APPENDIX B-2

California Environmental Protection Agency

AIR RESOURCES BOARD

PROPOSED

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

Adopted: [INSERT DATE OF ADOPTION]

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NOTE: This document is incorporated by reference in title 13, California Code of Regulations (CCR), sections 1961.4(f). 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 Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in title 13, CCR, section 1961.2(d));

2. "California Test Procedures for 2026 and Subsequent Model 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.

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

The provisions of Subparts B, C, and S, Part 86, Title 40, Code of Federal Regulations, as adopted or amended on May 4, 1999 or as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, and to the extent they pertain to exhaust emission standards and test procedures, are hereby adopted as the "California 2026 and Subsequent Model 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 Amend subparagraph (a) as follows: Except as otherwise indicated, the provisions of this subpart apply to new passenger cars, light-duty trucks, and medium-duty vehicles, including multi-fueled, alternative fueled, hybrid electric, plug-in hybrid electric, and electric vehicles. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section of this subpart.

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

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

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

shall be based on projected California sales. The small-volume manufacturer's light- and medium-duty vehicle and truck certification procedures are described in 40 CFR § 86.1838, as modified in section 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 Amend subparagraph (g) *Complete and incomplete vehicles* as follows: A manufacturer must certify any heavy-duty complete Otto-cycle vehicle or complete diesel vehicle of 14,000 pounds Gross Vehicle Weight Rating (GVWR) or less and any medium-duty passenger vehicle in accordance with the medium-duty chassis-standards in title 13, CCR, section 1961.4. A manufacturer must certify any heavy-duty vehicle of 10,000 pounds GVWR or less, including incomplete Otto-cycle vehicles and incomplete heavy-duty diesel vehicles, in accordance with the LEV IV medium-duty chassis-standards in title 13, CCR, section 1961.4. A manufacturer must certify any heavy-duty engine and vehicle of 10,001-14,000 pounds GVWR to the medium-duty engine standards in title 13, CCR, section 1956.8. A manufacturer may request to certify LEV IV heavy-duty complete diesel vehicles of 10,001 - 14,000 pounds GVWR to the chassis-standards in title 13, CCR, section 1961.4; heavy-duty engine or heavy-duty vehicle provisions of 40 CFR Part 86 subpart A do not apply to such a vehicle or engine.

1.1.8 Subparagraph (h) [No change.]

1.1.9 Subparagraph (i) [No change.]

1.1.10 Subparagraph (j) [n/a]

1.2. **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.

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

B. Definitions, Acronyms and Abbreviations

1. **§ 86.1803 Definitions.**

1.1. § 86.1803-01. 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.

"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 (CH_3CH_2OH) 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 (CH_3OH) 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 “OMNMHCE”) 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 “OMNMHCE”) 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.

"CH_4" 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.

"N_2O" means nitrous oxide.

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

“OBD” means on-board diagnostic system.

“PC” means passenger car.

“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 Amend subparagraph (b) as follows: Delete; Replace with: The full useful life of passenger cars, light-duty trucks, and medium-duty passenger vehicles certified to the greenhouse gas standards in title 13, CCR, section 1961.3 shall be 15 years or 150,000 miles, whichever occurs first.

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

3.1.5 Subparagraph (d): Delete and replace with: Incomplete medium-duty vehicles shall have the following statement printed prominently on the label required by paragraph (a)(3)(v) of this section: "This vehicle conforms to California regulations applicable to new 20xx model-year (specify 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 Subparagraph (e): [No change.]

3.1.7 Subparagraph (f): [No change.]

3.1.8 Subparagraph (g): Add the following: The manufacturer shall obtain approval from the Executive Officer for all emission control label formats and locations prior to use. If the Executive Officer finds that the information on the label is vague or subject to misinterpretation, or that the location does not comply with these specifications, the Executive Officer may require that the label or its location be modified accordingly. Samples of all actual production emission control labels used within a test group shall be submitted to the Executive Officer within thirty days after the start of production. The Executive Officer may approve alternate label locations or may, upon request, waive or modify the label content requirements provided that the intent of these requirements is met. If the

Executive Officer finds any motor vehicle or motor vehicle engine manufacturer using emission control labels which are different from those approved or which do not substantially comply with the readability or durability requirements set forth in these labeling requirements, the Executive Officer may invoke title 13, CCR, section 2109.

3.1.9 Subparagraph (h): [n/a]

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 but not limited to:

AIR - Secondary Air Injection (Pump);

CAC - Charge Air Cooler;

CFI - Continuous Fuel Injection;

CTOX - Continuous (Passive) Trap Oxidizer (Diesel Engine);

DFI - Direct Fuel Injection;

DOR - Direct Ozone Reduction;

DPF - Diesel Particulate Filter (Active);

EGR - Exhaust Gas Recirculation;

EGRC - EGR Cooler;

EHOC - Electrically Heated Oxidation Catalyst;

EHTWC - Electrically Heated Three-Way Catalyst;

EM - Engine Modification;

FFS - Flexible Fuel Sensor;

GPF - Particulate Filter for Spark-Ignited Engine;

HAC - Hydrocarbon Adsorbing Catalyst;

HO2S - Heated Oxygen Sensor;

IFI - Indirect Fuel Injection;

MFI - Multiport (Electronic) Fuel Injection, (Central) Multiport Fuel Injection;

NAC - NOx Adsorber Catalyst;

NH3OC - Ammonia Slip Catalyst;

NH3S - Ammonia Sensor;

NOXS - NOx Sensor;

OC - Oxidation Catalyst Only;

O2S - Oxygen Sensor;

PAIR - Pulsed Secondary Air Injection;

PMS - Particulate Matter Sensor;

RDQS - Reductant Quality Sensor;

SC - Supercharger;

SCRC - Selective Catalytic Reduction Catalyst (Urea-Based);

SCRC-NH3 - Selective Catalytic Reduction Catalyst (Ammonia-Based);

SFI - Sequential Multipoint (Electronic) Fuel Injection;

TBI - Throttle Body (Electronic) Fuel Injection;

TC - Turbocharger;

TWC - Three-Way Catalyst;

TWC+OC - Three-Way Catalyst + Oxidation Catalyst;

WR-HO2S - Wide Range/Linear/Air-Fuel Ratio Heated Oxygen Sensor;

WU-TWC - Warm-Up Catalyst with Three-Way Catalyst;

WU-OC - Warm-Up Catalyst with Oxidation Catalyst.

Abbreviations used shall be in accordance with the current version of SAE J1930, March 2017, including the above nomenclature. The Executive Officer shall approve upon request use of abbreviations in a more current version of SAE J1930. For components not listed in SAE J1930, the manufacturer shall request Executive Officer approval of the abbreviations to be used for the components. Executive Officer approval shall be granted upon determining the proposed abbreviation is consistent with existing terminology used for the component in the applicable industry and distinguishes other similar components.

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) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible-fueled vehicles). This section also applies to hybrid electric vehicles. The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated.

1.1. 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, except that 50°F standards and SFTP standards shall only apply at low altitude conditions.]

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 AECDs involving commanded enrichment, these AECDs 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 NOx emissions and comparing with the NMOG+NOx 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(c)(9), 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(c)(9), “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 NOx 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. **50ºF Requirements.**

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

2.2.2 The same test group shall not be selected in the succeeding two years unless the manufacturer produces fewer than three test groups. If the manufacturer produces more than three 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 50ºF 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 50ºF testing within a 30 day period after receiving such a list and description. The Executive Officer may revise the test groups selected after the 30 day period if the information provided by the manufacturer does not accurately reflect the test groups actually certified by the manufacturer.

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.3.5. 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) Add the following: For Otto-cycle vehicles or hybrid vehicles that use Otto-cycle engines, evidence shall be supplied showing that the air/fuel metering system or secondary air injection system is capable of providing sufficient oxygen to theoretically allow enough oxidation to attain the CO emission standards at barometric pressures equivalent to those expected at altitudes ranging from sea level to an elevation of 6000 feet. For fuel injected vehicles or hybrid electric vehicles that use fuel-injected engines, compliance may be demonstrated upon a showing by the manufacturer that the fuel injection system distributes fuel based on mass air flow, rather than volume flow, and is therefore self-compensating. All submitted test proposals will be evaluated on their acceptability by the Executive Officer. As an alternative to the demonstration described above, a manufacturer may demonstrate

compliance by testing California vehicle configurations as part of its federal high altitude certification requirements. Engine families that meet all the applicable California low altitude emission standards when tested at the EPA test elevation are deemed to be in compliance. The SFTP standards, Partial Soak NMOG+NOx exhaust standards, Quick Drive-Away NMOG+NOx standards, and Cold Start US06 NMOG+NOx exhaust emission standards do not apply to testing at high altitude.

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.]

3.2. **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+NOx certification level, as required in title 13, CCR, section 1961.4(c)(8). 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, section 1961.4(c)(8), the manufacturer may submit to the Executive Officer engineering data or other evidence showing that the system is capable of complying with the standard. If the Executive Officer finds, on the basis of an engineering evaluation, that the system can comply with the HWFET standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data.

3.4. **SC03 Test.**

Except for medium-duty passenger vehicles, in lieu of testing a medium-duty vehicle for SC03 emissions for certification, the manufacturer may submit to the Executive Officer an attestation that the system complies with the NMOG+NOx and CO standards in title 13, CCR, section 1961.4(c)(9)(F).

3.5. **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.3.5 for a model year, that same test group shall not be selected in the succeeding two model years unless the manufacturer produces fewer than four test groups that are certified to LEV 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.]

8.2. **HEVs.**

The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light that shall activate automatically by illuminating the first time the minimum performance level is observed for all battery system components. Possible battery system components requiring monitoring are: (i) battery water level; (ii) temperature control; (iii) pressure control; and (iv) other parameters critical for determining battery condition.

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

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

10. **§ 86.1836-01 Manufacturer-supplied production vehicles for testing.** [Delete.]
11. **§ 86.1837 Rounding of emission measurements.**

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

11.2. Fleet average NMOG+NOx value calculations shall be rounded, in accordance with 40 CFR § 1065.20 (April 28, 2014), to four significant figures before comparing with fleet average NMOG+NOx requirements.

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 NOx mass emission value. This result shall be compared to the NMOG+NOx 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(c)(9), 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)(15), 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+NOx standards to the LEV IV NMOG+NOx 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)(15)(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)(1) through (d)(6), or the greenhouse gas requirements in title 13, CCR, section 1961.3 for a given model year, and in order to confirm the accrual of credits or debits, each manufacturer shall submit an annual report to the Executive Officer which sets forth the production data used to establish compliance, by no later than March 1 or May 1, respectively, of the calendar year following the close of the model year.

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

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

(a) Modify § 86.1844-01 (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.

(b) Delete § 86.1844-01(d)(9).

