	611	48	643	46	675	52.7	707	56.3
516	54	548	55.9	580	51.1	612	47.1	644	46.3	676	52.4	708	56.4
517	54.1	549	55.9	581	50.7	613	46.2	645	46.8	677	52.1	709	56.5
518	54.2	550	55.8	582	50.3	614	46.1	646	47.5	678	51.7	710	56.7
519	54.5	551	55.6	583	49.8	615	46.1	647	48.2	679	51.1	711	56.9
520	54.8	552	55.4	584	49.3	616	46.2	648	48.8	680	50.5	712	57
521	54.9	553	55.2	585	48.7	617	46.9	649	49.5	681	50.1	713	57.3
522	55	554	55.1	586	48.2	618	47.8	650	50.2	682	49.8	714	57.7
523	55.1	555	55	587	48.1	619	49	651	50.7	683	49.7	715	58.2
524	55.2	556	54.9	588	48	620	49.7	652	51.1	684	49.6	716	58.8
525	55.2	557	54.6	589	48	621	50.6	653	51.7	685	49.5	717	59.1
526	55.3	558	54.4	590	48.1	622	51.5	654	52.2	686	49.5	718	59.2
527	55.4	559	54.2	591	48.4	623	52.2	655	52.5	687	49.7	719	59.1
528	55.5	560	54.1	592	48.9	624	52.7	656	52.1	688	50	720	58.8
529	55.6	561	53.8	593	49	625	53	657	51.6	689	50.2	721	58.5
530	55.7	562	53.4	594	49.1	626	53.6	658	51.1	690	50.6	722	58.1
531	55.8	563	53.3	595	49.1	627	54	659	51	691	51.1	723	57.7
532	55.9	564	53.1	596	49	628	54.1	660	51	692	51.6	724	57.3
533	56	565	52.9	597	49	629	54.4	661	51.1	693	51.9	725	57.1
534	56	566	52.6	598	48.9	630	54.7	662	51.4	694	52	726	56.8
535	56	567	52.4	599	48.6	631	55.1	663	51.7	695	52.1	727	56.5
536	56	568	52.2	600	48.3	632	55.4	664	52	696	52.4	728	56.2
537	56	569	52.1	601	48	633	55.4	665	52.2	697	52.9	729	55.5
538	56	570	52	602	47.9	634	55	666	52.5	698	53.3	730	54.6
539	56	571	52	603	47.8	635	54.5	667	52.8	699	53.7	731	54.1
540	56	572	52	604	47.7	636	53.6	668	52.7	700	54.2	732	53.7
541	56	573	52	605	47.9	637	52.5	669	52.6	701	54.5	733	53.2
542	56	574	52.1	606	48.3	638	50.2	670	52.3	702	54.8	734	52.9
543	56	575	52	607	49	639	48.2	671	52.3	703	55	735	52.5
544	56	576	52	608	49.1	640	46.5	672	52.4	704	55.5	736	52

F. US06 Bag 2 Driving Schedule.

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US06 Bag 2 Driving Schedule

(Speed vs Time Sequence)

Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)
1	0	31	58.4	61	58.1	91	64.3	121	62.5	151	62.2
2	0	32	59.6	62	59.4	92	64.2	122	62.5	152	62.4
3	0	33	59.9	63	59.9	93	63.9	123	62.9	153	62.7
4	0	34	60.2	64	61	94	64.2	124	62.8	154	62.6
5	0	35	60.5	65	61.4	95	63.4	125	62.2	155	63.7
6	0	36	59.7	66	61.9	96	64	126	62.4	156	64.3
7	2.7	37	58.3	67	62.5	97	63.9	127	62.3	157	64.8
8	9.2	38	58.1	68	62.5	98	64	128	62.3	158	65.1
9	16.1	39	57.8	69	62.7	99	63.8	129	62.4	159	65.9
10	22.7	40	57.3	70	62.2	100	64	130	62.1	160	66.1
11	29.2	41	57.5	71	62.5	101	63.3	131	62.5	161	67
12	34.2	42	56.6	72	63.1	102	63.4	132	62.8	162	67.2
13	38.8	43	57	73	62.7	103	63.9	133	62.3	163	67.5
14	43	44	56.6	74	62.8	104	64	134	62.3	164	68.3
15	45.3	45	56.5	75	63	105	64.3	135	62.4	165	68.3
16	46.8	46	56.2	76	64.1	106	64.8	136	61.9	166	68.8
17	48	47	56.4	77	63.9	107	65.1	137	62.8	167	69.1
18	49.5	48	56.6	78	64.1	108	64	138	62.8	168	69.4
19	50.3	49	56.4	79	64.3	109	64.2	139	62.3	169	71.7
20	51.5	50	56.1	80	64.5	110	63.1	140	62.8	170	72.1
21	52.2	51	56	81	64.9	111	63.7	141	62.4	171	74.9
22	52.6	52	55.9	82	65.3	112	63.1	142	62.1	172	72.6
23	53	53	54.8	83	66	113	63.7	143	61.9	173	72.2
24	53.8	54	54.2	84	66	114	63.5	144	61.8	174	72.2
25	53.8	55	54.6	85	66.4	115	63	145	62.1	175	72
26	53.8	56	52.2	86	64.1	116	63.1	146	62.1	176	72.5
27	54.6	57	54.7	87	63.6	117	63	147	62.1	177	72.8
28	56.3	58	55.7	88	63.9	118	63.3	148	62	178	72.7
29	56.9	59	57	89	64.1	119	63.4	149	62.4	179	71.8
30	58.1	60	58	90	63.7	120	63.3	150	62.2	180	71.4

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)	Time (Sec.)	Speed (mph)
181	71.1	212	76.5	243	68.5	274	71.3	305	67.5	336	62.6
182	71.1	213	74.3	244	68.9	275	70.8	306	67.6	337	62.6
183	70.9	214	72.6	245	68.6	276	71.2	307	67.6	338	63
184	71	215	70.8	246	69.4	277	71.7	308	67.2	339	62.6
185	71	216	67.6	247	69.4	278	71.9	309	67	340	62.2
186	71.2	217	66.4	248	69.4	279	72.6	310	66.3	341	61.1
187	72.1	218	66.7	249	70	280	72.3	311	66.6	342	59.5
188	72.6	219	66.1	250	70.4	281	72.3	312	66.2	343	58.8
189	73.6	220	65.9	251	70.6	282	72.1	313	66.4	344	56.8
190	74.8	221	66.2	252	70.9	283	72	314	65.9	345	55.7
191	75.7	222	66.1	253	70.3	284	71.9	315	66.1	346	54.1
192	77.3	223	67.1	254	70.6	285	72.6	316	65.5	347	51.5
193	78.4	224	67.4	255	70.3	286	72.8	317	62.2	348	49.2
194	79.3	225	68.3	256	69.7	287	73.2	318	62.2	349	48.8
195	78.2	226	68.3	257	69.9	288	72.1	319	61.4	350	47.6
196	76	227	68.7	258	70.1	289	71.5	320	61.1	351	44.9
197	75.6	228	68.2	259	69.6	290	70.9	321	61.4	352	41.5
198	76.4	229	68.1	260	69.3	291	70.4	322	61.1	353	37.2
199	77.6	230	68	261	69.9	292	70.5	323	61.4	354	34.6
200	78	231	67.1	262	69.7	293	70.9	324	61.4	355	33
201	79.1	232	66.4	263	69.5	294	70.2	325	61.8	356	29.2
202	79.5	233	66.1	264	69.9	295	71	326	61.8	357	22.3
203	79.9	234	65.7	265	70.2	296	70.2	327	61.8	358	17.7
204	79.9	235	66	266	70.2	297	70.3	328	61.8	359	17.3
205	80.3	236	66.4	267	70.2	298	69.1	329	62.2	360	14
206	80.3	237	66	268	71	299	68.8	330	61.8	361	10
207	79.5	238	66.3	269	70.8	300	68.2	331	62.2	362	6
208	79.5	239	67	270	70.9	301	68.3	332	62.6	363	2
209	79.1	240	67.5	271	70.7	302	68.2	333	62.2	364	0
210	78.7	241	67.9	272	70.9	303	67.7	334	62.6	365	0
211	77.6	242	68.1	273	71.2	304	67.3	335	62.2		

G. Hot 1435 Unified Cycle Driving Schedule.

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Hot 1435 Unified Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)		
1	0	31	11.5	61	0	91	26.9	121	32.3	151	30.7	181	36.9	211	0
2	0	32	11.1	62	0	92	26.5	122	32.3	152	32.6	182	36.9	212	0
3	0	33	11.1	63	1.2	93	25.7	123	31.9	153	34.2	183	37.2	213	0
4	0	34	11.1	64	3.5	94	21.9	124	30.3	154	35.3	184	37.6	214	0
5	0	35	13.1	65	7.7	95	16.5	125	28	155	36.9	185	37.2	215	0
6	0	36	15	66	11.1	96	10	126	24.2	156	36.9	186	37.6	216	0
7	0	37	16.9	67	13.8	97	4.6	127	20	157	37.2	187	38	217	0
8	0	38	16.9	68	16.5	98	1.5	128	16.1	158	37.6	188	38.4	218	0
9	0	39	16.1	69	18.4	99	0.4	129	11.5	159	37.6	189	39.2	219	0
10	0	40	15.7	70	20.4	100	0	130	8.1	160	37.6	190	39.6	220	0
11	0	41	15.4	71	20.7	101	0	131	5	161	37.2	191	39.9	221	0
12	0	42	15	72	19.6	102	0	132	3.5	162	37.2	192	40.7	222	0
13	0	43	13.8	73	17.3	103	0	133	1.9	163	36.9	193	40.3	223	0
14	0	44	10.8	74	12.3	104	0	134	0	164	36.5	194	41.1	224	0
15	0	45	8.4	75	8.1	105	0	135	0	165	36.5	195	41.1	225	0
16	0	46	6.1	76	6.1	106	0	136	0	166	34.9	196	40.7	226	0
17	0	47	4.2	77	9.6	107	0	137	0	167	33.4	197	31.9	227	0
18	0	48	3.5	78	12.7	108	0.4	138	0	168	31.9	198	23.9	228	0
19	0	49	3.5	79	15.7	109	1.2	139	0	169	29.2	199	15.9	229	0
20	0	50	1.5	80	18	110	1.9	140	0	170	25	200	7.9	230	0
21	1.2	51	0	81	20.4	111	3.8	141	0	171	25	201	2.7	231	0
22	4.2	52	0	82	21.9	112	7.7	142	0	172	26.1	202	0.4	232	0
23	7.3	53	0	83	23.4	113	11.5	143	1.5	173	27.6	203	0.4	233	0
24	8.8	54	0	84	23.8	114	14.6	144	6.9	174	29.2	204	2.7	234	0
25	10.8	55	0	85	24.6	115	18	145	12.7	175	31.1	205	3.8	235	0
26	12.3	56	0	86	25	116	21.5	146	16.5	176	32.3	206	3.8	236	0
27	13.1	57	0	87	26.1	117	25	147	20	177	34.2	207	1.5	237	0
28	12.3	58	0	88	26.1	118	28.4	148	23	178	34.9	208	0	238	1.5
29	12.3	59	0	89	26.9	119	30.7	149	25.7	179	35.7	209	0	239	5
30	11.5	60	0	90	26.9	120	31.9	150	28	180	36.5	210	0	240	8.8

Hot 1435 Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
241	11.5	271	31.1	301	0	331	43.8	361	44.9	391	56.4	421	59.9
242	14.2	272	29.6	302	0	332	44.5	362	44.2	392	56.4	422	59.5
243	15.4	273	29.2	303	0	333	45.3	363	43.8	393	56.4	423	59.1
244	16.1	274	29.2	304	0	334	45.3	364	44.5	394	57.2	424	59.1
245	16.1	275	28.8	305	0	335	44.9	365	44.9	395	56.8	425	59.5
246	16.9	276	28	306	0	336	44.5	366	45.3	396	57.6	426	59.5
247	16.5	277	23	307	0	337	43.8	367	46.5	397	57.6	427	59.5
248	16.9	278	21.1	308	0	338	43.4	368	48	398	57.6	428	59.9
249	18	279	21.5	309	0	339	42.6	369	48.8	399	58	429	60.3
250	19.2	280	20.7	310	0	340	41.9	370	49.5	400	58	430	60.7
251	20.4	281	20.7	311	0	341	41.5	371	49.9	401	58.4	431	60.7
252	20.4	282	19.6	312	0	342	40.7	372	49.9	402	58.4	432	61.4
253	21.1	283	16.5	313	0.4	343	40.3	373	49.9	403	58.8	433	61.8
254	21.1	284	13.1	314	2.7	344	41.1	374	49.5	404	59.1	434	61.8
255	22.3	285	9.6	315	7.3	345	41.5	375	49.5	405	58.8	435	61.8
256	23	286	7.3	316	11.5	346	42.6	376	48.8	406	58.8	436	61.8
257	23.8	287	3.8	317	15.4	347	43.4	377	48.8	407	58	437	61.1
258	24.2	288	0.8	318	18.4	348	44.2	378	48.8	408	58	438	60.7
259	24.6	289	0	319	20.7	349	44.9	379	48.4	409	57.6	439	60.3
260	25	290	0	320	24.2	350	45.7	380	48.8	410	57.6	440	60.3
261	25.7	291	0	321	26.9	351	46.5	381	49.5	411	57.6	441	60.3
262	25.7	292	0	322	29.6	352	46.8	382	50.3	412	57.6	442	59.5
263	26.5	293	0	323	31.1	353	47.2	383	50.7	413	57.6	443	58.8
264	27.6	294	0	324	32.6	354	48	384	51.8	414	59.1	444	59.1
265	28.4	295	0	325	33.8	355	47.6	385	52.6	415	59.5	445	58.8
266	29.2	296	0	326	34.9	356	48.4	386	53.4	416	59.9	446	58.8
267	30.3	297	0	327	36.9	357	48	387	54.1	417	60.3	447	58.8
268	31.1	298	0	328	39.2	358	47.2	388	55.3	418	60.3	448	58.4
269	31.1	299	0	329	41.1	359	46.1	389	55.3	419	61.1	449	58
270	30.7	300	0	330	43	360	45.7	390	56.1	420	60.3	450	58

Hot 1435 Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
481	46.1	511	28.4	541	10	571	0	601	30.3	631	21.9	661	35.3	691	29.2
482	43	512	28	542	10.4	572	0.4	602	30.3	632	22.7	662	36.1	692	28.4
483	37.2	513	26.5	543	10.4	573	1.5	603	30.3	633	23.8	663	36.1	693	25
484	29.6	514	24.2	544	5.4	574	3.5	604	30.7	634	25	664	36.9	694	21.1
485	21.5	515	22.7	545	1.9	575	6.1	605	31.1	635	25.3	665	36.9	695	16.9
486	16.5	516	20.4	546	0	576	10.4	606	32.3	636	25.7	666	37.6	696	13.4
487	15.7	517	17.7	547	0	577	14.2	607	32.6	637	26.5	667	37.6	697	13.1
488	18.4	518	15.7	548	0	578	16.9	608	32.6	638	26.9	668	38.4	698	12.3
489	21.5	519	13.1	549	0	579	19.2	609	32.6	639	27.3	669	38	699	12.7
490	25	520	10.8	550	0	580	20	610	31.1	640	28	670	37.6	700	15.7
491	27.3	521	8.4	551	0	581	21.5	611	26.9	641	29.2	671	37.6	701	19.2
492	29.2	522	7.3	552	0	582	23.4	612	22.3	642	30	672	37.2	702	22.3
493	30.7	523	5	553	0	583	24.6	613	18	643	30	673	36.9	703	24.6
494	31.5	524	3.8	554	0	584	24.2	614	13.8	644	29.6	674	36.1	704	25.7
495	31.1	525	3.5	555	0	585	20	615	9.6	645	29.6	675	35.7	705	26.5
496	31.1	526	1.9	556	0	586	16.9	616	4.6	646	28.8	676	36.1	706	26.5
497	30.3	527	0.8	557	0	587	13.4	617	6.1	647	28.4	677	35.7	707	26.9
498	30	528	0	558	0	588	13.4	618	10	648	28	678	35.7	708	27.3
499	30	529	0	559	0	589	15.7	619	14.2	649	27.3	679	35.7	709	27.3
500	29.6	530	0	560	0	590	18.4	620	17.3	650	25.7	680	36.1	710	27.6
501	30	531	0.8	561	0	591	21.1	621	20	651	24.6	681	36.1	711	28.4
502	28.8	532	1.9	562	0	592	23.4	622	21.5	652	25	682	35.7	712	28.8
503	28.8	533	3.8	563	0	593	25.3	623	22.3	653	26.5	683	35.7	713	28.8
504	28	534	6.9	564	0	594	27.6	624	22.3	654	28	684	34.9	714	29.2
505	28.4	535	9.6	565	0	595	28.8	625	22.3	655	29.6	685	34.6	715	28.8
506	28	536	11.1	566	0	596	30.3	626	22.3	656	30.7	686	34.2	716	28.8
507	28.4	537	11.1	567	0	597	30.7	627	23	657	32.3	687	33.8	717	28
508	28.4	538	10.4	568	0	598	31.5	628	23	658	33	688	33.4	718	28
509	28.8	539	8.8	569	0	599	31.1	629	22.7	659	34.2	689	33	719	27.6
510	28.4	540	9.2	570	0	600	31.1	630	22.3	660	34.6	690	30.3	720	26.5

Hot 1435 Unified Test Cycle

(Speed vs Time Sequence)

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)
721	24.6	751	0	781	17.3	811	4.6	841	2.3	871	63.4	901	64.1
722	20.7	752	0	782	19.2	812	4.6	842	0	872	63	902	63.7
723	16.5	753	0	783	20.4	813	4.6	843	1.2	873	63	903	63.7
724	15	754	0	784	21.1	814	4.2	844	6.9	874	62.6	904	63.7
725	14.2	755	0	785	22.3	815	5.4	845	13.8	875	61.8	905	64.5
726	14.2	756	0	786	22.3	816	4.6	846	18.8	876	61.8	906	64.5
727	13.8	757	0	787	22.7	817	3.5	847	23.8	877	62.2	907	64.9
728	13.8	758	0	788	22.3	818	2.3	848	27.3	878	62.2	908	64.5
729	11.9	759	0	789	22.7	819	2.3	849	30.7	879	62.6	909	64.1
730	8.4	760	0	790	22.3	820	1.9	850	33.8	880	63.7	910	64.9
731	4.2	761	0	791	23.8	821	3.1	851	37.6	881	64.5	911	65.3
732	1.2	762	0	792	25.7	822	6.1	852	40.7	882	64.9	912	65.3
733	0	763	1.5	793	27.6	823	4.6	853	43.8	883	66	913	65.3
734	0	764	5.4	794	29.6	824	2.7	854	46.1	884	66	914	64.1
735	0	765	9.2	795	30	825	2.3	855	48	885	66.8	915	63.4
736	0	766	11.5	796	29.2	826	2.3	856	49.5	886	66.4	916	63
737	0	767	14.6	797	27.6	827	3.1	857	51.5	887	66.8	917	63.4
738	0	768	17.3	798	25	828	4.2	858	53	888	67.2	918	64.1
739	0	769	19.2	799	23.8	829	3.5	859	54.5	889	66.4	919	64.9
740	0	770	21.1	800	23.4	830	3.8	860	55.7	890	66.4	920	65.3
741	0	771	20.7	801	24.2	831	4.2	861	56.8	891	66	921	64.5
742	0	772	20.7	802	23.4	832	3.5	862	58	892	65.7	922	64.1
743	0	773	19.6	803	23	833	3.5	863	59.1	893	65.7	923	63.4
744	0	774	18.4	804	20.4	834	3.5	864	60.3	894	66.4	924	63.7
745	0	775	16.9	805	18.8	835	4.6	865	61.1	895	66	925	63.4
746	0	776	16.9	806	17.3	836	5.8	866	61.8	896	65.7	926	63.4
747	0	777	16.5	807	15	837	3.5	867	61.8	897	65.3	927	63.4
748	0	778	16.9	808	13.1	838	0.8	868	61.8	898	65.3	928	63.4
749	0	779	16.9	809	9.2	839	3.5	869	61.8	899	64.5	929	63.7
750	0	780	16.9	810	6.9	840	3.8	870	62.6	900	64.5	930	64.5
		931	65.3	932	64.9	933	63.7	934	63	935	59.9	936	55.3
		937	50.7	938	49.2	939	48	940	46.1	941	44.2	942	41.1
		943	39.9	944	36.1	945	32.6	946	29.2	947	24.6	948	20.7
		949	19.2	950	16.5	951	15	952	11.9	953	9.6	954	8.4
		955	5.8	956	1.2	957	0	958	0	959	0	960	1.2

Hot 1435 Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
961	3.1	991	31.5	1021	0	1051	6.1	1081	1.9	1111	25.7	1141	42.6	1171	15
962	5	992	28.8	1022	0	1052	1.5	1082	2.3	1112	28	1142	42.2	1172	14.2
963	8.4	993	25.7	1023	0.4	1053	1.5	1083	2.7	1113	30	1143	43	1173	13.4
964	11.5	994	24.6	1024	2.7	1054	4.2	1084	3.5	1114	31.1	1144	43.4	1174	13.8
965	14.6	995	23.4	1025	6.1	1055	8.1	1085	6.5	1115	32.3	1145	43	1175	14.6
966	16.9	996	22.3	1026	9.2	1056	10.4	1086	10.8	1116	34.2	1146	42.6	1176	14.6
967	18.8	997	21.5	1027	11.5	1057	13.1	1087	13.8	1117	35.7	1147	41.9	1177	14.2
968	21.1	998	20	1028	14.2	1058	15.4	1088	16.1	1118	36.9	1148	40.7	1178	16.1
969	23.8	999	20	1029	16.1	1059	18	1089	18.4	1119	38.8	1149	36.9	1179	15.7
970	26.5	1000	19.2	1030	18	1060	20.4	1090	20.4	1120	40.3	1150	32.6	1180	15.7
971	28	1001	19.2	1031	20	1061	23	1091	21.9	1121	41.5	1151	28	1181	14.6
972	29.6	1002	18	1032	21.5	1062	25.3	1092	21.9	1122	42.2	1152	23.4	1182	13.1
973	30.7	1003	11.9	1033	23	1063	27.3	1093	20.7	1123	43	1153	18.4	1183	10
974	32.6	1004	6.9	1034	24.2	1064	28.8	1094	17.3	1124	43.8	1154	14.6	1184	7.3
975	34.2	1005	2.7	1035	25	1065	30.3	1095	13.1	1125	43.8	1155	12.3	1185	3.5
976	35.3	1006	0.8	1036	25.7	1066	31.1	1096	9.6	1126	43.4	1156	9.2	1186	0.8
977	36.1	1007	0.4	1037	26.9	1067	32.3	1097	8.8	1127	43	1157	5.8	1187	0
978	36.9	1008	0	1038	27.6	1068	31.9	1098	10.8	1128	42.2	1158	1.9	1188	0
979	38	1009	0	1039	27.6	1069	32.3	1099	12.7	1129	41.9	1159	0.4	1189	0
980	38	1010	0	1040	28.4	1070	31.9	1100	14.2	1130	41.5	1160	0	1190	0
981	38	1011	0	1041	29.2	1071	31.1	1101	14.6	1131	41.9	1161	0	1191	0.4
982	38	1012	0	1042	29.2	1072	28.8	1102	13.1	1132	41.9	1162	0	1192	2.7
983	38	1013	0	1043	30	1073	25	1103	11.1	1133	41.9	1163	0	1193	7.3
984	37.2	1014	0	1044	29.6	1074	22.7	1104	11.1	1134	42.2	1164	0	1194	11.5
985	36.9	1015	0	1045	29.6	1075	18.8	1105	11.1	1135	42.6	1165	0.4	1195	15.4
986	36.1	1016	0	1046	28.8	1076	15.4	1106	13.1	1136	42.6	1166	4.2	1196	19.2
987	35.7	1017	0	1047	28	1077	13.4	1107	15.7	1137	42.6	1167	9.2	1197	21.9
988	34.9	1018	0	1048	23.8	1078	11.9	1108	18.4	1138	42.6	1168	11.9	1198	23.8
989	34.9	1019	0	1049	18.8	1079	8.8	1109	20.7	1139	42.6	1169	14.2	1199	25
990	33.8	1020	0	1050	11.9	1080	5	1110	23.8	1140	42.6	1170	15.7	1200	26.1