(c) § 86.1844-01(d)(11)(iii). Delete; Replace with: For vehicles with spark-ignition engines, describe how AECDs 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.

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

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

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

(b) The NMOG/NMHC and/or formaldehyde to NMHC ratios established according to Part I, section I.1.2 of these test procedures.

4.1.4 Delete § 86.1844-01(e)(7).

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 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^{o}F and 86^{o}F; and

(c) the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

4.5. **Greenhouse Gas Reporting Requirements.**

(a) For the purpose of demonstrating compliance with greenhouse gas requirements in title 13, CCR, section 1961.3, the manufacturer shall provide by May 1 of the calendar year following the close of the model year:

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

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

(b) All data submitted in accordance with this Part I, section H.4.5, must be submitted electronically and organized in a format specified by the Executive Officer to clearly demonstrate compliance with California's greenhouse gas exhaust emission requirements in title 13, CCR, section 1961.3.

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(c)(9)(B) or (c)(9)(E), 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(c)(9)(B) or (c)(9)(E), 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(c)(9)(B) or (c)(9)(E), 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(c)(9)(B) or (c)(9)(E), 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(c)(1) must have a minimum odometer mileage of 105,000 miles or 75 percent of full useful life mileage. See § 86.1838-01(c)(2) for small volume manufacturer mileage requirements.

1.1.4 **High Altitude Testing.** Amend subparagraph (c)(5)(i) of 40 CFR § 86.1845-04 by adding the following sentence: High altitude testing shall not apply at 50^{o}F. High altitude testing is not required for demonstrating compliance with the Partial Soak NMOG+NOx standards in title 13, CCR, section 1961.4(c)(6), the Quick Drive-Away NMOG+NOx standards in title 13, CCR, section 1961.4(c)(7), or the High Power Cold Start US06 standards in title 13, CCR, section 1961.4(c)(10).

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 NOx exhaust emissions and compared to the NMOG+NOx 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+NOx standards, the manufacturer may request from the Executive Officer the use of a methanol (M85) or ethanol (E85) NMOG exhaust emission to gasoline NMHC exhaust emission ratio which shall be established during certification testing for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. After approval by the Executive Officer, the measured gasoline NMHC exhaust emissions shall be multiplied by the M85 or E85 NMOG to gasoline NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. The equivalent NMOG exhaust emission value shall be added to the measured NOx exhaust emissions and compared to the NMOG+NOx exhaust emission standard applicable to the vehicle emission category (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 Combined 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^{o} F (30^{o} 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, NOx, 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 towing with a combined vehicle weight with a minimum of 70% GCWR within ±5%. 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 which exceed 24,000 lbs. (10,886 kg), the minimum trailer frontal area is 75 ft^2 (6.97 m^2), however the frontal area of the trailer shall 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, then CARB may review specifications of the alternate trailer as part of the test plan approval and determine if it may be used for testing. The manufacturer will have to provide supporting documentation for the alternate trailer.

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, CO_2 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:

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

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 ± 3.6° F (± 2° 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. Retesting must be conducted if a test is determined to be invalid. A valid test is determined by meeting all of the following conditions:

4.1.2.1 Test start: emissions sampling (NMHC, CO, NOx, PM and CO_2), 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.

4.1.2.2 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.

4.1.2.3 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.

4.1.2.4 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 CO_2 emission rate [g CO_2/hour] during the 300 second window by the

product of the engine's FTP CO_2 family certification level (FCL) value and the maximum power output of the engine.

$$Percent\ Engine\ Load_{window} = \frac{3{,}600\ sec/hr}{FCL\ \times\ HP_{max}} \times \frac{\sum_{t=1}^{300}(\dot{m}_{CO2} \times \Delta t)}{300\ sec}$$

Where,

Percent Engine $Load_{window}$ is the percent engine load calculated with the average CO_2 emission rate and the FCL

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

NOx, 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:

$$e_{sos\ a,b} = \frac{\sum_{k=1}^{n_b}\sum_{t=1}^{300}(\dot{m}_a \times \Delta t)}{\sum_{k=1}^{n_b}\sum_{t=1}^{300}(\dot{m}_{CO2} \times \Delta t)} \times FCL$$

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, NOx, 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]

$\dot{m}_{CO2}$ is the mass emission rate of CO_2 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:

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

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 NOx is the only pollutant with an idle standard, pollutant "a", in this equation represents only NOx 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%	$e_{sos\ a,Idle}$ ≤ CF[B] x Idle standard[A]
Low	6% < $Percent\ Engine\ Load_{window}$ ≤ 20%	$e_{sos\ a,Low}$ ≤ CF[B] x LLC standard[A]
Medium/High	20% < $Percent\ Engine\ Load_{window}$	$e_{sos\ a,MedHigh}$ ≤ CF[B] x 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:

$$e_{sos\ a} = \frac{\sum_{k=1}^{n_b}\sum_{t=1}^{300}(\dot{m}_a \times \Delta t)}{\sum_{k=1}^{n_b}\sum_{t=1}^{300}(\dot{m}_{CO2} \times \Delta t)} \times FCL$$

Where:

$e_{sos\ a}$ 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]

$\dot{m}_{CO2}$ is the mass emission rate of CO_2 [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 x 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:

Pollutants	*Otto-Cycle FTP Standard (g/bhp-hr)*
NOx	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.

$$FCL = \frac{FTP\ CO2\ [g]}{FTP\ Work\ [bhp-hr]}$$

Where:

FTP CO_2 = Weighted 3-phase chassis FTP-75 CO_2 [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 CO_2. Measure or determine O_2 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, NO_2, and NOx, 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, NO_2, and NOx 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 but are not limited to the following vehicle, engine, OBD/MIL, maintenance, and PEMS system information outlined in the following bulleted list:

- 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 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, NOx, 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 CARB Executive Officer is authorized to conduct In-use Compliance testing using the appropriate procedures in title 13, CCR, §1961.4, 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.

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 The manufacturer must test in-use vehicles from the test groups CARB selects. CARB may 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 may select one test group per calendar year for testing.

4.6.2 Over any four-year period, CARB will not select more than the average number of test groups that the manufacture has certified over that four-year period (the model year when the selection is made and the preceding three model years), based on rounding the average value to the nearest whole number.

4.6.3 If there is clear evidence of a nonconformity with regard to a test group, CARB may select that test group without counting it as a selected test group under this section. CARB will consult with the manufacturer in reaching a conclusion whether clear evidence of a nonconformity exists for any test group. In general, there is clear evidence of a nonconformity regarding a test group under this section in any of the following cases:

4.6.3.1 The test group was not remedied but is a carry-over from a test group the manufacturer tested under these test procedures and was subsequently remedied based at least in part on the outcomes described in these test procedures.

4.6.3.2 The test group was not remedied but is a carry-over from a test group that was remedied based on a U.S. EPA in-use testing program.

4.6.4 The manufacturer must complete all the required testing and reporting under these sections within 18 months after CARB directs the manufacturer to test a particular test group. CARB will typically select test groups for testing and notify the manufacturer in writing by June 30 of the applicable calendar year. The manufacturer may ask for up to six months

longer to complete testing if there is a reasonable basis for needing more time. In very unusual circumstances the manufacturer may request an additional six months to complete testing.

4.6.5 If the manufacturer makes a good-faith effort to access enough test vehicles to complete testing requirements under these sections for a test group, but are unable to do so, the manufacturer must ask CARB either to modify the testing requirements for the selected test group or select a different test group.

4.6.6 After the manufacturer completes the in-use testing requirements for a test group that CARB selected for testing in a given calendar year, CARB may select that same test group in a later year to evaluate the test group's compliance closer to the end of its useful life. This would count as an additional test group selection under Part I, section I.4.6.1, except as described in Part I, section I.4.6.3.

4.6.7 For any communication related to this section, contact iuvp@arb.ca.gov

4.7. **MAW Vehicle Selection and Screening**

4.7.1 Once CARB directs the manufacturer to do testing under these sections, the manufacturer must select test vehicles that meet the following criteria:

4.7.1.1 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 The usage of the vehicles must be representative of typical usage for the vehicles' particular application.

4.7.1.3 The vehicles come from at least two independent sources.

4.7.1.4 The key vehicle/engine systems (e.g., power train, drive train, emission control) have been properly maintained and used.

4.7.1.5 The vehicles have not been tampered with, rebuilt or undergone major repair that could be expected to affect emissions.

4.7.1.6 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.

4.7.1.7 The vehicles do not have an illuminated MIL or stored OBD trouble code that leads the manufacturer to reject the vehicle from the test program as described in Part I, section I.4.8.2.2.

4.7.1.8 The vehicles are likely to operate for at least three hours over a complete test sampling period.

4.7.1.9 The vehicles have not exceeded the applicable useful life in miles or years. The manufacturer may otherwise not exclude engines from testing based on their age or mileage.

4.7.1.10 The vehicle has appropriate space for safe and proper mounting of the PEMS equipment.

4.7.2 The manufacturer must keep any records of a vehicle's maintenance and use history obtained from the owner or operator, as required by these test procedures. The manufacturer must report the engine's maintenance and use history and information related to the OBD system, as described in these test procedures.

4.7.3 The manufacturer must notify CARB before rejecting a candidate vehicle for reasons other than failing to meet the acceptance criteria of this section. A candidate vehicle is any prospective vehicle identified to potentially fulfill testing requirements under these test procedures. Include reasons for rejecting each vehicle. If an owner declines to participate in the test program, the manufacturer may reject the vehicle without prior notification. Such a rejection must be reported as described in these test procedures. CARB may allow replacing the rejected vehicle with another candidate vehicle to meet testing requirements for the specific test group.

4.7.4 The manufacturer must report when, how, and why candidate vehicles are rejected, as described in the MAW reporting section.

4.8. **Vehicle Preparation for MAW In-use Testing**

4.8.1 Limit maintenance to what is in the owner’s manual for vehicles with that amount of service and age. For anything CARB considers an adjustable parameter (see Part I, section G.7), the manufacturer may adjust that parameter only if it is outside of its adjustable range. The manufacturer must then set the adjustable parameter to the mid-point of its adjustable range or the recommended setting, unless CARB approves the request to do otherwise. The manufacturer must receive permission from CARB before adjusting anything not considered to be an adjustable parameter. The manufacturer must keep records of all maintenance and adjustments,

as required by these test procedures. The manufacturer must send CARB these records, as described in reporting section for the MAW, unless CARB instructs not to send them.

4.8.2 The manufacturer may treat a vehicle with an illuminated MIL or stored trouble code as follows:

4.8.2.1 If the length of MIL illumination or trouble code storage is consistent with proper maintenance and use, either test the prospective test vehicle as received or repair the vehicle before testing. If the manufacturer elects to repair the vehicle/engine, but ultimately determines that repairs cannot be completed in a timely manner, the manufacturer may reject the vehicle from the test program and replace it with another vehicle. If the manufacturer repairs or rejects the vehicle, the manufacturer must describe the MIL or trouble code information in the report.

4.8.2.2 If the length of MIL illumination or trouble code storage is inconsistent with proper maintenance and use, either test the prospective test vehicle as received, repair the vehicle before testing, or reject the vehicle from the test program and replace it with another vehicle. If the manufacturer repairs or rejects the vehicle, the manufacturer must describe the MIL or trouble code information in the report.

4.8.3 If a MIL is illuminated or a trouble code is set during an in-use test, do one of the following:

4.8.3.1 Stop the test, repair the vehicle, and restart the testing. In this case, only the portion of the full test results without the MIL illuminated or trouble code set would be used in the vehicle-pass determination as described in Part I, section I.4.4. Describe the MIL or trouble code information in the report.

4.8.3.2 Stop the test, repair the vehicle, and initiate a new test. In this case, only the post-repair test results would be used in the vehicle-pass determination as described in Part I, section I.4.4. Describe the MIL or trouble code information in the report.

4.8.3.3 If three hours of operation have been accumulated prior to the time a MIL is illuminated or trouble code set, stop the test and use the accumulated test results in the vehicle-pass determination as described in Part I, section I.4.4.

4.8.3.4 If three hours of operation have not been accumulated prior to the time a MIL is illuminated or trouble code is set, and the manufacturer elects to repair the vehicle/engine, but ultimately determines that repairs cannot be completed in a timely manner, the manufacturer may reject the vehicle from the test program and replace it with another vehicle. If the manufacturer repairs or rejects the vehicle, the manufacturer must describe the MIL or trouble code information in the report.

4.8.4 Use appropriate fuels for testing, as follows:

4.8.4.1 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 section 86.1), as required in the calendar year that in-use testing occurs. For diesel vehicles, the manufacturer may alternatively use any commercially available biodiesel fuel blend.

4.8.4.2 For Otto-cycle vehicles, the manufacturer shall use commercially available fuel that meets the following California fuel specifications:

4.8.4.2.1 For conventional gasoline vehicles: California Reformulated Gasoline Phase 3 as indicated in title 13, CCR, section 2262

4.8.4.2.2 For flex-fueled gasoline vehicles: E-85 Fuel Ethanol as indicated in title 13, CCR, section 2292.4

4.8.4.3 Any fuel that is added to the fuel tank(s) of a prospective test vehicle, or during an in-use test, must be purchased at a local retail establishment near the site of vehicle procurement or screening, or along the test route. Alternatively, the fuel may be drawn from a central fueling source, provided that the fuel used is representative of that which is commercially available in the area where the vehicle is operated.

4.8.4.4 No post-refinery fuel additives are allowed, except that one or more specific fuel additives may be used during in-use testing if the manufacturer can document that the owner/operator of the prospective test vehicle has a history of normally using the fuel treatment(s), and the fuel additive(s) is not prohibited in the

vehicle's owner or operator manual or in the engine manufacturer's published fuel-additive recommendations.

4.8.4.5 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 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. The manufacturer must report any fuel tests that are the basis of voiding a test in the report.

4.8.5 The manufacturer must test the vehicle under conditions reasonably expected to be encountered during normal vehicle operation and use. For the purposes of these sections, 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), and normal ambient conditions.

4.8.6 The manufacturer may ask CARB to waive measurement of a particular emissions if the manufacturer can show that in-use testing for such emissions is not necessary.

4.9. **MAW In-use Reporting**

4.9.1 Send CARB electronic reports to iuvp@arb.ca.gov. If the manufacturer wants to use a different format, send CARB a written request with justification.

4.9.2 Within 45 days after the end of each calendar quarter, send CARB reports containing the test data from each vehicle for which testing was completed during the calendar quarter. Alternatively, the manufacturer may separately send CARB the test data within 30 days after the manufacturer completes testing for a vehicle. If the manufacturer requests it, CARB may allow additional time to send this information. Once the manufacturer sends CARB information under this section, the manufacturer does not send that information again in later reports. Prepare test reports as follows:

4.9.2.1 For each test group, describe how the manufacturer recruited vehicles. Describe how the manufacture used any criteria or thresholds to narrow the search or to screen individual vehicles.

4.9.2.2 Include a summary of the candidate vehicles rejected and the reasons the manufacturer rejected them, whether the manufacturer base the rejection on the criteria in these test procedures or anything else. If the manufacturer rejected a candidate vehicle due to misfueling, include the results of any fuel sample tests.

4.9.2.3 For the test vehicle, include the following background information:

4.9.2.3.1 The CARB test group designation, and the engine's model number, total displacement, and power rating.

4.9.2.3.2 The date CARB selected the test group for testing.

4.9.2.3.3 The vehicle's make and model and the year it was built.

4.9.2.3.4 The vehicle identification number and engine serial number.

4.9.2.3.5 The vehicle's type or application. Also, identify the type of trailer and weight loading.

4.9.2.3.6 The vehicle's maintenance and use history.

4.9.2.3.7 The known status history of the vehicle's OBD system and any actions the owner or operator took to address OBD trouble codes or MIL illumination over the vehicle's lifetime.

4.9.2.3.8 Any OBD codes or MIL illumination that occur after the manufacturer accepts the vehicle for in-use testing under this section.

4.9.2.3.9 Any steps the manufacturer took to maintain, adjust, modify, or repair the vehicle or its engine to prepare for or continue testing, including actions to address OBD trouble codes or MIL illumination. Include any steps taken to drain and refill the vehicle's fuel tank(s) to correct misfueling, and the results of any fuel test conducted to identify misfueling.

4.9.2.4 For each test, include the following data and measurements:

4.9.2.4.1. The date and time of testing, and the test number.

4.9.2.4.2. Days of testing, duration of testing, and the total hours of operation.

4.9.2.4.3. Route and location of testing. The manufacturer may base this description on the output from a global-positioning system.

4.9.2.4.4. The steps the manufacturer took to ensure that vehicle operation during testing was consistent with normal operation and use, as described in these test procedures.

4.9.2.4.5. Fuel test results, if fuel was tested under these test procedures.

4.9.2.4.6. The vehicle's mileage at the start of the test. Include the engine's total lifetime hours of operation, if available.

4.9.2.4.7. Ambient temperature, dewpoint, and atmospheric pressure at the start and finish of each valid window.

4.9.2.4.8. Total number of windows and the number of windows per bin.

4.9.2.4.9. Describe the method used to determine NMHC as specified in 40 CFR § 1065, subpart J. Report analysis as described in the 3B-MAW and MAW sections of these test procedures.

4.9.2.4.10. Exhaust-flow measurements.

4.9.2.4.11. 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.

- Ambient temperature.
- Ambient pressure.
- Ambient humidity.
- Altitude.
- Emissions of THC, NMHC, CO, CO_2 or O_2, and NO_X (as appropriate). Report results for PM if it was measured in a manner that provides one-hertz test data. Report results for CH_4 if it was measured and used to determine NMHC.
- Differential back-pressure of any PEMS attachments to vehicle exhaust.

- Exhaust flow
- Exhaust aftertreatment temperatures
- Engine brake torque.
- Intake manifold temperature.
- Intake manifold pressure.
- Throttle position.
- Any parameter sensed or controlled in order to modulate the emission-control system
- engine speed
- actual engine torque
- reference engine maximum torque
- engine coolant temperature
- 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

4.9.2.4.12 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 1968.2g(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.

4.9.2.4.13 Include the following summary information after the manufacturer completes testing with the vehicle:

(i) For vehicles, identify the in-use thresholds for the 3B-MAW and MAW as described in these test procedures.

(ii) State whether the vehicle meets the vehicle-pass criteria in these test procedures.

(iii) Identify how many vehicles the manufacturer has tested from the applicable test group and how many vehicles still need to be tested.

(iv) Identify how many vehicles from a test group have passed the vehicle-pass criteria and the number that have failed the vehicle-pass criteria.

(v) If possible, state the outcome of testing for the test group based on the criteria in these test procedures.

4.9.3 In the reports under this section, the manufacturer must do all the following:

4.9.3.1 Include results from all emission testing required under these sections.

4.9.3.2 Describe if any testing or evaluations were conducted to determine why a vehicle failed the vehicle-pass criteria in these test procedures.

4.9.3.3 Describe the purpose of any diagnostic procedures conducted.

4.9.3.4 Describe any instances in which the OBD system illuminated the MIL or set trouble codes. Also describe any approved actions taken to address the trouble codes or MIL.

4.9.3.5 Describe any instances of misfueling, the approved actions taken to address the problem, and the results of any associated fuel sample testing.

4.9.3.6 Describe any incomplete or invalid tests that were conducted under these sections.

4.9.3.7 For Otto-cycle vehicles, show how enrichment operation was determined and used for data exclusion.

4.9.4 Send CARB an electronic notification at iuvp@arb.ca.gov describing any voluntary vehicle/engine emission evaluation testing the manufacturer intends to conduct with portable in-use measurement systems on the same test groups that are being tested under these sections, from the time that test group was selected for in-use testing under these test procedures until the final results of all testing for that test group are reported to CARB under this section.

4.9.5 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.

4.9.6 CARB may ask the manufacturer to send less information in the reports than specified in this section.

4.9.7 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 Manufacturer must organize and maintain records as described in this section. CARB may review the manufacturer records at any time, so it is important to keep required information readily available.

4.10.2 Keep the following paper or electronic records of in-use testing for five years after completing all the testing required for a test group:

4.10.2.1 Keep a copy of the reports described in these test procedures.

4.10.2.2 Keep any additional records, including forms created, and related to any of the following:

4.10.2.2.1 The procurement and vehicle-selection process described in these test procedures, including the vehicle owner's name, address, phone number, and e-mail address.

4.10.2.2.2 Pre-test maintenance and adjustments to the engine performed under these test procedures.

4.10.2.2.3 Test results for all void, incomplete, and voluntary testing described in these test procedures.

4.10.2.2.4 Evaluations to determine why a vehicle failed the vehicle-pass criteria described in these test procedures.

4.10.2.3 Keep a copy of the relevant calibration results.

4.10.3 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 NOx standards.** [n/a]
14. **§ 86.1863-07 Optional Chassis Certification for Diesel Vehicles.** [n/a]
15. **§ 86.1865-12 How to comply with the fleet average CO_2 standards. October 25, 2016.** [n/a]
16. **§ 86.1866-12 CO_2 fleet average credit programs. October 25, 2016.** [n/a]
17. **§ 86.1867-12 Optional early CO_2 credit programs. October 25, 2016.** [n/a]
18. **§ 86.1868-12 CO_2 credits for improving the efficiency of air conditioning systems. October 25, 2016.** [n/a]
19. **§ 86.1869-12 CO_2 credits for off-cycle CO_2-reducing technologies. October 25, 2016.** [n/a]
20. **§ 86.1870-12 CO_2 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 ºF	
50% point	205-215 ºF	
90% point	310-320 ºF	
EP, maximum	390 ºF	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§ 2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§ 2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§ 2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§ 2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§ 2263, title 13 CCR
Benzene	0.6-0.8 vol. %	§ 2263, title 13 CCR
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
Oxidation Stability	1000 minutes (min)	D 525-88

California Certification Gasoline Specifications for LEV IV Light-Duty Vehicles and Medium-Duty Vehicles		
Fuel Property[a]	**Limit**	**Test Method [b]**
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, NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in “California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years.” In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

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

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

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 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 NOx intake-air humidity correction. October 25, 2016.