Hot 1435 Unified Test Cycle (Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)		
1201	27.3	1231	0	1261	40.7	1291	46.8	1321	31.5	1351	34.6	1381	3.5	1411	8.4
1202	28.8	1232	0	1262	40.7	1292	47.6	1322	29.6	1352	34.9	1382	2.7	1412	6.1
1203	30	1233	0	1263	40.7	1293	48	1323	29.2	1353	34.6	1383	2.3	1413	4.2
1204	29.6	1234	0	1264	41.5	1294	48.4	1324	28.8	1354	34.9	1384	1.5	1414	3.5
1205	29.6	1235	0	1265	42.6	1295	48	1325	28.8	1355	34.9	1385	1.2	1415	3.5
1206	28.8	1236	0	1266	43	1296	48	1326	28	1356	34.9	1386	0	1416	1.5
1207	26.1	1237	0	1267	44.5	1297	47.2	1327	28	1357	34.2	1387	1.2	1417	0
1208	22.3	1238	0	1268	45.3	1298	46.5	1328	28.4	1358	33.8	1388	4.2	1418	0
1209	19.2	1239	0	1269	45.3	1299	46.8	1329	29.6	1359	32.6	1389	7.3	1419	0
1210	16.5	1240	3.5	1270	44.9	1300	47.2	1330	30	1360	31.5	1390	8.8	1420	0
1211	12.7	1241	10.4	1271	43.4	1301	48.4	1331	30.3	1361	30	1391	10.8	1421	0
1212	9.6	1242	15.4	1272	40.3	1302	48.4	1332	29.2	1362	28.8	1392	12.3	1422	0
1213	6.9	1243	17.3	1273	38	1303	48.8	1333	26.5	1363	27.3	1393	13.1	1423	0
1214	4.2	1244	17.3	1274	36.1	1304	48.4	1334	25.3	1364	23.8	1394	12.3	1424	0
1215	2.3	1245	18.4	1275	36.5	1305	47.6	1335	25	1365	23	1395	12.3	1425	0
1216	0.8	1246	21.5	1276	38	1306	46.5	1336	24.6	1366	23	1396	11.5	1426	0
1217	0	1247	24.6	1277	39.2	1307	44.2	1337	24.6	1367	22.3	1397	11.5	1427	0
1218	0	1248	27.3	1278	40.7	1308	42.2	1338	25.3	1368	20.4	1398	11.1	1428	0
1219	0	1249	30	1279	42.2	1309	41.5	1339	26.1	1369	18.8	1399	11.1	1429	0
1220	0	1250	31.5	1280	43.4	1310	41.1	1340	27.3	1370	17.7	1400	11.1	1430	0
1221	0	1251	31.9	1281	44.9	1311	40.7	1341	28.4	1371	16.1	1401	13.1	1431	0
1222	0	1252	32.6	1282	45.7	1312	40.3	1342	29.2	1372	14.6	1402	15	1432	0
1223	0	1253	33.4	1283	46.1	1313	39.6	1343	29.2	1373	12.7	1403	16.9	1433	0
1224	0	1254	34.9	1284	46.8	1314	39.2	1344	29.6	1374	11.1	1404	16.9	1434	0
1225	0	1255	36.5	1285	46.5	1315	38.8	1345	30	1375	9.2	1405	16.1	1435	0
1226	0	1256	37.6	1286	46.5	1316	38	1346	31.1	1376	8.8	1406	15.7		
1227	0	1257	39.2	1287	46.5	1317	37.6	1347	32.6	1377	7.3	1407	15.4		
1228	0	1258	40.3	1288	46.1	1318	37.2	1348	33.8	1378	6.1	1408	15		
1229	0	1259	40.7	1289	46.1	1319	36.5	1349	34.6	1379	5	1409	13.8		
1230	0	1260	41.1	1290	46.1	1320	34.6	1350	34.9	1380	4.2	1410	10.8		

H. Quick Drive-Away UDDS Driving Schedule.

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Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)		
0	0	30	15.5	60	25.6	90	30.9	120	0	150	0	180	24.5	210	51.0
1	0	31	16.0	61	25.7	91	31.0	121	0	151	0	181	27.3	211	51.5
2	0	32	17.1	62	25.4	92	30.9	122	0	152	3.3	182	30.5	212	52.2
3	0	33	19.1	63	24.9	93	30.4	123	0	153	6.6	183	33.5	213	53.2
4	0	34	21.1	64	25.0	94	29.8	124	0	154	9.9	184	36.2	214	54.1
5	0	35	22.7	65	25.4	95	29.9	125	0	155	13.2	185	37.3	215	54.6
6	0	36	22.9	66	26.0	96	30.2	126	0	156	16.5	186	39.3	216	54.9
7	0	37	22.7	67	26.0	97	30.7	127	0	157	19.8	187	40.5	217	55.0
8	0	38	22.6	68	25.7	98	31.2	128	0	158	22.2	188	42.1	218	54.9
9	3.0	39	21.3	69	26.1	99	31.8	129	0	159	24.3	189	43.5	219	54.6
10	5.9	40	19.0	70	26.7	100	32.2	130	0	160	25.8	190	45.1	220	54.6
11	8.6	41	17.1	71	27.5	101	32.4	131	0	161	26.4	191	46.0	221	54.8
12	11.5	42	15.8	72	28.6	102	32.2	132	0	162	25.7	192	46.8	222	55.1
13	14.3	43	15.8	73	29.3	103	31.7	133	0	163	25.1	193	47.5	223	55.5
14	16.9	44	17.7	74	29.8	104	28.6	134	0	164	24.7	194	47.5	224	55.7
15	17.3	45	19.8	75	30.1	105	25.3	135	0	165	25.0	195	47.3	225	56.1
16	18.1	46	21.6	76	30.4	106	22.0	136	0	166	25.2	196	47.2	226	56.3
17	20.7	47	23.2	77	30.7	107	18.7	137	0	167	25.4	197	47.0	227	56.6
18	21.7	48	24.2	78	30.7	108	15.4	138	0	168	25.8	198	47.0	228	56.7
19	22.4	49	24.6	79	30.5	109	12.1	139	0	169	27.2	199	47.0	229	56.7
20	22.5	50	24.9	80	30.4	110	8.8	140	0	170	26.5	200	47.0	230	56.5
21	22.1	51	25.0	81	30.3	111	5.5	141	0	171	24.0	201	47.0	231	56.5
22	21.5	52	24.6	82	30.4	112	2.2	142	0	172	22.7	202	47.2	232	56.5
23	20.9	53	24.5	83	30.8	113	0	143	0	173	19.4	203	47.4	233	56.5
24	20.4	54	24.7	84	30.4	114	0	144	0	174	17.7	204	47.9	234	56.5
25	19.8	55	24.8	85	29.9	115	0	145	0	175	17.2	205	48.5	235	56.5
26	17.0	56	24.7	86	29.5	116	0	146	0	176	18.1	206	49.1	236	56.4
27	14.9	57	24.6	87	29.8	117	0	147	0	177	18.6	207	49.5	237	56.1
28	14.9	58	24.6	88	30.3	118	0	148	0	178	20.0	208	50.0	238	55.8
29	15.2	59	25.1	89	30.7	119	0	149	0	179	22.2	209	50.6	239	55.1

Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
240	54.6	270	56.0	300	35.2	330	0	360	36.0	390	0	420	0
241	54.2	271	55.8	301	33.8	331	0	361	36.0	391	2.6	421	0
242	54.0	272	55.2	302	32.5	332	0	362	36.0	392	5.9	422	0
243	53.7	273	54.5	303	31.5	333	0	363	36.0	393	9.2	423	0
244	53.6	274	53.6	304	30.6	334	0	364	36.0	394	12.5	424	0
245	53.9	275	52.5	305	30.5	335	1.0	365	36.0	395	15.8	425	0
246	54.0	276	51.5	306	30.0	336	4.3	366	36.1	396	19.1	426	0
247	54.1	277	51.5	307	29.0	337	7.6	367	36.4	397	22.4	427	0
248	54.1	278	51.5	308	27.5	338	10.9	368	36.5	398	25.0	428	0
249	53.8	279	51.1	309	24.8	339	14.2	369	36.4	399	25.6	429	0
250	53.4	280	50.1	310	21.5	340	17.3	370	36.0	400	27.5	430	0
251	53.0	281	50.0	311	20.1	341	20.0	371	35.1	401	29.0	431	0
252	52.6	282	50.1	312	19.1	342	22.5	372	34.1	402	30.0	432	0
253	52.1	283	50.0	313	18.5	343	23.7	373	33.5	403	30.1	433	0
254	52.4	284	49.6	314	17.0	344	25.2	374	31.4	404	30.0	434	0
255	52.0	285	49.5	315	15.5	345	26.6	375	29.0	405	29.7	435	0
256	51.9	286	49.5	316	12.5	346	28.1	376	25.7	406	29.3	436	3.3
257	51.7	287	49.5	317	10.8	347	30.0	377	23.0	407	28.8	437	6.6
258	51.5	288	49.1	318	8.0	348	30.8	378	20.3	408	28.0	438	9.9
259	51.6	289	48.6	319	4.7	349	31.6	379	17.5	409	25.0	439	13.2
260	51.8	290	48.1	320	1.4	350	32.1	380	14.5	410	21.7	440	16.5
261	52.1	291	47.2	321	0	351	32.8	381	12.0	411	18.4	441	19.8
262	52.5	292	46.1	322	0	352	33.6	382	8.7	412	15.1	442	23.1
263	53.0	293	45.0	323	0	353	34.5	383	5.4	413	11.8	443	26.4
264	53.5	294	43.8	324	0	354	34.6	384	2.1	414	8.5	444	27.8
265	54.0	295	42.6	325	0	355	34.9	385	0	415	5.2	445	29.1
266	54.9	296	41.5	326	0	356	34.8	386	0	416	1.9	446	31.5
267	55.4	297	40.3	327	0	357	34.5	387	0	417	0	447	33.0
268	55.6	298	38.5	328	0	358	34.7	388	0	418	0	448	33.6
269	56.0	299	37.0	329	0	359	35.5	389	0	419	0	449	34.8

Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)		
480	33.5	510	0	540	25.2	570	6.6	600	21.6	630	0	660	25.6	690	0
481	32.0	511	1.2	541	25.0	571	9.9	601	22.0	631	0	661	26.0	691	0
482	30.1	512	3.5	542	25.0	572	13.0	602	22.4	632	0	662	26.1	692	0
483	28.0	513	5.5	543	25.0	573	14.6	603	22.5	633	0	663	26.2	693	0
484	25.5	514	6.5	544	24.4	574	16.0	604	22.5	634	0	664	26.2	694	1.4
485	22.5	515	8.5	545	23.1	575	17.0	605	22.5	635	0	665	26.4	695	3.3
486	19.8	516	9.6	546	19.8	576	17.0	606	22.7	636	0	666	26.5	696	4.4
487	16.5	517	10.5	547	16.5	577	17.0	607	23.7	637	0	667	26.5	697	6.5
488	13.2	518	11.9	548	13.2	578	17.5	608	25.1	638	0	668	26.0	698	9.2
489	10.3	519	14.0	549	9.9	579	17.7	609	26.0	639	0	669	25.5	699	11.3
490	7.2	520	16.0	550	6.6	580	17.7	610	26.5	640	0	670	23.6	700	13.5
491	4.0	521	17.7	551	3.3	581	17.5	611	27.0	641	0	671	21.4	701	14.6
492	1.0	522	19.0	552	0	582	17.0	612	26.1	642	0	672	18.5	702	16.4
493	0	523	20.1	553	0	583	16.9	613	22.8	643	0	673	16.4	703	16.7
494	0	524	21.0	554	0	584	16.6	614	19.5	644	0	674	14.5	704	16.5
495	0	525	22.0	555	0	585	17.0	615	16.2	645	0	675	11.6	705	16.5
496	0	526	23.0	556	0	586	17.1	616	12.9	646	2.0	676	8.7	706	18.2
497	0	527	23.8	557	0	587	17.0	617	9.6	647	4.5	677	5.8	707	19.2
498	0	528	24.5	558	0	588	16.6	618	6.3	648	7.8	678	3.5	708	20.1
499	0	529	24.9	559	0	589	16.5	619	3.0	649	10.2	679	2.0	709	21.5
500	0	530	25.0	560	0	590	16.5	620	0	650	12.5	680	0	710	22.5
501	0	531	25.0	561	0	591	16.6	621	0	651	14.0	681	0	711	22.5
502	0	532	25.0	562	0	592	17.0	622	0	652	15.3	682	0	712	22.1
503	0	533	25.0	563	0	593	17.6	623	0	653	17.5	683	0	713	22.7
504	0	534	25.0	564	0	594	18.5	624	0	654	19.6	684	0	714	23.3
505	0	535	25.0	565	0	595	19.2	625	0	655	21.0	685	0	715	23.5
506	0	536	25.6	566	0	596	20.2	626	0	656	22.2	686	0	716	22.5
507	0	537	25.8	567	0	597	21.0	627	0	657	23.3	687	0	717	21.6
508	0	538	26.0	568	0	598	21.1	628	0	658	24.5	688	0	718	20.5
509	0	539	25.6	569	3.3	599	21.2	629	0	659	25.3	689	0	719	18.0

Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
720	15.0	750	28.0	780	27.5	810	34.2	840	19.2	870	25.1	900	26.9
721	12.0	751	27.5	781	28.0	811	34.0	841	19.2	871	25.5	901	26.6
722	9.0	752	26.8	782	28.3	812	34.0	842	20.1	872	25.7	902	26.5
723	6.2	753	25.5	783	28.9	813	33.9	843	20.9	873	26.2	903	26.5
724	4.5	754	23.5	784	28.9	814	33.6	844	21.4	874	26.9	904	26.5
725	3.0	755	21.5	785	28.9	815	33.1	845	22.0	875	27.5	905	26.3
726	2.1	756	19.0	786	28.8	816	33.0	846	22.6	876	27.8	906	26.2
727	0.5	757	16.5	787	28.5	817	32.5	847	23.2	877	28.4	907	26.2
728	0.5	758	14.9	788	28.3	818	32.0	848	24.0	878	29.0	908	25.9
729	3.2	759	12.5	789	28.3	819	31.9	849	25.0	879	29.2	909	25.6
730	6.5	760	9.4	790	28.3	820	31.6	850	26.0	880	29.1	910	25.6
731	9.6	761	6.2	791	28.2	821	31.5	851	26.6	881	29.0	911	25.9
732	12.5	762	3.0	792	27.6	822	30.6	852	26.6	882	28.9	912	25.8
733	14.0	763	1.5	793	27.5	823	30.0	853	26.8	883	28.5	913	25.5
734	16.0	764	1.5	794	27.5	824	29.9	854	27.0	884	28.1	914	24.6
735	18.0	765	0.5	795	27.5	825	29.9	855	27.2	885	28.0	915	23.5
736	19.6	766	0	796	27.5	826	29.9	856	27.8	886	28.0	916	22.2
737	21.5	767	3.0	797	27.5	827	29.9	857	28.1	887	27.6	917	21.6
738	23.1	768	6.3	798	27.5	828	29.6	858	28.8	888	27.2	918	21.6
739	24.5	769	9.6	799	27.6	829	29.5	859	28.9	889	26.6	919	21.7
740	25.5	770	12.9	800	28.0	830	29.5	860	29.0	890	27.0	920	22.6
741	26.5	771	15.8	801	28.5	831	29.3	861	29.1	891	27.5	921	23.4
742	27.1	772	17.5	802	30.0	832	28.9	862	29.0	892	27.8	922	24.0
743	27.6	773	18.4	803	31.0	833	28.2	863	28.1	893	28.0	923	24.2
744	27.9	774	19.5	804	32.0	834	27.7	864	27.5	894	27.8	924	24.4
745	28.3	775	20.7	805	33.0	835	27.0	865	27.0	895	28.0	925	24.9
746	28.6	776	22.0	806	33.0	836	25.5	866	25.8	896	28.0	926	25.1
747	28.6	777	23.2	807	33.6	837	23.7	867	25.0	897	28.0	927	25.2
748	28.3	778	25.0	808	34.0	838	22.0	868	24.5	898	27.7	928	25.3
749	28.2	779	26.5	809	34.3	839	20.5	869	24.8	899	27.4	929	25.5

Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
960	2.0	990	21.5	1020	7.6	1050	0	1080	18.0	1110	16.0	1140	26.0
961	5.3	991	21.8	1021	4.3	1051	0	1081	15.0	1111	18.1	1141	25.5
962	8.6	992	22.5	1022	1.0	1052	0	1082	12.3	1112	20.0	1142	24.6
963	11.9	993	23.0	1023	0	1053	1.2	1083	11.1	1113	21.0	1143	23.5
964	15.2	994	22.8	1024	0	1054	4.0	1084	10.6	1114	21.2	1144	21.5
965	17.5	995	22.8	1025	0	1055	7.3	1085	10.0	1115	21.3	1145	20.0
966	18.6	996	23.0	1026	0	1056	10.6	1086	9.5	1116	21.4	1146	17.5
967	20.0	997	22.7	1027	0	1057	13.9	1087	9.1	1117	21.7	1147	16.0
968	21.1	998	22.7	1028	0	1058	17.0	1088	8.7	1118	22.5	1148	14.0
969	22.0	999	22.7	1029	0	1059	18.5	1089	8.6	1119	23.0	1149	10.7
970	23.0	1000	23.5	1030	0	1060	20.0	1090	8.8	1120	23.8	1150	7.4
971	24.5	1001	24.0	1031	0	1061	21.8	1091	9.0	1121	24.5	1151	4.1
972	26.3	1002	24.6	1032	0	1062	23.0	1092	8.7	1122	25.0	1152	0.8
973	27.5	1003	24.8	1033	0	1063	24.0	1093	8.6	1123	24.9	1153	0
974	28.1	1004	25.1	1034	0	1064	24.8	1094	8.0	1124	24.8	1154	0
975	28.4	1005	25.5	1035	0	1065	25.6	1095	7.0	1125	25.0	1155	0
976	28.5	1006	25.6	1036	0	1066	26.5	1096	5.0	1126	25.4	1156	0
977	28.5	1007	25.5	1037	0	1067	26.8	1097	4.2	1127	25.8	1157	0
978	28.5	1008	25.0	1038	0	1068	27.4	1098	2.6	1128	26.0	1158	0
979	27.7	1009	24.1	1039	0	1069	27.9	1099	1.0	1129	26.4	1159	0
980	27.5	1010	23.7	1040	0	1070	28.3	1100	0	1130	26.6	1160	0
981	27.2	1011	23.2	1041	0	1071	28.0	1101	0.1	1131	26.9	1161	0
982	26.8	1012	22.9	1042	0	1072	27.5	1102	0.6	1132	27.0	1162	0
983	26.5	1013	22.5	1043	0	1073	27.0	1103	1.6	1133	27.0	1163	0
984	26.0	1014	22.0	1044	0	1074	27.0	1104	3.6	1134	27.0	1164	0
985	25.7	1015	21.6	1045	0	1075	26.3	1105	6.9	1135	26.9	1165	0
986	25.2	1016	20.5	1046	0	1076	24.5	1106	10.0	1136	26.8	1166	0
987	24.0	1017	17.5	1047	0	1077	22.5	1107	12.8	1137	26.8	1167	0
988	22.0	1018	14.2	1048	0	1078	21.5	1108	14.0	1138	26.5	1168	0
989	21.5	1019	10.9	1049	0	1079	20.6	1109	14.5	1139	26.4	1169	2.1

Quick Drive-Away UDDS Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1200	6.5	1222	22.0	1244	0	1266	8.5	1288	24.0	1310	8.2	1332	0
1201	9.8	1223	21.9	1245	0	1267	7.6	1289	24.1	1311	4.9	1333	0
1202	12.0	1224	21.7	1246	0	1268	8.8	1290	24.5	1312	1.6	1334	0
1203	12.9	1225	21.5	1247	0	1269	11.0	1291	24.7	1313	0	1335	0
1204	13.0	1226	21.5	1248	0	1270	14.0	1292	25.0	1314	0	1336	0
1205	12.6	1227	21.4	1249	0	1271	17.0	1293	25.4	1315	0	1337	0
1206	12.8	1228	20.1	1250	0	1272	19.5	1294	25.6	1316	0	1338	1.5
1207	13.1	1229	19.5	1251	0	1273	21.0	1295	25.7	1317	0	1339	4.8
1208	13.1	1230	19.2	1252	1.0	1274	21.8	1296	26.0	1318	0	1340	8.1
1209	14.0	1231	19.6	1253	1.0	1275	22.2	1297	26.2	1319	0	1341	11.4
1210	15.5	1232	19.8	1254	1.0	1276	23.0	1298	27.0	1320	0	1342	13.2
1211	17.0	1233	20.0	1255	1.0	1277	23.6	1299	27.8	1321	0	1343	15.1
1212	18.6	1234	19.5	1256	1.0	1278	24.1	1300	28.3	1322	0	1344	16.8
1213	19.7	1235	17.5	1257	1.6	1279	24.5	1301	29.0	1323	0	1345	18.3
1214	21.0	1236	15.5	1258	3.0	1280	24.5	1302	29.1	1324	0	1346	19.5
1215	21.5	1237	13.0	1259	4.0	1281	24.0	1303	29.0	1325	0	1347	20.3
1216	21.8	1238	10.0	1260	5.0	1282	23.5	1304	28.0	1326	0	1348	21.3
1217	21.8	1239	8.0	1261	6.3	1283	23.5	1305	24.7	1327	0	1349	21.9
1218	21.5	1240	6.0	1262	8.0	1284	23.5	1306	21.4	1328	0	1350	22.1
1219	21.2	1241	4.0	1263	10.0	1285	23.5	1307	18.1	1329	0	1351	22.4
1220	21.5	1242	2.5	1264	10.5	1286	23.5	1308	14.8	1330	0	1352	22.0
1221	21.8	1243	0.7	1265	9.5	1287	23.5	1309	11.5	1331	0	1353	21.6

I. Test Procedures for 2026 and Subsequent Model Hybrid-Electric Vehicles, Except Plug-in Hybrid Electric Vehicles.

This section, Part II, section I, contains the test procedures for 2026 and subsequent model hybrid-electric vehicles, except plug-in hybrid electric vehicles. Plug-in hybrid-electric vehicles must be tested in accordance with the "California Test Procedures for 2026 and Subsequent Model Year Zero-Emission Vehicles and Plug-in Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes." A manufacturer of a hybrid vehicle equipped with an energy storage device that is not included in these procedures may request Executive Officer approval to employ an alternative to the SOC Criterion in Part II, section I.5. Executive Officer approval of an SOC Criterion alternative shall be conditioned upon the manufacturer providing supporting data and/or engineering evaluation demonstrating the equivalence of the proposed alternative procedure to the SOC Criterion.