   1066.620 Removed water correction. April 28, 2014.

   1066.625 Flow meter calibration calculations. October 25, 2016.

   1066.630 PDP, SSV, and CFV flow rate calculations. October 25, 2016.

   1066.635 NMOG determination. October 25, 2016. [n/a]

   California NMOG Determination. The provisions of Part II, section D.2 shall apply. A manufacturer may use the conversion factors in section Part II, section D.1.7.5 as alternatives to those set forth in this section § 1066.635.

   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 subparagraphs (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 86º 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 Subparagraphs (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. The test sequence outlined in Part II, sections B.9.1.4.1.2 to B.9.1.4.3 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 Drive-Away 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, $e_{partial\_soak}$, in grams per mile, using the following equation:

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

Where:

m_{ps} = 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.

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.9.1.4.1.1, 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.9.1.4.1.1, 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.9.1.4.1.1, in grams.

D_{ps} = 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.

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.9.1.4.1.1, 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.9.1.4.1.1, 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.9.1.4.1.1, 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, $e_{quick\_drive\_away}$, in grams per mile, using the following equation:

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

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. 50ºF Emission Test Procedure.

The NMOG, CO, NOx, and formaldehyde emissions from all light- and medium-duty vehicles shall be measured according to the Federal Test Procedure as set forth in 40 CFR Part 1066 at a nominal temperature of 50ºF 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 50ºF, the nominal preconditioning, soak, and test temperatures shall be maintained within 3ºF of the nominal temperature on an average basis and within 5ºF of the nominal temperature on a continuous basis. The temperature shall be sampled at least once every 15 seconds during the preconditioning and test periods and at least once each 5 minutes during the soak period. A continuous strip chart recording of the temperature with these minimum time resolutions is an acceptable alternative to employing a data acquisition system.

(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 86ºF. 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 86ºF during a time interval not to exceed 10 minutes. In such cases, the vehicle shall be restabilized to 50ºF by soaking the vehicle in the nominal 50ºF test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.

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

D. Unified Cycle Driving Schedule.

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Unified Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	74	12.3	147	20	220	0	293	0	366	45.3	439	60.3	512	28
2	0	75	8.1	148	23	221	0	294	0	367	46.5	440	60.3	513	26.5
3	0	76	6.1	149	25.7	222	0	295	0	368	48	441	60.3	514	24.2
4	0	77	9.6	150	28	223	0	296	0	369	48.8	442	59.5	515	22.7
5	0	78	12.7	151	30.7	224	0	297	0	370	49.5	443	58.8	516	20.4
6	0	79	15.7	152	32.6	225	0	298	0	371	49.9	444	59.1	517	17.7
7	0	80	18	153	34.2	226	0	299	0	372	49.9	445	58.8	518	15.7
8	0	81	20.4	154	35.3	227	0	300	0	373	49.9	446	58.8	519	13.1
9	0	82	21.9	155	36.9	228	0	301	0	374	49.5	447	58.8	520	10.8
10	0	83	23.4	156	36.9	229	0	302	0	375	49.5	448	58.4	521	8.4
11	0	84	23.8	157	37.2	230	0	303	0	376	48.8	449	58	522	7.3
12	0	85	24.6	158	37.6	231	0	304	0	377	48.8	450	58	523	5
13	0	86	25	159	37.6	232	0	305	0	378	48.8	451	58	524	3.8
14	0	87	26.1	160	37.6	233	0	306	0	379	48.4	452	58.4	525	3.5
15	0	88	26.1	161	37.2	234	0	307	0	380	48.8	453	59.1	526	1.9
16	0	89	26.9	162	37.2	235	0	308	0	381	49.5	454	59.5	527	0.8
17	0	90	26.9	163	36.9	236	0	309	0	382	50.3	455	59.9	528	0
18	0	91	26.9	164	36.5	237	0	310	0	383	50.7	456	59.9	529	0
19	0	92	26.5	165	36.5	238	1.5	311	0	384	51.8	457	60.3	530	0
20	0	93	25.7	166	34.9	239	5	312	0	385	52.6	458	61.1	531	0.8
21	1.2	94	21.9	167	33.4	240	8.8	313	0.4	386	53.4	459	61.1	532	1.9
22	4.2	95	16.5	168	31.9	241	11.5	314	2.7	387	54.1	460	61.1	533	3.8
23	7.3	96	10	169	29.2	242	14.2	315	7.3	388	55.3	461	61.4	534	6.9
24	8.8	97	4.6	170	25	243	15.4	316	11.5	389	55.3	462	61.4	535	9.6
25	10.8	98	1.5	171	25	244	16.1	317	15.4	390	56.1	463	61.1	536	11.1
26	12.3	99	0.4	172	26.1	245	16.1	318	18.4	391	56.4	464	60.7	537	11.1
27	13.1	100	0	173	27.6	246	16.9	319	20.7	392	56.4	465	59.9	538	10.4
28	12.3	101	0	174	29.2	247	16.5	320	24.2	393	56.4	466	59.1	539	8.8
29	12.3	102	0	175	31.1	248	16.9	321	26.9	394	57.2	467	59.1	540	9.2
30	11.5	103	0	176	32.3	249	18	322	29.6	395	56.8	468	59.1	541	10
31	11.5	104	0	177	34.2	250	19.2	323	31.1	396	57.6	469	59.9	542	10.4
32	11.1	105	0	178	34.9	251	20.4	324	32.6	397	57.6	470	59.5	543	10.4
33	11.1	106	0	179	35.7	252	20.4	325	33.8	398	57.6	471	59.9	544	5.4
34	11.1	107	0	180	36.5	253	21.1	326	34.9	399	58	472	58.8	545	1.9
35	13.1	108	0.4	181	36.9	254	21.1	327	36.9	400	58	473	58	546	0

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)
36	15	109	1.2	182	36.9	255	22.3	328	39.2	401	58.4	474	57.6	547	0
37	16.9	110	1.9	183	37.2	256	23	329	41.1	402	58.4	475	56.8	548	0
38	16.9	111	3.8	184	37.6	257	23.8	330	43	403	58.8	476	56.1	549	0
39	16.1	112	7.7	185	37.2	258	24.2	331	43.8	404	59.1	477	55.3	550	0
40	15.7	113	11.5	186	37.6	259	24.6	332	44.5	405	58.8	478	54.1	551	0
41	15.4	114	14.6	187	38	260	25	333	45.3	406	58.8	479	52.6	552	0
42	15	115	18	188	38.4	261	25.7	334	45.3	407	58	480	49.2	553	0
43	13.8	116	21.5	189	39.2	262	25.7	335	44.9	408	58	481	46.1	554	0
44	10.8	117	25	190	39.6	263	26.5	336	44.5	409	57.6	482	43	555	0
45	8.4	118	28.4	191	39.9	264	27.6	337	43.8	410	57.6	483	37.2	556	0
46	6.1	119	30.7	192	40.7	265	28.4	338	43.4	411	57.6	484	29.6	557	0
47	4.2	120	31.9	193	40.3	266	29.2	339	42.6	412	57.6	485	21.5	558	0
48	3.5	121	32.3	194	41.1	267	30.3	340	41.9	413	57.6	486	16.5	559	0
49	3.5	122	32.3	195	41.1	268	31.1	341	41.5	414	59.1	487	15.7	560	0
50	1.5	123	31.9	196	40.7	269	31.1	342	40.7	415	59.5	488	18.4	561	0
51	0	124	30.3	197	31.9	270	30.7	343	40.3	416	59.9	489	21.5	562	0
52	0	125	28	198	23.9	271	31.1	344	41.1	417	60.3	490	25	563	0
53	0	126	24.2	199	15.9	272	29.6	345	41.5	418	60.3	491	27.3	564	0
54	0	127	20	200	7.9	273	29.2	346	42.6	419	61.1	492	29.2	565	0
55	0	128	16.1	201	2.7	274	29.2	347	43.4	420	60.3	493	30.7	566	0
56	0	129	11.5	202	0.4	275	28.8	348	44.2	421	59.9	494	31.5	567	0
57	0	130	8.1	203	0.4	276	28	349	44.9	422	59.5	495	31.1	568	0
58	0	131	5	204	2.7	277	23	350	45.7	423	59.1	496	31.1	569	0
59	0	132	3.5	205	3.8	278	21.1	351	46.5	424	59.1	497	30.3	570	0
60	0	133	1.9	206	3.8	279	21.5	352	46.8	425	59.5	498	30	571	0
61	0	134	0	207	1.5	280	20.7	353	47.2	426	59.5	499	30	572	0.4
62	0	135	0	208	0	281	20.7	354	48	427	59.5	500	29.6	573	1.5
63	1.2	136	0	209	0	282	19.6	355	47.6	428	59.9	501	30	574	3.5
64	3.5	137	0	210	0	283	16.5	356	48.4	429	60.3	502	28.8	575	6.1
65	7.7	138	0	211	0	284	13.1	357	48	430	60.7	503	28.8	576	10.4
66	11.1	139	0	212	0	285	9.6	358	47.2	431	60.7	504	28	577	14.2
67	13.8	140	0	213	0	286	7.3	359	46.1	432	61.4	505	28.4	578	16.9
68	16.5	141	0	214	0	287	3.8	360	45.7	433	61.8	506	28	579	19.2
69	18.4	142	0	215	0	288	0.8	361	44.9	434	61.8	507	28.4	580	20
70	20.4	143	1.5	216	0	289	0	362	44.2	435	61.8	508	28.4	581	21.5
71	20.7	144	6.9	217	0	290	0	363	43.8	436	61.8	509	28.8	582	23.4
72	19.6	145	12.7	218	0	291	0	364	44.5	437	61.1	510	28.4	583	24.6

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)
73	17.3	146	16.5	219	0	292	0	365	44.9	438	60.7	511	28.4	584	24.2

Unified Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
585	20	658	33	731	4.2	804	20.4	877	62.2	950	16.5	1023	0.4	1096	9.6
586	16.9	659	34.2	732	1.2	805	18.8	878	62.2	951	15	1024	2.7	1097	8.8
587	13.4	660	34.6	733	0	806	17.3	879	62.6	952	11.9	1025	6.1	1098	10.8
588	13.4	661	35.3	734	0	807	15	880	63.7	953	9.6	1026	9.2	1099	12.7
589	15.7	662	36.1	735	0	808	13.1	881	64.5	954	8.4	1027	11.5	1100	14.2
590	18.4	663	36.1	736	0	809	9.2	882	64.9	955	5.8	1028	14.2	1101	14.6
591	21.1	664	36.9	737	0	810	6.9	883	66	956	1.2	1029	16.1	1102	13.1
592	23.4	665	36.9	738	0	811	4.6	884	66	957	0	1030	18	1103	11.1
593	25.3	666	37.6	739	0	812	4.6	885	66.8	958	0	1031	20	1104	11.1
594	27.6	667	37.6	740	0	813	4.6	886	66.4	959	0	1032	21.5	1105	11.1
595	28.8	668	38.4	741	0	814	4.2	887	66.8	960	1.2	1033	23	1106	13.1
596	30.3	669	38	742	0	815	5.4	888	67.2	961	3.1	1034	24.2	1107	15.7
597	30.7	670	37.6	743	0	816	4.6	889	66.4	962	5	1035	25	1108	18.4
598	31.5	671	37.6	744	0	817	3.5	890	66.4	963	8.4	1036	25.7	1109	20.7
599	31.1	672	37.2	745	0	818	2.3	891	66	964	11.5	1037	26.9	1110	23.8
600	31.1	673	36.9	746	0	819	2.3	892	65.7	965	14.6	1038	27.6	1111	25.7
601	30.3	674	36.1	747	0	820	1.9	893	65.7	966	16.9	1039	27.6	1112	28
602	30.3	675	35.7	748	0	821	3.1	894	66.4	967	18.8	1040	28.4	1113	30
603	30.3	676	36.1	749	0	822	6.1	895	66	968	21.1	1041	29.2	1114	31.1
604	30.7	677	35.7	750	0	823	4.6	896	65.7	969	23.8	1042	29.2	1115	32.3
605	31.1	678	35.7	751	0	824	2.7	897	65.3	970	26.5	1043	30	1116	34.2
606	32.3	679	35.7	752	0	825	2.3	898	65.3	971	28	1044	29.6	1117	35.7
607	32.6	680	36.1	753	0	826	2.3	899	64.5	972	29.6	1045	29.6	1118	36.9
608	32.6	681	36.1	754	0	827	3.1	900	64.5	973	30.7	1046	28.8	1119	38.8
609	32.6	682	35.7	755	0	828	4.2	901	64.1	974	32.6	1047	28	1120	40.3
610	31.1	683	35.7	756	0	829	3.5	902	63.7	975	34.2	1048	23.8	1121	41.5
611	26.9	684	34.9	757	0	830	3.8	903	63.7	976	35.3	1049	18.8	1122	42.2
612	22.3	685	34.6	758	0	831	4.2	904	63.7	977	36.1	1050	11.9	1123	43
613	18	686	34.2	759	0	832	3.5	905	64.5	978	36.9	1051	6.1	1124	43.8
614	13.8	687	33.8	760	0	833	3.5	906	64.5	979	38	1052	1.5	1125	43.8
615	9.6	688	33.4	761	0	834	3.5	907	64.9	980	38	1053	1.5	1126	43.4

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)
616	4.6	689	33	762	0	835	4.6	908	64.5	981	38	1054	4.2	1127	43
617	6.1	690	30.3	763	1.5	836	5.8	909	64.1	982	38	1055	8.1	1128	42.2
618	10	691	29.2	764	5.4	837	3.5	910	64.9	983	38	1056	10.4	1129	41.9
619	14.2	692	28.4	765	9.2	838	0.8	911	65.3	984	37.2	1057	13.1	1130	41.5
620	17.3	693	25	766	11.5	839	3.5	912	65.3	985	36.9	1058	15.4	1131	41.9
621	20	694	21.1	767	14.6	840	3.8	913	65.3	986	36.1	1059	18	1132	41.9
622	21.5	695	16.9	768	17.3	841	2.3	914	64.1	987	35.7	1060	20.4	1133	41.9
623	22.3	696	13.4	769	19.2	842	0	915	63.4	988	34.9	1061	23	1134	42.2
624	22.3	697	13.1	770	21.1	843	1.2	916	63	989	34.9	1062	25.3	1135	42.6
625	22.3	698	12.3	771	20.7	844	6.9	917	63.4	990	33.8	1063	27.3	1136	42.6
626	22.3	699	12.7	772	20.7	845	13.8	918	64.1	991	31.5	1064	28.8	1137	42.6
627	23	700	15.7	773	19.6	846	18.8	919	64.9	992	28.8	1065	30.3	1138	42.6
628	23	701	19.2	774	18.4	847	23.8	920	65.3	993	25.7	1066	31.1	1139	42.6
629	22.7	702	22.3	775	16.9	848	27.3	921	64.5	994	24.6	1067	32.3	1140	42.6
630	22.3	703	24.6	776	16.9	849	30.7	922	64.1	995	23.4	1068	31.9	1141	42.6
631	21.9	704	25.7	777	16.5	850	33.8	923	63.4	996	22.3	1069	32.3	1142	42.2
632	22.7	705	26.5	778	16.9	851	37.6	924	63.7	997	21.5	1070	31.9	1143	43
633	23.8	706	26.5	779	16.9	852	40.7	925	63.4	998	20	1071	31.1	1144	43.4
634	25	707	26.9	780	16.9	853	43.8	926	63.4	999	20	1072	28.8	1145	43
635	25.3	708	27.3	781	17.3	854	46.1	927	63.4	1000	19.2	1073	25	1146	42.6
636	25.7	709	27.3	782	19.2	855	48	928	63.4	1001	19.2	1074	22.7	1147	41.9
637	26.5	710	27.6	783	20.4	856	49.5	929	63.7	1002	18	1075	18.8	1148	40.7
638	26.9	711	28.4	784	21.1	857	51.5	930	64.5	1003	11.9	1076	15.4	1149	36.9
639	27.3	712	28.8	785	22.3	858	53	931	65.3	1004	6.9	1077	13.4	1150	32.6
640	28	713	28.8	786	22.3	859	54.5	932	64.9	1005	2.7	1078	11.9	1151	28
641	29.2	714	29.2	787	22.7	860	55.7	933	63.7	1006	0.8	1079	8.8	1152	23.4
642	30	715	28.8	788	22.3	861	56.8	934	63	1007	0.4	1080	5	1153	18.4
643	30	716	28.8	789	22.7	862	58	935	59.9	1008	0	1081	1.9	1154	14.6
644	29.6	717	28	790	22.3	863	59.1	936	55.3	1009	0	1082	2.3	1155	12.3
645	29.6	718	28	791	23.8	864	60.3	937	50.7	1010	0	1083	2.7	1156	9.2
646	28.8	719	27.6	792	25.7	865	61.1	938	49.2	1011	0	1084	3.5	1157	5.8
647	28.4	720	26.5	793	27.6	866	61.8	939	48	1012	0	1085	6.5	1158	1.9
648	28	721	24.6	794	29.6	867	61.8	940	46.1	1013	0	1086	10.8	1159	0.4
649	27.3	722	20.7	795	30	868	61.8	941	44.2	1014	0	1087	13.8	1160	0
650	25.7	723	16.5	796	29.2	869	61.8	942	41.1	1015	0	1088	16.1	1161	0
651	24.6	724	15	797	27.6	870	62.6	943	39.9	1016	0	1089	18.4	1162	0
652	25	725	14.2	798	25	871	63.4	944	36.1	1017	0	1090	20.4	1163	0
653	26.5	726	14.2	799	23.8	872	63	945	32.6	1018	0	1091	21.9	1164	0

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)
654	28	727	13.8	800	23.4	873	63	946	29.2	1019	0	1092	21.9	1165	0.4
655	29.6	728	13.8	801	24.2	874	62.6	947	24.6	1020	0	1093	20.7	1166	4.2
656	30.7	729	11.9	802	23.4	875	61.8	948	20.7	1021	0	1094	17.3	1167	9.2
657	32.3	730	8.4	803	23	876	61.8	949	19.2	1022	0	1095	13.1	1168	11.9

Unified Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1169	14.2	1240	3.5	1311	40.7	1382	2.7	1453	0	1524	26.9	1595	37.6	1666	0
1170	15.7	1241	10.4	1312	40.3	1383	2.3	1454	0	1525	26.9	1596	37.2	1667	0
1171	15	1242	15.4	1313	39.6	1384	1.5	1455	0	1526	26.9	1597	37.2	1668	0
1172	14.2	1243	17.3	1314	39.2	1385	1.2	1456	1.2	1527	26.5	1598	36.9	1669	0
1173	13.4	1244	17.3	1315	38.8	1386	0	1457	4.2	1528	25.7	1599	36.5	1670	0
1174	13.8	1245	18.4	1316	38	1387	1.2	1458	7.3	1529	21.9	1600	36.5	1671	0
1175	14.6	1246	21.5	1317	37.6	1388	4.2	1459	8.8	1530	16.5	1601	34.9	1672	0
1176	14.6	1247	24.6	1318	37.2	1389	7.3	1460	10.8	1531	10	1602	33.4	1673	1.5
1177	14.2	1248	27.3	1319	36.5	1390	8.8	1461	12.3	1532	4.6	1603	31.9	1674	5
1178	16.1	1249	30	1320	34.6	1391	10.8	1462	13.1	1533	1.5	1604	29.2	1675	8.8
1179	15.7	1250	31.5	1321	31.5	1392	12.3	1463	12.3	1534	0.4	1605	25	1676	11.5
1180	15.7	1251	31.9	1322	29.6	1393	13.1	1464	12.3	1535	0	1606	25	1677	14.2
1181	14.6	1252	32.6	1323	29.2	1394	12.3	1465	11.5	1536	0	1607	26.1	1678	15.4
1182	13.1	1253	33.4	1324	28.8	1395	12.3	1466	11.5	1537	0	1608	27.6	1679	16.1
1183	10	1254	34.9	1325	28.8	1396	11.5	1467	11.1	1538	0	1609	29.2	1680	16.1
1184	7.3	1255	36.5	1326	28	1397	11.5	1468	11.1	1539	0	1610	31.1	1681	16.9
1185	3.5	1256	37.6	1327	28	1398	11.1	1469	11.1	1540	0	1611	32.3	1682	16.5
1186	0.8	1257	39.2	1328	28.4	1399	11.1	1470	13.1	1541	0	1612	34.2	1683	16.9
1187	0	1258	40.3	1329	29.6	1400	11.1	1471	15	1542	0	1613	34.9	1684	18
1188	0	1259	40.7	1330	30	1401	13.1	1472	16.9	1543	0.4	1614	35.7	1685	19.2
1189	0	1260	41.1	1331	30.3	1402	15	1473	16.9	1544	1.2	1615	36.5	1686	20.4
1190	0	1261	40.7	1332	29.2	1403	16.9	1474	16.1	1545	1.9	1616	36.9	1687	20.4
1191	0.4	1262	40.7	1333	26.5	1404	16.9	1475	15.7	1546	3.8	1617	36.9	1688	21.1
1192	2.7	1263	40.7	1334	25.3	1405	16.1	1476	15.4	1547	7.7	1618	37.2	1689	21.1
1193	7.3	1264	41.5	1335	25	1406	15.7	1477	15	1548	11.5	1619	37.6	1690	22.3
1194	11.5	1265	42.6	1336	24.6	1407	15.4	1478	13.8	1549	14.6	1620	37.2	1691	23
1195	15.4	1266	43	1337	24.6	1408	15	1479	10.8	1550	18	1621	37.6	1692	23.8
1196	19.2	1267	44.5	1338	25.3	1409	13.8	1480	8.4	1551	21.5	1622	38	1693	24.2
1197	21.9	1268	45.3	1339	26.1	1410	10.8	1481	6.1	1552	25	1623	38.4	1694	24.6
1198	23.8	1269	45.3	1340	27.3	1411	8.4	1482	4.2	1553	28.4	1624	39.2	1695	25
1199	25	1270	44.9	1341	28.4	1412	6.1	1483	3.5	1554	30.7	1625	39.6	1696	25.7
1200	26.1	1271	43.4	1342	29.2	1413	4.2	1484	3.5	1555	31.9	1626	39.9	1697	25.7
1201	27.3	1272	40.3	1343	29.2	1414	3.5	1485	1.5	1556	32.3	1627	40.7	1698	26.5
1202	28.8	1273	38	1344	29.6	1415	3.5	1486	0	1557	32.3	1628	40.3	1699	27.6
1203	30	1274	36.1	1345	30	1416	1.5	1487	0	1558	31.9	1629	41.1	1700	28.4