Confirmatory testing and in-use compliance testing for Part II, section I may be performed in any driver-selectable mode to ensure compliance with emission standards.

1. Vehicle and Battery Break-In Period.

A manufacturer shall use good engineering judgment in determining the proper stabilized emissions mileage test point and report same according to the requirements of Part I, section H.4.3.

2. Urban Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

Where noted, a manufacturer may use alternative test procedures that are shown to yield equivalent emission results and have been approved in advance by the Executive Officer of the California Air Resources Board. A manufacturer must submit a request to the Executive Officer, at least 60 days in advance of the certification application of the applicable vehicle test group, with an engineering evaluation that demonstrates or justifies, based on good engineering judgment, the use of the alternative test procedures will yield equivalent emission results for the applicable vehicle test group. The Executive Officer shall review the submitted evaluation and shall use good engineering judgment to consider, on a case-by-case basis, the similarities and differences between the alternative procedures and the test procedures outlined in the applicable section of this document. Upon review, the Executive Officer shall approve, on a case-by-case basis, the alternative procedures if they yield equivalent emission results for the applicable vehicle test group. The Executive Officer shall notify the manufacturer of the decision no later than 30 days after receiving the request for the use of alternative test procedures.

Unless otherwise specified, approval requests, supporting documentation, data and reports must be provided to the California Air Resources Board via e-mail at: onrld@arb.ca.gov.

For vehicles with one or more driver-selectable modes (e.g., normal mode, economy mode, performance mode, or any other operating mode available to the driver), emission testing must be done in the one driver-selectable mode that represents the worst case urban NMOG + NO_x emissions over the Urban Emission Test set forth in this Part II, section I.2. For example, if a vehicle has two driver-selectable modes, the manufacturer shall determine worst case NMOG + NO_x emissions by comparing the emission results of the two driver-selectable modes. Compliance with applicable emission standards shall be based on worst case emission testing.

2.1. Urban Test Applicability and General Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR § 1066.801 with the following revisions:

- 2.1.1 Subparagraphs (a) through (b): [No change.]
- 2.1.2 Amend subparagraph (c)(1): The Urban Emission Test, which includes the general driving cycle.
- 2.1.3 Amend subparagraph (c)(1)(i): The Urban Emission Test consists of an engine startup during the first UDDS cycle followed by a 10-minute key-off soak. The first engine startup (with all accessories turned off) that occurs during a UDDS cycle with vehicle shutdown at the end of the UDDS cycle makes a complete cold-start UDDS cycle. Following a 10-minute key-off soak, the subsequent UDDS cycle is a hot-start UDDS cycle. The UDDS cycle can be considered as a two-phase cycle where the first 505 seconds of the UDDS cycle is the transient phase, and the remaining 867 seconds of the UDDS cycle is the stabilized phase.
- 2.1.4 Delete subparagraphs (c)(1)(ii) through (c)(5).
- 2.1.5 Subparagraph (d): [No change.]
- 2.1.6 Subparagraph (e): [No change except the hot soak test temperature in the three-day diurnal emission test sequence is 105°F.]

2.2. Urban Vehicle Preconditioning for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles" with the following supplemental requirements:

- 2.2.1 The vehicle shall be preconditioned in the driver-selectable mode to be tested.
- 2.2.2 The hybrid electric vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.5. of the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles."
- 2.2.3 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours. After completing the initial soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned by driving the UDDS cycle.
- 2.2.4 After completing the preconditioning drive, initial state-of-charge may be set by driving an additional distance on the chassis dynamometer such that the SOC Criterion is satisfied by applying the $\pm 1\%$ SOC Net Energy Change Tolerances in Part II, section I.5. However, if the alternative End-of-Test Criterion in Part II, section I.2.3.18 is used, then setting initial SOC shall not be permitted due to the larger $\pm 5\%$ SOC Net Energy Change Tolerance provided by the alternative End-of-Test Criterion in Part II, section I.2.3.18.
- 2.2.5 A fuel drain and fill shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles."
- 2.2.6 The vehicle shall be soaked for 12-36 hours. During this soak period, canister preconditioning shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2026 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles." Initial SOC may be set during the soak period by discharging or charging the battery such that the SOC Criterion is satisfied when applying the $\pm 1\%$ SOC Net Energy Change Tolerances in Part II, section I.5. However, if the

alternative End-of-Test Criterion in Part II, section I.2.3.18 is used, then setting initial SOC shall not be permitted due to the larger $\pm 5\%$ SOC Net Energy Change Tolerance provided by the alternative End-of-Test criterion in Part II, section I.2.3.18.

2.3. Urban Dynamometer Test Run, Gaseous and Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR § 1066.815 with the following revisions:

- 2.3.1 Amend subparagraph (a): *General*. The Urban Emission Test consists of a cold-start UDDS cycle and a hot-start UDDS cycle as described in Part II, section I.2.1.3. If driver-selectable modes are available, activate the driver-selectable mode to be tested for the Urban Emission Test to determine worst case emissions as described in the introductory paragraphs of Part II, section I.2.
- 2.3.2 Amend subparagraph (b): *PM sampling options*. Collect PM using the procedures specified in subparagraphs (b)(1) or (b)(2) or (b)(5) of 40 CFR § 1066.815 (subparagraphs (b)(3) and (b)(4) are not applicable) and use the corresponding equation in Part II, section I.2.5 to calculate composite PM emissions. Testing must meet the requirements related to filter face velocity as described in 40 CFR § 1065.170(c)(1)(vi) [June 29, 2021], except as specified in paragraph (b)(5) of 40 CFR § 1066.815. For procedures involving flow weighting, set the filter face velocity to a weighting target of 1.0 to meet the requirements of 40 CFR § 1065.170(c)(1)(vi) [June 29, 2021]. Allow filter face velocity to decrease as a percentage of the weighting factor if the weighting factor is less than 1.0. Use the appropriate equations in 40 CFR § 1066.610 to show that you meet the dilution factor requirements of 40 CFR § 1066.110(b)(2)(iii)(B).
- 2.3.3 Amend subparagraphs (b)(1): A separate PM sample for transient and stabilized phases of the cold-start UDDS cycle and the hot-start UDDS cycle may be collected. This may be done by sampling with four filters.
- 2.3.4 Subparagraph (b)(2): [No change.]
- 2.3.5 Delete subparagraphs (b)(3) and (b)(4).
- 2.3.6 Subparagraphs (b)(5) through (c)(2): [No change.]

- 2.3.7 Delete subparagraph (c)(3):
- 2.3.8 Amend subparagraph (d): *Test sequence*. Follow the exhaust emission measurement procedures specified in 40 CFR § 1066.410 through § 1066.425, subject to the following exceptions and additional provisions:
- 2.3.9 Subparagraph (d)(1): [No change.]
- 2.3.10 Amend subparagraph (d)(1)(i): Precondition the vehicle as described in Part II, section I.2.2. Initiate the cold-start UDDS cycle in the driver-selectable mode to be tested for the Urban Emission Test following the 12 to 36 hour soak period.
- 2.3.11 Subparagraphs (d)(1)(ii) and (d)(1)(iii): [No change.]
- 2.3.12 Amend subparagraph (d)(1)(iv): Five seconds after the vehicle is turned off, stop all stabilized interval sampling and recording, including background sampling. Stop any integrating devices for the stabilized interval and indicate the end of the stabilized interval in the recorded data. Note that the 5 second delay is intended to account for sampling system transport.
- 2.3.13 Subparagraph (2): [No change.]
- 2.3.14 Amend subparagraph (2)(i): Initiate the hot-start UDDS cycle in the same driver-selectable mode as in Part II, section I.2.3.10 above (9 to 11 minutes) after the end of the sample period for the cold-start UDDS cycle.
- 2.3.15 Amend subparagraph (2)(ii): Repeat the steps in paragraph (d)(1)(ii) of this section.
- 2.3.16 Amend subparagraph (2)(iii): For bag 4 measurement or single bag per UDDS cycle measurement, operate the vehicle over the remainder of the UDDS and conclude the testing as described in paragraphs (d)(1)(iii) and (iv) of this section.
- 2.3.17 Amend subparagraph (3): **End-of-Test Criteria**. A valid test shall satisfy the SOC Net Energy Change Tolerances in Part II, section I.5. For HEVs that use a battery as an energy storage device, $(\text{Amp-hr}_{\text{initial}})$ is the stored charge at the beginning of the cold-start UDDS cycle, and $(\text{Amp-hr}_{\text{final}})$ is the stored battery charge at the end of the subsequent hot-start UDDS cycle. The final stored battery charge, $(\text{Amp-hr}_{\text{final}})$, shall not exceed either $(\text{Amp-hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp-hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V^2_{initial}) is the square of the

capacitor voltage stored at the beginning of the cold-start UDDS cycle, and (V_{final}) is the stored capacitor voltage at the end of the subsequent hot-start UDDS cycle. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{\text{final}})_{\text{max}}$ or $(V_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(\text{rpm}^2_{\text{initial}})$ is the squared flywheel rotational speed at the beginning of the cold-start UDDS cycle, and $(\text{rpm}_{\text{final}})$ is the flywheel rotational speed at the end of the subsequent hot-start UDDS cycle. The final flywheel rotational speed, $(\text{rpm}_{\text{final}})$, shall not exceed either $(\text{rpm}_{\text{final}})_{\text{max}}$ or $(\text{rpm}_{\text{final}})_{\text{min}}$ for a valid test

2.3.18 Additional End-of-Test Criterion. If the SOC Net Energy Change Tolerance is not satisfied after the hot-start UDDS cycle in Part II, section I.2.3.17, then the alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 may be used to validate an Urban Emission Test with approval from the Executive Officer. Appendix C of SAE J1711 may not be used to correct measured values for any emissions.