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)
1204	29.6	1275	36.5	1346	31.1	1417	0	1488	0	1559	30.3	1630	41.1	1701	29.2
1205	29.6	1276	38	1347	32.6	1418	0	1489	0	1560	28	1631	40.7	1702	30.3
1206	28.8	1277	39.2	1348	33.8	1419	0	1490	0	1561	24.2	1632	31.9	1703	31.1
1207	26.1	1278	40.7	1349	34.6	1420	0	1491	0	1562	20	1633	23.9	1704	31.1
1208	22.3	1279	42.2	1350	34.9	1421	0	1492	0	1563	16.1	1634	15.9	1705	30.7
1209	19.2	1280	43.4	1351	34.6	1422	0	1493	0	1564	11.5	1635	7.9	1706	31.1
1210	16.5	1281	44.9	1352	34.9	1423	0	1494	0	1565	8.1	1636	2.7	1707	29.6
1211	12.7	1282	45.7	1353	34.6	1424	0	1495	0	1566	5	1637	0.4	1708	29.2
1212	9.6	1283	46.1	1354	34.9	1425	0	1496	0	1567	3.5	1638	0.4	1709	29.2
1213	6.9	1284	46.8	1355	34.9	1426	0	1497	0	1568	1.9	1639	2.7	1710	28.8
1214	4.2	1285	46.5	1356	34.9	1427	0	1498	1.2	1569	0	1640	3.8	1711	28
1215	2.3	1286	46.5	1357	34.2	1428	0	1499	3.5	1570	0	1641	3.8	1712	23
1216	0.8	1287	46.5	1358	33.8	1429	0	1500	7.7	1571	0	1642	1.5	1713	21.1
1217	0	1288	46.1	1359	32.6	1430	0	1501	11.1	1572	0	1643	0	1714	21.5
1218	0	1289	46.1	1360	31.5	1431	0	1502	13.8	1573	0	1644	0	1715	20.7
1219	0	1290	46.1	1361	30	1432	0	1503	16.5	1574	0	1645	0	1716	20.7
1220	0	1291	46.8	1362	28.8	1433	0	1504	18.4	1575	0	1646	0	1717	19.6
1221	0	1292	47.6	1363	27.3	1434	0	1505	20.4	1576	0	1647	0	1718	16.5
1222	0	1293	48	1364	23.8	1435	0	1506	20.7	1577	0	1648	0	1719	13.1
1223	0	1294	48.4	1365	23	1436	0	1507	19.6	1578	1.5	1649	0	1720	9.6
1224	0	1295	48	1366	23	1437	0	1508	17.3	1579	6.9	1650	0	1721	7.3
1225	0	1296	48	1367	22.3	1438	0	1509	12.3	1580	12.7	1651	0	1722	3.8
1226	0	1297	47.2	1368	20.4	1439	0	1510	8.1	1581	16.5	1652	0	1723	0.8
1227	0	1298	46.5	1369	18.8	1440	0	1511	6.1	1582	20	1653	0	1724	0
1228	0	1299	46.8	1370	17.7	1441	0	1512	9.6	1583	23	1654	0	1725	0
1229	0	1300	47.2	1371	16.1	1442	0	1513	12.7	1584	25.7	1655	0	1726	0
1230	0	1301	48.4	1372	14.6	1443	0	1514	15.7	1585	28	1656	0	1727	0
1231	0	1302	48.4	1373	12.7	1444	0	1515	18	1586	30.7	1657	0	1728	0
1232	0	1303	48.8	1374	11.1	1445	0	1516	20.4	1587	32.6	1658	0	1729	0
1233	0	1304	48.4	1375	9.2	1446	0	1517	21.9	1588	34.2	1659	0	1730	0
1234	0	1305	47.6	1376	8.8	1447	0	1518	23.4	1589	35.3	1660	0	1731	0
1235	0	1306	46.5	1377	7.3	1448	0	1519	23.8	1590	36.9	1661	0	1732	0
1236	0	1307	44.2	1378	6.1	1449	0	1520	24.6	1591	36.9	1662	0	1733	0
1237	0	1308	42.2	1379	5	1450	0	1521	25	1592	37.2	1663	0	1734	0
1238	0	1309	41.5	1380	4.2	1451	0	1522	26.1	1593	37.6	1664	0	1735	0
1239	0	1310	41.1	1381	3.5	1452	0	1523	26.1	1594	37.6	1665	0		

E. Highway Driving Schedule.

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Highway Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	74	47.2	147	42	220	43.1	293	30.6	366	56.9	439	58	512	54
2	0	75	47.3	148	43.1	221	43.2	294	29.6	367	56.9	440	57.9	513	54
3	2.0	76	47.2	149	43.7	222	43.4	295	28.8	368	57	441	57.9	514	54
4	4.9	77	47.1	150	44.1	223	43.9	296	28.4	369	57	442	57.9	515	54
5	8.1	78	47	151	44.3	224	44.3	297	28.6	370	57	443	57.9	516	54
6	11.3	79	46.9	152	44.4	225	44.7	298	29.5	371	57	444	57.9	517	54.1
7	14.5	80	46.9	153	44.6	226	45.1	299	31.4	372	57	445	58	518	54.2
8	17.3	81	46.9	154	44.7	227	45.4	300	33.4	373	57	446	58.1	519	54.5
9	19.6	82	47	155	44.9	228	45.8	301	35.6	374	57	447	58.1	520	54.8
10	21.8	83	47.1	156	45.2	229	46.5	302	37.5	375	57	448	58.2	521	54.9
11	24	84	47.1	157	45.7	230	46.9	303	39.1	376	57	449	58.2	522	55
12	25.8	85	47.2	158	45.9	231	47.2	304	40.2	377	56.9	450	58.2	523	55.1
13	27.1	86	47.1	159	46.3	232	47.4	305	41.1	378	56.8	451	58.1	524	55.2
14	28	87	47	160	46.8	233	47.3	306	41.8	379	56.5	452	58	525	55.2
15	29	88	46.9	161	46.9	234	47.3	307	42.4	380	56.2	453	58	526	55.3
16	30	89	46.5	162	47	235	47.2	308	42.8	381	56	454	58	527	55.4
17	30.7	90	46.3	163	47.1	236	47.2	309	43.3	382	56	455	58	528	55.5
18	31.5	91	46.2	164	47.6	237	47.2	310	43.8	383	56	456	58	529	55.6
19	32.2	92	46.3	165	47.9	238	47.1	311	44.3	384	56.1	457	58	530	55.7
20	32.9	93	46.5	166	48	239	47	312	44.7	385	56.4	458	57.9	531	55.8
21	33.5	94	46.9	167	48	240	47	313	45	386	56.7	459	57.9	532	55.9
22	34.1	95	47.1	168	47.9	241	46.9	314	45.2	387	56.9	460	58	533	56
23	34.6	96	47.4	169	47.8	242	46.8	315	45.4	388	57.1	461	58.1	534	56
24	34.9	97	47.7	170	47.3	243	46.9	316	45.5	389	57.3	462	58.1	535	56
25	35.1	98	48	171	46.7	244	47	317	45.8	390	57.4	463	58.2	536	56
26	35.7	99	48.2	172	46.2	245	47.2	318	46	391	57.4	464	58.3	537	56
27	35.9	100	48.5	173	45.9	246	47.5	319	46.1	392	57.2	465	58.3	538	56
28	35.8	101	48.8	174	45.7	247	47.9	320	46.5	393	57	466	58.3	539	56
29	35.3	102	49.1	175	45.5	248	48	321	46.8	394	56.9	467	58.2	540	56
30	34.9	103	49.2	176	45.4	249	48	322	47.1	395	56.6	468	58.1	541	56
31	34.5	104	49.1	177	45.3	250	48	323	47.7	396	56.3	469	58	542	56
32	34.6	105	49.1	178	45	251	48	324	48.3	397	56.1	470	57.8	543	56
33	34.8	106	49	179	44	252	48	325	49	398	56.4	471	57.5	544	56
34	35.1	107	49	180	43.1	253	48.1	326	49.7	399	56.7	472	57.1	545	56
35	35.7	108	49.1	181	42.2	254	48.2	327	50.3	400	57.1	473	57	546	56
36	36.1	109	49.2	182	41.5	255	48.2	328	51	401	57.5	474	56.6	547	55.9