To request approval, the manufacturer shall submit to the Executive Officer, at least 60 days in advance of the certification application of the applicable vehicle test group, vehicle test data or an engineering evaluation that justifies, through the application of good engineering judgment, the use of alternative-end-of test criteria and demonstrates that the alternative end-of-test criteria requirements are satisfied for the applicable vehicle test group. The Executive Officer shall review the submitted documents and shall use good engineering judgment to consider, on a case-by-case basis, the justification for the use of alternative end-of-test criteria and evaluate whether the alternative end-of-test criteria is satisfied by the applicable test group. Upon review, the Executive Officer shall approve, on a case-by-case basis, the use of alternative end-of-test criteria if the manufacturer justified the use of alternative end-of-test criteria and demonstrated that the alternative-end-of test criteria requirements are satisfied by the applicable vehicle test group. The Executive Officer shall notify the manufacturer of the decision no later than 30 days after receiving the request for the use of alternative end-of-test criteria.

Unless otherwise specified, approval requests and supporting information must be provided to the California Air Resources Board via e-mail at: onrld@arb.ca.gov.

2.4. Calculations – Urban Gaseous Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR § 1066.820 with the following revisions:

2.4.1 Subparagraph (a): [No change.]

2.4.2 Amend subparagraph (b): Calculate the final composite gaseous test results as a mass-weighted value, $e_{[\text{emission}]\text{-FTPcomp}}$, in grams per mile using the following equation:

$$e_{[\text{emission}]\text{-FTPcomp}} = 0.43 \left(\frac{m_c}{D_c} \right) + 0.57 \left(\frac{m_h}{D_h} \right)$$

Where:

m_c = the mass emissions determined from the cold-start UDDS cycle, in grams. If the cold-start UDDS cycle consists of phase 1 cold transient emissions and phase 2 cold stabilized emissions, then sum phase 1 and phase 2 emissions to determine m_c .

D_c = the measured driving distance from the cold-start UDDS cycle, in miles. If the cold-start UDDS cycle consists of phase 1 distance and phase 2 distance, then sum phase 1 and phase 2 distances to determine D_c .

m_h = the mass emissions determined from the hot-start UDDS cycle, in grams. If the hot-start UDDS cycle consists of phase 3 hot transient emissions and phase 4 hot stabilized emissions, then sum phase 3 and phase 4 emissions to determine m_h .

D_h = the driving distance from the hot-start UDDS cycle, in miles. If the hot-start UDDS cycle consists of phase 3 distance and phase 4 distance, then sum phase 3 and phase 4 distances to determine D_h .

2.4.3 Subparagraph (c): [Not applicable.]

2.5. Calculations – Urban Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR § 1066.820 with the following revisions:

2.5.1 Subparagraphs (a) to (b): [Not applicable.]

2.5.2 Amend subparagraphs (c) through (c)(1): Calculate the final composite PM test results as a mass-weighted value, $e_{PM-FTPcomp}$, in grams per mile as follows:

(1) Use the following equation for PM measured as described in § 1066.815(b)(1) or (2):

$$e_{PM-FTPcomp} = 0.43 \left(\frac{m_{PM-cUDDS}}{D_c} \right) + 0.57 \left(\frac{m_{PM-hUDDS}}{D_h} \right)$$

Where:

$m_{PM-cUDDS}$ = the combined PM mass emissions determined from the cold-start UDDS cycle (phase 1 and phase 2), in grams, as calculated using Eq. 1066.605-2.

D_c = the measured driving distance from the cold-start UDDS cycle, in miles. If the cold-start UDDS cycle consists of phase 1 distance and phase 2 distance, then sum phase 1 and phase 2 distances to determine D_c .

$m_{PM-hUDDS}$ = the combined PM mass emissions determined from the hot-start UDDS cycle (phase 3 and phase 4), in grams, as calculated using Eq. 1066.605-2.

D_h = the driving distance from the hot-start UDDS cycle, in miles. If the hot-start UDDS cycle consists of phase 3 distance and phase 4 distance, then sum phase 3 and phase 4 distances to determine D_h .

2.5.3 Subparagraph (c)(2): [Not applicable.]

2.5.4 Amend subparagraph (c)(3): Use the following equation for PM measured as described in § 1066.815(b)(5):

$$e_{PM-FTPcomp} = \frac{m_{PM}}{0.43(D_c) + 0.57(D_h)}$$

Where:

m_{PM} = the combined PM mass emissions determined from the cold-start UDDS cycle and the hot-start UDDS cycle (phase 1, phase 2, phase 3, and phase 4), in grams, as calculated using Eq. 1066.605-4.

D_c = the measured driving distance from the cold-start UDDS cycle, in miles. If the cold-start UDDS cycle consists of phase 1 distance and phase 2 distance, then sum phase 1 and phase 2 distances to determine D_c .

D_h = the driving distance from the hot-start UDDS cycle, in miles. If the hot-start UDDS cycle consists of phase 3 distance and phase 4 distance, then sum phase 3 and phase 4 distances to determine D_h .

3. Highway Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR § 1066.801, except as noted.

Alternative procedures may be used if shown to yield equivalent results and if approved in advance by the Executive Officer of the Air Resources Board under the procedure in Part II, section I.2.

For vehicles with one or more driver-selectable modes (e.g., normal mode, economy mode, performance mode, or any other operating mode available to the driver), emission testing must be done in the one driver-selectable mode that represents the worst-case highway NMOG + NO_x emissions over the Highway Emission Test set forth in this Part II, section I.3. For example, if a vehicle has two driver-selectable modes, the manufacturer shall determine worst case NMOG + NO_x emissions by comparing the emission results of the two driver-selectable modes. Compliance with applicable emission standards shall be based on worst case emission testing.

3.1. Determination of Highway Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §1066.840 with the following revisions:

3.1.1 Amend subparagraph (a): Perform the Highway Emission Test immediately following the Urban Emission Test or a previous Highway Emission Test when this is practical. If the Highway Emission Test starts more than 3 hours after the Urban Emission Test (including evaporative emission measurements, if applicable) or a previous Highway Emission Test, operate the vehicle over one UDDS cycle to precondition the

vehicle. If driver-selectable modes are available, activate the driver-selectable mode to be tested for the UDDS preconditioning drive.

- 3.1.2 Amend subparagraph (b): Operate the vehicle over the HFEDS cycle for preconditioning. If driver-selectable modes are available, activate the driver-selectable mode to be tested for the preconditioning drive and for the following HFEDS cycle with emission sampling. Allow the vehicle to idle for 15 seconds (with the vehicle in gear), then start a repeat run of the HFEDS cycle and simultaneously start sampling and recording. End-of-Test Criteria: A valid test shall satisfy the SOC Net Energy Change Tolerances in Part II, section I.5 for the HFEDS cycle with emission sampling. For HEVs that use a battery as an energy storage device, $(\text{Amp-hr}_{\text{initial}})$ is the stored charge at the beginning of the HFEDS cycle with emission sampling, and $(\text{Amp-hr}_{\text{final}})$ is the stored battery charge at the end of the same HFEDS cycle with emission sampling. The final stored battery charge, $(\text{Amp-hr}_{\text{final}})$, shall not exceed either $(\text{Amp-hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp-hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V^2_{initial}) is the square of the capacitor voltage stored at the beginning of the same HFEDS cycle with emission sampling, and (V_{final}) is the stored capacitor voltage at the end of the HFEDS cycle with emission sampling. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{\text{final}})_{\text{max}}$ or $(V_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(\text{rpm}^2_{\text{initial}})$ is the squared flywheel rotational speed at the beginning of the HFEDS cycle with emission sampling, and $(\text{rpm}_{\text{final}})$ is the flywheel rotational speed at the end of the same HFEDS cycle with emission sampling. The final flywheel rotational speed, $(\text{rpm}_{\text{final}})$, shall not exceed either $(\text{rpm}_{\text{final}})_{\text{max}}$ or $(\text{rpm}_{\text{final}})_{\text{min}}$ for a valid test.
- 3.1.3 Amend subparagraph (c): Turn the vehicle off at the end of the HFEDS cycle and stop all sampling and recording, including background. Stop any integrating devices and indicate the end of the test cycle in the recorded data.
- 3.1.4 **Additional End-of-Test Criterion.** If the SOC Net Energy Change Tolerance is not satisfied for the HFEDS cycle with emission sampling in Part II, section I.3.1.2, then the alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 may be used to validate a Highway Emission Test with approval from the Executive Officer. Appendix C of SAE J1711 may not be used to correct

measured values for any emissions. To submit an approval request, follow the procedure in Part II, section I.2.3.18.

4. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

Alternative procedures may be used if approved in advance by the Executive Officer of the Air Resources Board under the procedure in Part II, section I.2.

For vehicles with one or more driver-selectable modes (e.g., normal mode, economy mode, performance mode, or any other operating mode available to the driver), emission testing must be done in the one driver-selectable mode that represents the worst case SFTP NMOG + NO_x emissions over the SFTP Emission Test set forth in this Part II, section I.4. For example, if a vehicle has two driver-selectable modes, the manufacturer shall determine worst case NMOG + NO_x emissions by comparing the emission results of the two driver-selectable modes. Compliance with applicable emission standards shall be based on worst case emission testing.

To be conducted pursuant to 40 CFR § 1066.801, except as noted.

4.1. US06 Emission Test.

To be conducted pursuant to 40 CFR § 1066.831 with the following revisions:

- 4.1.1 Subparagraphs (a) through (b)(1): [No change.]
- 4.1.2 Amend subparagraph (b)(1)(i): For aggressive-driving tests that do not follow the Urban Emission Test or the Highway Emission Test.
- 4.1.3 Amend subparagraph (b)(1)(ii): For a test element that starts more than 72 hours after the most recent Urban Emission Test or Highway Emission Test (with or without evaporative emission measurements).
- 4.1.4 Amend subparagraph (b)(1)(iii): For testing in which the test vehicle has not remained in an area where ambient temperatures were within the range specified for testing since the previous Urban Emission Test or Highway Emission Test.
- 4.1.5 Subparagraphs (b)(2) through (b)(3)(i): [No change.]
- 4.1.6 Amend subparagraph (b)(3)(ii) as follows: Delete the following sentence: For our testing, we will generally operate the vehicle over the same preconditioning cycle that will be used for testing in this section. Add the following sentence: If driver-selectable modes are available, activate

the driver-selectable mode to be tested for the preconditioning drive and for the following US06 cycle with emission sampling.

4.1.7 Subparagraphs (b)(3)(ii)(A) through (b)(3)(ii)(B): [No change.]

4.1.8 Amend subparagraph (b)(3)(ii)(C): The HFEDS cycle.

4.1.9 Subparagraphs (b)(3)(ii)(D) through (e)(2)(iii): [No change.]

4.1.10 Amend subparagraph (e)(3): Turn the vehicle off 2 seconds after the end of the last deceleration. Five seconds after the vehicle stops running, stop all sampling and recording, including background sampling. Stop any integrating devices and indicate the end of the test cycle in the recorded data. Note that the 5 second delay is intended to account for sampling system transport. End-of-Test Criteria: A valid test shall satisfy the SOC Net Energy Change Tolerances in Part II, section I.5 for the US06 cycle with emission sampling. For HEVs that use a battery as an energy storage device, $(\text{Amp-hr}_{\text{initial}})$ is the stored charge at the beginning of the US06 cycle with emission sampling, and $(\text{Amp-hr}_{\text{final}})$ is the stored battery charge at the end of the same US06 cycle with emission sampling. The final stored battery charge, $(\text{Amp-hr}_{\text{final}})$, shall not exceed either $(\text{Amp-hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp-hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V^2_{initial}) is the square of the capacitor voltage stored at the beginning of the US06 cycle with emission sampling, and (V_{final}) is the stored capacitor voltage at the end of the US06 cycle with emission sampling. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{\text{final}})_{\text{max}}$ or $(V_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(\text{rpm}^2_{\text{initial}})$ is the squared flywheel rotational speed at the beginning of the US06 cycle with emission sampling, and $(\text{rpm}_{\text{final}})$ is the flywheel rotational speed at the end of the US06 cycle with emission sampling. The final flywheel rotational speed, $(\text{rpm}_{\text{final}})$, shall not exceed either $(\text{rpm}_{\text{final}})_{\text{max}}$ or $(\text{rpm}_{\text{final}})_{\text{min}}$ for a valid test.

4.1.11 Subparagraph (e)(4): [No change.]

4.1.12 **Additional End-of-Test Criterion.** If the SOC Net Energy Change Tolerance is not satisfied for the US06 cycle with emission sampling in Part II, section I.4.1.10, then the alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 may be used to validate a US06 Emission Test with approval from the Executive Officer. Appendix C of SAE J1711 may not be used to correct measured

values for any emissions. To submit an approval request, follow the procedure in Part II, section I.2.3.18.

4.2. SC03 Emission Test.

To be conducted pursuant to 40 CFR § 1066.835 with the following revisions:

- 4.2.1 Subparagraphs (a) through (c)(4): [No change.]
- 4.2.2 Amend subparagraph (c)(5): Perform a preconditioning drive by operating the test vehicle over the first 505 seconds of the UDDS cycle (phase 1), the last 867 seconds of the UDDS cycle (phase 2), or the SC03 driving schedule. If driver-selectable modes are available, activate the driver-selectable mode to be tested for the preconditioning drive and for the following SC03 cycle with emission sampling. If the air conditioning test sequence starts more than 2 hours after a different exhaust emission test, the vehicle may be driven over one full UDDS cycle for the preconditioning drive instead of over one of the cycles listed previously in this section (c)(5).
- 4.2.3 Subparagraphs (c)(6) through (d): [No change.]
- 4.2.4 Amend subparagraph (d)(1): Place the vehicle in gear 15 seconds after starting vehicle, which is 3 seconds before the first acceleration. If a driver-selectable mode is to be tested, start the vehicle, activate the driver-selectable mode, and place the vehicle in gear 15 seconds after starting vehicle. Follow the SC03 driving schedule.
- 4.2.5 Amend subparagraph (d)(2): Turn the vehicle off 2 seconds after the end of the last deceleration. Five seconds after the vehicle stops running, stop all sampling and recording, including background sampling. Stop any integrating devices and indicate the end of the test cycle in the recorded data. Note that the 5 second delay is intended to account for sampling system transport. End-of-Test Criterion: A valid test shall satisfy the SOC Net Energy Change Tolerances in Part II, section I.5 for the SC03 cycle with emission sampling. For HEVs that use a battery as an energy storage device, $(\text{Amp-hr}_{\text{initial}})$ is the stored charge at the beginning of the SC03 cycle with emission sampling, and $(\text{Amp-hr}_{\text{final}})$ is the stored battery charge at the end of the SC03 cycle with emission sampling. The final stored battery charge, $(\text{Amp-hr}_{\text{final}})$, shall not exceed either $(\text{Amp-hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp-hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V^2_{initial}) is the square of the

capacitor voltage stored at the beginning of the SC03 cycle with emission sampling, and (V_{final}) is the stored capacitor voltage at the end of the SC03 cycle with emission sampling. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{final})_{max}$ or $(V_{final})_{min}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(rpm^2_{initial})$ is the squared flywheel rotational speed at the beginning of the SC03 cycle with emission sampling, and (rpm_{final}) is the flywheel rotational speed at the end of the SC03 cycle with emission sampling. The final flywheel rotational speed, (rpm_{final}) , shall not exceed either $(rpm_{final})_{max}$ or $(rpm_{final})_{min}$ for a valid test.

4.2.6 Subparagraphs (d)(3) through (f)(3)(iv): [No change.]

4.2.7 **Additional End-of-Test Criterion.** If the SOC Net Energy Change Tolerance is not satisfied for the SC03 cycle with emission sampling in Part II, section I.4.2.4, then the alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 may be used to validate an SC03 Emission Test with approval from the Executive Officer. Appendix C of SAE J1711 may not be used to correct measured values for any emissions. To submit an approval request, follow the procedure in Part II, section I.2.3.18.

5. State-of-Charge Net Energy Change Tolerances for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

5.1. For hybrid electric vehicles that use a battery as an energy storage device, the following state-of-charge net energy change tolerance shall apply:

$$(\text{Amp-hr}_{final})_{max} = (\text{Amp-hr}_{initial}) + 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

Where:

$(\text{Amp-hr}_{final})_{max}$ = Maximum allowed Amp-hr stored in battery at the end of the test

- (Amp-hr_{final})_{min} = Minimum allowed Amp-hr stored in battery at the end of the test
- (Amp-hr_{initial}) = Battery Amp-hr stored at the beginning of the test
- NHV_{fuel} = Net heating value of consumable fuel, in Joules/kg
- m_{fuel} = Total mass of fuel consumed during test, in kg
- K₁ = Conversion factor, 3600 seconds/hour
- V_{system} = Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the California Air Resources Board.

5.2. For hybrid electric vehicles that use a capacitor as an energy storage device, the following state-of-charge net energy change tolerance shall apply:

$$(V_{\text{final}})_{\text{max}} = \sqrt{V_{\text{initial}}^2 + 0.01 * \frac{(2 * NHV_{\text{fuel}} * m_{\text{fuel}})}{C}}$$

$$(V_{\text{final}})_{\text{min}} = \sqrt{V_{\text{initial}}^2 - 0.01 * \frac{(2 * NHV_{\text{fuel}} * m_{\text{fuel}})}{C}}$$

Where:

- (V_{final})_{max} = The maximum stored capacitor voltage allowed at the end of the test
- (V_{final})_{min} = The minimum stored capacitor voltage allowed at the end of the test
- V = The square of the capacitor voltage stored at the beginning of the test
- NHV_{fuel} = Net heating value of consumable fuel, in Joules/kg
- m_{fuel} = Total mass of fuel consumed during test, in kg

C = Rated capacitance of the capacitor, in Farads

5.3. For hybrid electric vehicles that use an electro-mechanical flywheel as an energy storage device, the following state-of-charge net energy change tolerance shall apply:

$$(rpm_{final})_{max} = \sqrt{rpm_{initial}^2 + 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

$$(rpm_{final})_{min} = \sqrt{rpm_{initial}^2 - 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

Where:

$(rpm_{final})_{max}$ = The maximum flywheel rotational speed allowed at the end of the test

$(rpm_{final})_{min}$ = The minimum flywheel rotational speed allowed at the end of the test

rpm = The squared flywheel rotational speed at the beginning of the test

NHV_{fuel} = Net heating value of consumable fuel, in Joules/kg

m_{fuel} = Total mass of fuel consumed during test, in kg

K_3 = Conversion factor, $\frac{4\pi^2}{3600sec^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m²

6. 50°F and 20°F Test Provision for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Plug-in Hybrid Electric Vehicles.

50°F testing shall be conducted pursuant to Part II, section I.2 with the modifications in Part II, section C and the additional following revisions.

20°F testing shall be conducted pursuant to Part II, section I.2 with the modifications in Part II, section B and the additional following revisions.

6.1. To satisfy test requirements for the 50°F emission test, the vehicle shall be emission tested in driver-selectable mode (if available) that represents the worst case urban NMOG + NOx emissions as determined in Part II, section I.2. To satisfy test requirements for the 20°F emission test, the vehicle shall be emission tested in the driver-selectable mode (if available) that represents the worst-case CO emissions of the urban emission test following the procedure outlined in Part II, section I.2. For the 20°F and 50°F emission tests, the vehicle is not required to meet SOC net energy change tolerances.

6.2. One of the following two emission test options must be performed.

- (i) A three-phase test that includes phase one as the first 505 seconds of the cold-start UDDS cycle, phase two as the remaining 867 seconds of the cold-start UDDS cycle, a 10 minute key-off soak period, and phase three as the first 505 seconds of the hot-start UDDS cycle. Emission weighting is as follows:

$$Y_{wm} = 0.43 * \left(\frac{Y_1 + Y_2}{D_1 + D_2} \right) + 0.57 * \left(\frac{Y_2 + Y_3}{D_2 + D_3} \right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH₄, NO_x, or CO₂, in grams per vehicle mile.

Y_1 = Mass emissions as calculated from phase one of the three phase test, in grams.

Y_2 = Mass emissions as calculated from phase two of the three phase test, in grams.

Y_3 = Mass emissions as calculated from phase three of the three phase test, in grams.

D_1 = The measured driving distance from phase one of the three phase tests, in miles.

D_2 = The measured driving distance from phase two of the three phase tests, in miles.

D_3 = The measured driving distance from phase three of the three phase tests, in miles.

- (ii) A two-phase test that includes phase one as a UDDS cycle, a 10-minute key-off soak period, and phase two as a UDDS cycle. Emission weighting for the four-phase test will follow the procedure outlined in Part II, section I.2.4.

7. Partial Soak Emission Testing.

The test sequence consists of an Urban Emission Test as described in Part II, section I.2 followed by one, or a consecutive sequence of, Cold-Start Partial Soak Tests as described by the following procedure:

7.1. Vehicle Preconditioning Requirements.

Conduct an Urban Emission Test as described in subsection Part II, section I.2.

7.2. Partial Soak.

After the Urban Emission Test is complete, the vehicle shall be soaked for 10 minutes to 12 hours. Throughout the soak period, the vehicle shall remain shut off, the engine compartment cover (i.e. hood) shall be closed, and cooling of any vehicle components is not permitted, except by ambient air. The ambient air temperature must remain between 68 to 86 degrees Fahrenheit throughout the soak period.

7.3. Cold-Start Partial Soak Test Run.

Following the 10 minute to 12 hour soak period, initiate a Cold-Start Partial Soak Test by following 40 CFR § 1066.815 with the following revisions:

- 7.3.1 Amend subparagraph (a) as follows: *General*. The Cold-Start Partial Soak Test consists of one UDDS cycle. Conduct the Cold-Start Partial Soak Test in the driver-selectable mode (e.g., normal mode, economy mode, performance mode, battery charging mode, or any other operating mode available to the driver) that represent the worst case NMOG+NO_x emissions for the Cold-Start Partial Soak Test.

- 7.3.2 Subparagraph (b): PM sampling options. [n/a]

7.3.3 Amend subparagraph (c) as follows:

7.3.3.1 Subparagraphs (c)(1) and (c)(2): [No change.]

7.3.3.2 Subparagraphs (c)(3): [n/a]

7.3.4 Amend subparagraph (d) as follows: *Test sequence*. Follow the exhaust emission measurement procedures specified in 40 CFR § 1066.410 through § 1066.425, subject to the following exceptions and additional provisions:

7.3.4.1 Amend subparagraph (d)(1) as follows: Take the following steps for the Cold-Start Partial Soak Test:

7.3.4.1.1 Amend subparagraph (d)(1)(i): Following the 10 minute to 12 hour soak, initiate the Cold-Start Partial Soak Test in the driver-selectable mode to be tested by operating the vehicle over one UDDS cycle.