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)
37	36.2	110	49.3	183	41.5	256	48.1	329	51.7	402	57.8	475	56.1	548	55.9
38	36.5	111	49.4	184	42.1	257	48.6	330	52.4	403	58	476	56	549	55.9
39	36.7	112	49.5	185	42.9	258	48.9	331	53.1	404	58	477	55.8	550	55.8
40	36.9	113	49.5	186	43.5	259	49.1	332	53.8	405	58	478	55.5	551	55.6
41	37	114	49.5	187	43.9	260	49.1	333	54.5	406	58	479	55.2	552	55.4
42	37	115	49.4	188	43.6	261	49.1	334	55.2	407	58	480	55.1	553	55.2
43	37	116	49.1	189	43.3	262	49.1	335	55.8	408	58	481	55	554	55.1
44	37	117	48.9	190	43	263	49.1	336	56.4	409	57.9	482	54.9	555	55
45	37	118	48.6	191	43.1	264	49	337	56.9	410	57.8	483	54.9	556	54.9
46	37	119	48.4	192	43.4	265	48.9	338	57	411	57.7	484	54.9	557	54.6
47	37.1	120	48.1	193	43.9	266	48.2	339	57.1	412	57.7	485	54.9	558	54.4
48	37.3	121	47.7	194	44.3	267	47.7	340	57.3	413	57.8	486	54.9	559	54.2
49	37.8	122	47.4	195	44.6	268	47.5	341	57.6	414	57.9	487	54.9	560	54.1
50	38.6	123	47.3	196	44.9	269	47.2	342	57.8	415	58	488	55	561	53.8
51	39.3	124	47.5	197	44.8	270	46.7	343	58	416	58.1	489	55	562	53.4
52	40	125	47.8	198	44.4	271	46.2	344	58.1	417	58.4	490	55	563	53.3
53	40.7	126	47.9	199	43.9	272	46	345	58.4	418	58.9	491	55	564	53.1
54	41.4	127	48	200	43.4	273	45.8	346	58.7	419	59.1	492	55	565	52.9
55	42.2	128	47.9	201	43.2	274	45.6	347	58.8	420	59.4	493	55	566	52.6
56	42.9	129	47.9	202	43.2	275	45.4	348	58.9	421	59.8	494	55.1	567	52.4
57	43.5	130	47.9	203	43.1	276	45.2	349	59	422	59.9	495	55.1	568	52.2
58	44	131	48	204	43	277	45	350	59	423	59.9	496	55	569	52.1
59	44.3	132	48	205	43	278	44.7	351	58.9	424	59.8	497	54.9	570	52
60	44.5	133	48	206	43.1	279	44.5	352	58.8	425	59.6	498	54.9	571	52
61	44.8	134	47.9	207	43.4	280	44.2	353	58.6	426	59.4	499	54.8	572	52
62	44.9	135	47.3	208	43.9	281	43.5	354	58.4	427	59.2	500	54.7	573	52
63	45	136	46	209	44	282	42.8	355	58.2	428	59.1	501	54.6	574	52.1
64	45.1	137	43.3	210	43.5	283	42	356	58.1	429	59	502	54.4	575	52
65	45.4	138	41.2	211	42.6	284	40.1	357	58	430	58.9	503	54.3	576	52
66	45.7	139	39.5	212	41.5	285	38.6	358	57.9	431	58.7	504	54.3	577	51.9
67	46	140	39.2	213	40.7	286	37.5	359	57.6	432	58.6	505	54.2	578	51.6
68	46.3	141	39	214	40	287	35.8	360	57.4	433	58.5	506	54.1	579	51.4
69	46.5	142	39	215	40	288	34.7	361	57.2	434	58.4	507	54.1	580	51.1
70	46.8	143	39.1	216	40.3	289	34	362	57.1	435	58.4	508	54.1	581	50.7
71	46.9	144	39.5	217	41	290	33.3	363	57	436	58.3	509	54	582	50.3
72	47	145	40.1	218	42	291	32.5	364	57	437	58.2	510	54	583	49.8
73	47.1	146	41	219	42.7	292	31.7	365	56.9	438	58.1	511	54	584	49.3

Highway Test Cycle

(Speed vs Time Sequence)

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

F. US06 Bag 2 Driving Schedule.

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US06 Bag 2 Driving Schedule

(Speed vs Time Sequence)

Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)
1	0	62	59.4	123	62.9	184	71	245	68.6	306	67.6
2	0	63	59.9	124	62.8	185	71	246	69.4	307	67.6
3	0	64	61	125	62.2	186	71.2	247	69.4	308	67.2
4	0	65	61.4	126	62.4	187	72.1	248	69.4	309	67
5	0	66	61.9	127	62.3	188	72.6	249	70	310	66.3
6	0	67	62.5	128	62.3	189	73.6	250	70.4	311	66.6
7	2.7	68	62.5	129	62.4	190	74.8	251	70.6	312	66.2
8	9.2	69	62.7	130	62.1	191	75.7	252	70.9	313	66.4
9	16.1	70	62.2	131	62.5	192	77.3	253	70.3	314	65.9
10	22.7	71	62.5	132	62.8	193	78.4	254	70.6	315	66.1
11	29.2	72	63.1	133	62.3	194	79.3	255	70.3	316	65.5
12	34.2	73	62.7	134	62.3	195	78.2	256	69.7	317	62.2
13	38.8	74	62.8	135	62.4	196	76	257	69.9	318	62.2
14	43	75	63	136	61.9	197	75.6	258	70.1	319	61.4
15	45.3	76	64.1	137	62.8	198	76.4	259	69.6	320	61.1
16	46.8	77	63.9	138	62.8	199	77.6	260	69.3	321	61.4
17	48	78	64.1	139	62.3	200	78	261	69.9	322	61.1
18	49.5	79	64.3	140	62.8	201	79.1	262	69.7	323	61.4
19	50.3	80	64.5	141	62.4	202	79.5	263	69.5	324	61.4
20	51.5	81	64.9	142	62.1	203	79.9	264	69.9	325	61.8
21	52.2	82	65.3	143	61.9	204	79.9	265	70.2	326	61.8
22	52.6	83	66	144	61.8	205	80.3	266	70.2	327	61.8
23	53	84	66	145	62.1	206	80.3	267	70.2	328	61.8
24	53.8	85	66.4	146	62.1	207	79.5	268	71	329	62.2
25	53.8	86	64.1	147	62.1	208	79.5	269	70.8	330	61.8
26	53.8	87	63.6	148	62	209	79.1	270	70.9	331	62.2
27	54.6	88	63.9	149	62.4	210	78.7	271	70.7	332	62.6
28	56.3	89	64.1	150	62.2	211	77.6	272	70.9	333	62.2
29	56.9	90	63.7	151	62.2	212	76.5	273	71.2	334	62.6
30	58.1	91	64.3	152	62.4	213	74.3	274	71.3	335	62.2
31	58.4	92	64.2	153	62.7	214	72.6	275	70.8	336	62.6

32	59.6	93	63.9	154	62.6	215	70.8	276	71.2	337	62.6
33	59.9	94	64.2	155	63.7	216	67.6	277	71.7	338	63
34	60.2	95	63.4	156	64.3	217	66.4	278	71.9	339	62.6
35	60.5	96	64	157	64.8	218	66.7	279	72.6	340	62.2
36	59.7	97	63.9	158	65.1	219	66.1	280	72.3	341	61.1
37	58.3	98	64	159	65.9	220	65.9	281	72.3	342	59.5
38	58.1	99	63.8	160	66.1	221	66.2	282	72.1	343	58.8
39	57.8	100	64	161	67	222	66.1	283	72	344	56.8
40	57.3	101	63.3	162	67.2	223	67.1	284	71.9	345	55.7
41	57.5	102	63.4	163	67.5	224	67.4	285	72.6	346	54.1
42	56.6	103	63.9	164	68.3	225	68.3	286	72.8	347	51.5
43	57	104	64	165	68.3	226	68.3	287	73.2	348	49.2
44	56.6	105	64.3	166	68.8	227	68.7	288	72.1	349	48.8
45	56.5	106	64.8	167	69.1	228	68.2	289	71.5	350	47.6
46	56.2	107	65.1	168	69.4	229	68.1	290	70.9	351	44.9
47	56.4	108	64	169	71.7	230	68	291	70.4	352	41.5
48	56.6	109	64.2	170	72.1	231	67.1	292	70.5	353	37.2
49	56.4	110	63.1	171	74.9	232	66.4	293	70.9	354	34.6
50	56.1	111	63.7	172	72.6	233	66.1	294	70.2	355	33
51	56	112	63.1	173	72.2	234	65.7	295	71	356	29.2
52	55.9	113	63.7	174	72.2	235	66	296	70.2	357	22.3
53	54.8	114	63.5	175	72	236	66.4	297	70.3	358	17.7
54	54.2	115	63	176	72.5	237	66	298	69.1	359	17.3
55	54.6	116	63.1	177	72.8	238	66.3	299	68.8	360	14
56	52.2	117	63	178	72.7	239	67	300	68.2	361	10
57	54.7	118	63.3	179	71.8	240	67.5	301	68.3	362	6
58	55.7	119	63.4	180	71.4	241	67.9	302	68.2	363	2
59	57	120	63.3	181	71.1	242	68.1	303	67.7	364	0
60	58	121	62.5	182	71.1	243	68.5	304	67.3	365	0
61	58.1	122	62.5	183	70.9	244	68.9	305	67.5		