7.3.4.1.2 Subparagraph (d)(1)(ii) to (d)(1)(iv): [No change.]

7.3.4.2 Subparagraph (d)(2) and (d)(3): [n/a].

7.4. **End-of-Test Criteria.**

A valid test shall satisfy the SOC Net Energy Change Tolerances in subsection Part II, section I.5. For HEVs that use a battery as an energy storage device, $(\text{Amp}\cdot\text{hr}_{\text{initial}})$ is the stored charge at the beginning of the Cold-Start Partial Soak Test, and $(\text{Amp}\cdot\text{hr}_{\text{final}})$ is the stored battery charge at the end of the Cold-Start Partial Soak Test. The final stored battery charge, $(\text{Amp}\cdot\text{hr}_{\text{final}})$, shall not exceed either $(\text{Amp}\cdot\text{hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp}\cdot\text{hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V_{initial}^2) is the square of the capacitor voltage stored at the beginning of the Cold-Start Partial Soak Test, and (V_{final}) is the stored capacitor voltage at the end of the Cold-Start Partial Soak Test. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{\text{final}})_{\text{max}}$ or $(V_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(\text{rpm}^2_{\text{initial}})$ is the squared flywheel rotational speed at the beginning of the Cold-Start Partial Soak Test, and $(\text{rpm}_{\text{final}})$ is the flywheel rotational speed at the end of the Cold-Start Partial Soak Test. The final flywheel rotational speed, $(\text{rpm}_{\text{final}})$, shall not exceed either $(\text{rpm}_{\text{final}})_{\text{max}}$ or $(\text{rpm}_{\text{final}})_{\text{min}}$ for a valid test.

7.5. Alternative End-of-Test Criteria.

With approval from the Executive Officer under the procedure in Part II, section I.2.3.18, if the End-of-Test Criteria in subsection Part II, section I.7.4 is not satisfied after the Cold-Start Partial Soak Test, the test may be considered valid if:

- 7.5.1 The alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 is satisfied (Note: Appendix C of SAE J1711 may not be used to correct measured values for any emissions.); or
- 7.5.2 The SOC at the end of the Cold-Start Partial Soak Test is higher than the SOC at the beginning of the Cold-Start Partial Soak Test.

7.6. Option to Conduct Additional Cold-Start Partial Soak Tests.

To determine compliance with the Partial Soak emission standards, the test sequence in Part II, sections I.7.2 to I.7.5 may be repeated to measure exhaust emissions on additional Cold-Start Partial Soak Tests.

7.7. Partial Soak Test Emissions Calculations.

To be conducted pursuant to 40 CFR § 1066.820 [October 25, 2016] with the following revisions:

- 7.7.1 Amend Subparagraph (a) as follows: Determine the mass of exhaust emissions of each pollutant for each test interval in subsection Part II, section I.7.7.2 as described in § 1066.605.
- 7.7.2 Amend Subparagraph (b) as follows: Calculate the final composite gaseous test results as a mass-weighted value, $e_{\text{partial_soak}}$, in grams per mile, using the following equation:

$$e_{\text{partial_soak}} = 0.43 \left(\frac{m_{ps}}{D_{ps}} \right) + 0.57 \left(\frac{m_h}{D_h} \right)$$

Where:

m_{ps} = the mass emissions determined from the Cold-Start Partial Soak Test in subsection Part II, section I.7.3, in grams. If the Cold-Start Partial Soak Test consists of phase 1 cold transient emissions and phase 2 cold stabilized emissions, then sum phase 1 and phase 2 emissions to determine m_{ps} .

- m_h = the mass emissions determined from the hot-start UDDS cycle in subsection Part II, section I.7.1, in grams. If the hot-start UDDS cycle consists of phase 3 hot transient emissions and phase 4 hot stabilized emissions, then sum phase 3 and phase 4 emissions to determine m_h .
- D_{ps} = the measured driving distance from the Cold-Start Partial Soak Test in subsection Part II, section I.7.3, in miles. If the Cold-Start Partial Soak Test consists of phase 1 distance and phase 2 distance, then sum phase 1 and phase 2 distances to determine D_{ps} .
- D_h = the measured driving distance from the hot-start UDDS cycle in subsection Part II, section I.7.1, in miles. If the hot-start UDDS cycle consists of phase 3 distance and phase 4 distance, then sum phase 3 and phase 4 distances to determine D_h .

7.7.3 Subparagraph (c): [n/a.]

8. Quick Drive-Away Emission Testing.

8.1. Vehicle Preconditioning for Quick Drive-Away Emission Test.

Precondition the vehicle following the procedure outlined in subsection Part II, section I.2.2. If the alternative End-of-Test Criterion in Part II, section I.8.4.1 is used, then setting initial SOC shall not be permitted due to the larger $\pm 5\%$ SOC Net Energy Change Tolerance provided by the alternative End-of-Test Criterion in Part II, section I.8.4.1.

8.2. Quick Drive-Away Test Run.

Amend § 1066.815 as follows:

8.2.1 Amend subparagraph (a) as follows: *General.* The Quick Drive-Away Emission Test consists of a cold-start Quick Drive-Away UDDS cycle. Conduct the Quick Drive-Away Test in the driver-selectable mode (e.g., normal mode, economy mode, performance mode, battery charging mode, or any other operating mode available to the driver) that represent the worst case NMOG+NO_x emissions for the Quick Drive-Away Emission Test.

8.2.2 Subparagraph (b): PM sampling options. [n/a]

8.2.3 Amend subparagraph (c) as follows:

8.2.3.1 Subparagraphs (c)(1) and (c)(2): [No change.]

8.2.3.2 Subparagraphs (c)(3): [n/a]

8.2.4 Amend subparagraph (d) as follows: *Test sequence*. Follow the exhaust emission measurement procedures specified in 40 CFR § 1066.410 through § 1066.425, subject to the following exceptions and additional provisions:

8.2.4.1 Amend subparagraph (d)(1) as follows: Take the following steps for the Quick Drive-Away Emission Test:

8.2.4.1.1. Amend subparagraph (d)(1)(i) as follows: Following the 12 to 36 hour soak, initiate the Quick Drive-Away Emission Test in the driver-selectable mode to be tested by operating the vehicle over one Quick Drive-Away UDDS cycle described in Part II, section H.

8.2.4.1.2. Amend subparagraph (d)(1)(ii) as follows: Start sampling and recording simultaneously with starting the vehicle. Place the vehicle in gear 6 seconds after engine starting, which is 2 seconds before the first acceleration.

8.2.4.1.3. Amend subparagraph (d)(1)(iii) as follows: At the end of the deceleration scheduled to occur 505 seconds into the Quick Drive-Away UDDS, simultaneously switch all the sample flows from the cold-start transient interval to the stabilized interval, stopping all cold-start transient interval sampling and recording, including background sampling. Reset integrating devices for the stabilized interval and indicate the end of the cold-start interval in the recorded data. Operate the vehicle over the remainder of the Quick Drive-Away UDDS. Turn the engine off 2 seconds after the end of the last deceleration in the stabilized interval (1,369 seconds after the start of the driving schedule).

8.2.4.1.4. Subparagraph (d)(1)(iv): [No change.]

8.2.4.2 Subparagraph (d)(2) and (d)(3): [n/a].

8.3. **End-of-Test Criteria.**

A valid test shall satisfy the SOC Net Energy Change Tolerances in subsection Part II, section I.5. For HEVs that use a battery as an energy storage device, ($\text{Amp}\cdot\text{hr}_{\text{initial}}$) is the stored charge at the beginning of the

Quick Drive-Away Emission Test, and $(\text{Amp}\cdot\text{hr}_{\text{final}})$ is the stored battery charge at the end of the Quick Drive-Away Emission Test. The final stored battery charge, $(\text{Amp}\cdot\text{hr}_{\text{final}})$, shall not exceed either $(\text{Amp}\cdot\text{hr}_{\text{final}})_{\text{max}}$ or $(\text{Amp}\cdot\text{hr}_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use a capacitor as an energy storage device, (V_{initial}^2) is the square of the capacitor voltage stored at the beginning of the Quick Drive-Away Emission Test, and (V_{final}) is the stored capacitor voltage at the end of the Quick Drive-Away Emission Test. The final stored capacitor voltage, (V_{final}) , shall not exceed either $(V_{\text{final}})_{\text{max}}$ or $(V_{\text{final}})_{\text{min}}$ for a valid test. For HEVs that use an electro-mechanical flywheel as an energy storage device, $(\text{rpm}^2_{\text{initial}})$ is the squared flywheel rotational speed at the beginning of the Quick Drive-Away Emission Test, and $(\text{rpm}_{\text{final}})$ is the flywheel rotational speed at the end of the Quick Drive-Away Emission Test. The final flywheel rotational speed, $(\text{rpm}_{\text{final}})$, shall not exceed either $(\text{rpm}_{\text{final}})_{\text{max}}$ or $(\text{rpm}_{\text{final}})_{\text{min}}$ for a valid test.

8.4. Alternative End-of-Test Criteria.

With approval from the Executive Officer under the procedure in Part II, section I.2.3.18, if the End-of-Test Criteria in subsection Part II, section I.8.3 is not satisfied after the Quick Drive-Away Emission Test, the test may be considered valid if:

- 8.4.1 The alternative End-of-Test criterion of $\pm 5\%$ SOC Net Energy Change Tolerance in Appendix C of SAE J1711 is satisfied (Note: Appendix C of SAE J1711 may not be used to correct measured values for any emissions.); or
- 8.4.2 The SOC at the end of the Quick Drive-Away Emission Test is higher than the SOC at the beginning of the Quick Drive-Away Emission Test.

8.5. Determining Hot-Start Emissions.

Conduct an Urban Emission Test as described in subsection Part II, section I.2 to determine hot-start emissions.

8.6. Quick Drive-Away Test Emissions Calculations.

To be conducted pursuant to 40 CFR § 1066.820 [October 25, 2016] with the following revisions:

- 8.6.1 Amend subparagraph (a) as follows: Determine the mass of exhaust emissions of each pollutant for each test interval in subsection Part II, section I.8.6.2 as described in § 1066.605.

8.6.2 Amend subparagraph (b) as follows: Calculate the final composite gaseous test results as a mass-weighted value, $e_{\text{quick_drive_away}}$, in grams per mile, using the following equation:

$$e_{\text{quick_drive_away}} = 0.43 \left(\frac{m_{qd}}{D_{qd}} \right) + 0.57 \left(\frac{m_h}{D_h} \right)$$

Where:

m_{qd} = the mass emissions determined from the Quick Drive-Away Emission Test in subsection Part II, section 1.8.2, in grams. If the Quick Drive-Away Emission Test consists of phase 1 cold transient emissions and phase 2 cold stabilized emissions, then sum phase 1 and phase 2 emissions to determine m_{qd} .

m_h = the mass emissions determined from the hot-start UDDS cycle in subsection Part II, section 1.8.5, in grams. If the hot-start UDDS cycle consists of phase 3 hot transient emissions and phase 4 hot stabilized emissions, then sum phase 3 and phase 4 emissions to determine m_h .

D_{qd} = the measured driving distance from the Quick Drive-Away Emission Test in subsection Part II, section 1.8.2, in miles. If the Quick Drive-Away Emission Test consists of phase 1 distance and phase 2 distance, then sum phase 1 and phase 2 distances to determine D_{qd} .

D_h = the measured driving distance from the hot-start UDDS cycle in subsection Part II, section 1.8.5, in miles. If the hot-start UDDS cycle consists of phase 3 distance and phase 4 distance, then sum phase 3 and phase 4 distances to determine D_h .

8.6.3 Subparagraph (c). [n/a.]