G. Hot 1435 Unified Cycle Driving Schedule.

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Hot 1435 Unified Test Cycle

(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	61	0	121	32.3	181	36.9	241	11.5	301	0	361	44.9	421	59.9
2	0	62	0	122	32.3	182	36.9	242	14.2	302	0	362	44.2	422	59.5
3	0	63	1.2	123	31.9	183	37.2	243	15.4	303	0	363	43.8	423	59.1
4	0	64	3.5	124	30.3	184	37.6	244	16.1	304	0	364	44.5	424	59.1
5	0	65	7.7	125	28	185	37.2	245	16.1	305	0	365	44.9	425	59.5
6	0	66	11.1	126	24.2	186	37.6	246	16.9	306	0	366	45.3	426	59.5
7	0	67	13.8	127	20	187	38	247	16.5	307	0	367	46.5	427	59.5
8	0	68	16.5	128	16.1	188	38.4	248	16.9	308	0	368	48	428	59.9
9	0	69	18.4	129	11.5	189	39.2	249	18	309	0	369	48.8	429	60.3
10	0	70	20.4	130	8.1	190	39.6	250	19.2	310	0	370	49.5	430	60.7
11	0	71	20.7	131	5	191	39.9	251	20.4	311	0	371	49.9	431	60.7
12	0	72	19.6	132	3.5	192	40.7	252	20.4	312	0	372	49.9	432	61.4
13	0	73	17.3	133	1.9	193	40.3	253	21.1	313	0.4	373	49.9	433	61.8
14	0	74	12.3	134	0	194	41.1	254	21.1	314	2.7	374	49.5	434	61.8
15	0	75	8.1	135	0	195	41.1	255	22.3	315	7.3	375	49.5	435	61.8
16	0	76	6.1	136	0	196	40.7	256	23	316	11.5	376	48.8	436	61.8
17	0	77	9.6	137	0	197	31.9	257	23.8	317	15.4	377	48.8	437	61.1
18	0	78	12.7	138	0	198	23.9	258	24.2	318	18.4	378	48.8	438	60.7
19	0	79	15.7	139	0	199	15.9	259	24.6	319	20.7	379	48.4	439	60.3
20	0	80	18	140	0	200	7.9	260	25	320	24.2	380	48.8	440	60.3
21	1.2	81	20.4	141	0	201	2.7	261	25.7	321	26.9	381	49.5	441	60.3
22	4.2	82	21.9	142	0	202	0.4	262	25.7	322	29.6	382	50.3	442	59.5
23	7.3	83	23.4	143	1.5	203	0.4	263	26.5	323	31.1	383	50.7	443	58.8
24	8.8	84	23.8	144	6.9	204	2.7	264	27.6	324	32.6	384	51.8	444	59.1
25	10.8	85	24.6	145	12.7	205	3.8	265	28.4	325	33.8	385	52.6	445	58.8
26	12.3	86	25	146	16.5	206	3.8	266	29.2	326	34.9	386	53.4	446	58.8
27	13.1	87	26.1	147	20	207	1.5	267	30.3	327	36.9	387	54.1	447	58.8
28	12.3	88	26.1	148	23	208	0	268	31.1	328	39.2	388	55.3	448	58.4
29	12.3	89	26.9	149	25.7	209	0	269	31.1	329	41.1	389	55.3	449	58
30	11.5	90	26.9	150	28	210	0	270	30.7	330	43	390	56.1	450	58

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)
31	11.5	91	26.9	151	30.7	211	0	271	31.1	331	43.8	391	56.4	451	58
32	11.1	92	26.5	152	32.6	212	0	272	29.6	332	44.5	392	56.4	452	58.4
33	11.1	93	25.7	153	34.2	213	0	273	29.2	333	45.3	393	56.4	453	59.1
34	11.1	94	21.9	154	35.3	214	0	274	29.2	334	45.3	394	57.2	454	59.5
35	13.1	95	16.5	155	36.9	215	0	275	28.8	335	44.9	395	56.8	455	59.9
36	15	96	10	156	36.9	216	0	276	28	336	44.5	396	57.6	456	59.9
37	16.9	97	4.6	157	37.2	217	0	277	23	337	43.8	397	57.6	457	60.3
38	16.9	98	1.5	158	37.6	218	0	278	21.1	338	43.4	398	57.6	458	61.1
39	16.1	99	0.4	159	37.6	219	0	279	21.5	339	42.6	399	58	459	61.1
40	15.7	100	0	160	37.6	220	0	280	20.7	340	41.9	400	58	460	61.1
41	15.4	101	0	161	37.2	221	0	281	20.7	341	41.5	401	58.4	461	61.4
42	15	102	0	162	37.2	222	0	282	19.6	342	40.7	402	58.4	462	61.4
43	13.8	103	0	163	36.9	223	0	283	16.5	343	40.3	403	58.8	463	61.1
44	10.8	104	0	164	36.5	224	0	284	13.1	344	41.1	404	59.1	464	60.7
45	8.4	105	0	165	36.5	225	0	285	9.6	345	41.5	405	58.8	465	59.9
46	6.1	106	0	166	34.9	226	0	286	7.3	346	42.6	406	58.8	466	59.1
47	4.2	107	0	167	33.4	227	0	287	3.8	347	43.4	407	58	467	59.1
48	3.5	108	0.4	168	31.9	228	0	288	0.8	348	44.2	408	58	468	59.1
49	3.5	109	1.2	169	29.2	229	0	289	0	349	44.9	409	57.6	469	59.9
50	1.5	110	1.9	170	25	230	0	290	0	350	45.7	410	57.6	470	59.5
51	0	111	3.8	171	25	231	0	291	0	351	46.5	411	57.6	471	59.9
52	0	112	7.7	172	26.1	232	0	292	0	352	46.8	412	57.6	472	58.8
53	0	113	11.5	173	27.6	233	0	293	0	353	47.2	413	57.6	473	58
54	0	114	14.6	174	29.2	234	0	294	0	354	48	414	59.1	474	57.6
55	0	115	18	175	31.1	235	0	295	0	355	47.6	415	59.5	475	56.8
56	0	116	21.5	176	32.3	236	0	296	0	356	48.4	416	59.9	476	56.1
57	0	117	25	177	34.2	237	0	297	0	357	48	417	60.3	477	55.3
58	0	118	28.4	178	34.9	238	1.5	298	0	358	47.2	418	60.3	478	54.1
59	0	119	30.7	179	35.7	239	5	299	0	359	46.1	419	61.1	479	52.6
60	0	120	31.9	180	36.5	240	8.8	300	0	360	45.7	420	60.3	480	49.2

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)
481	46.1	541	10	601	30.3	661	35.3	721	24.6	781	17.3	841	2.3	901	64.1
482	43	542	10.4	602	30.3	662	36.1	722	20.7	782	19.2	842	0	902	63.7
483	37.2	543	10.4	603	30.3	663	36.1	723	16.5	783	20.4	843	1.2	903	63.7
484	29.6	544	5.4	604	30.7	664	36.9	724	15	784	21.1	844	6.9	904	63.7
485	21.5	545	1.9	605	31.1	665	36.9	725	14.2	785	22.3	845	13.8	905	64.5
486	16.5	546	0	606	32.3	666	37.6	726	14.2	786	22.3	846	18.8	906	64.5
487	15.7	547	0	607	32.6	667	37.6	727	13.8	787	22.7	847	23.8	907	64.9
488	18.4	548	0	608	32.6	668	38.4	728	13.8	788	22.3	848	27.3	908	64.5
489	21.5	549	0	609	32.6	669	38	729	11.9	789	22.7	849	30.7	909	64.1
490	25	550	0	610	31.1	670	37.6	730	8.4	790	22.3	850	33.8	910	64.9
491	27.3	551	0	611	26.9	671	37.6	731	4.2	791	23.8	851	37.6	911	65.3
492	29.2	552	0	612	22.3	672	37.2	732	1.2	792	25.7	852	40.7	912	65.3
493	30.7	553	0	613	18	673	36.9	733	0	793	27.6	853	43.8	913	65.3
494	31.5	554	0	614	13.8	674	36.1	734	0	794	29.6	854	46.1	914	64.1
495	31.1	555	0	615	9.6	675	35.7	735	0	795	30	855	48	915	63.4
496	31.1	556	0	616	4.6	676	36.1	736	0	796	29.2	856	49.5	916	63
497	30.3	557	0	617	6.1	677	35.7	737	0	797	27.6	857	51.5	917	63.4
498	30	558	0	618	10	678	35.7	738	0	798	25	858	53	918	64.1
499	30	559	0	619	14.2	679	35.7	739	0	799	23.8	859	54.5	919	64.9
500	29.6	560	0	620	17.3	680	36.1	740	0	800	23.4	860	55.7	920	65.3
501	30	561	0	621	20	681	36.1	741	0	801	24.2	861	56.8	921	64.5
502	28.8	562	0	622	21.5	682	35.7	742	0	802	23.4	862	58	922	64.1
503	28.8	563	0	623	22.3	683	35.7	743	0	803	23	863	59.1	923	63.4
504	28	564	0	624	22.3	684	34.9	744	0	804	20.4	864	60.3	924	63.7
505	28.4	565	0	625	22.3	685	34.6	745	0	805	18.8	865	61.1	925	63.4
506	28	566	0	626	22.3	686	34.2	746	0	806	17.3	866	61.8	926	63.4
507	28.4	567	0	627	23	687	33.8	747	0	807	15	867	61.8	927	63.4
508	28.4	568	0	628	23	688	33.4	748	0	808	13.1	868	61.8	928	63.4
509	28.8	569	0	629	22.7	689	33	749	0	809	9.2	869	61.8	929	63.7
510	28.4	570	0	630	22.3	690	30.3	750	0	810	6.9	870	62.6	930	64.5
511	28.4	571	0	631	21.9	691	29.2	751	0	811	4.6	871	63.4	931	65.3

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)
512	28	572	0.4	632	22.7	692	28.4	752	0	812	4.6	872	63	932	64.9
513	26.5	573	1.5	633	23.8	693	25	753	0	813	4.6	873	63	933	63.7
514	24.2	574	3.5	634	25	694	21.1	754	0	814	4.2	874	62.6	934	63
515	22.7	575	6.1	635	25.3	695	16.9	755	0	815	5.4	875	61.8	935	59.9
516	20.4	576	10.4	636	25.7	696	13.4	756	0	816	4.6	876	61.8	936	55.3
517	17.7	577	14.2	637	26.5	697	13.1	757	0	817	3.5	877	62.2	937	50.7
518	15.7	578	16.9	638	26.9	698	12.3	758	0	818	2.3	878	62.2	938	49.2
519	13.1	579	19.2	639	27.3	699	12.7	759	0	819	2.3	879	62.6	939	48
520	10.8	580	20	640	28	700	15.7	760	0	820	1.9	880	63.7	940	46.1
521	8.4	581	21.5	641	29.2	701	19.2	761	0	821	3.1	881	64.5	941	44.2
522	7.3	582	23.4	642	30	702	22.3	762	0	822	6.1	882	64.9	942	41.1
523	5	583	24.6	643	30	703	24.6	763	1.5	823	4.6	883	66	943	39.9
524	3.8	584	24.2	644	29.6	704	25.7	764	5.4	824	2.7	884	66	944	36.1
525	3.5	585	20	645	29.6	705	26.5	765	9.2	825	2.3	885	66.8	945	32.6
526	1.9	586	16.9	646	28.8	706	26.5	766	11.5	826	2.3	886	66.4	946	29.2
527	0.8	587	13.4	647	28.4	707	26.9	767	14.6	827	3.1	887	66.8	947	24.6
528	0	588	13.4	648	28	708	27.3	768	17.3	828	4.2	888	67.2	948	20.7
529	0	589	15.7	649	27.3	709	27.3	769	19.2	829	3.5	889	66.4	949	19.2
530	0	590	18.4	650	25.7	710	27.6	770	21.1	830	3.8	890	66.4	950	16.5
531	0.8	591	21.1	651	24.6	711	28.4	771	20.7	831	4.2	891	66	951	15
532	1.9	592	23.4	652	25	712	28.8	772	20.7	832	3.5	892	65.7	952	11.9
533	3.8	593	25.3	653	26.5	713	28.8	773	19.6	833	3.5	893	65.7	953	9.6
534	6.9	594	27.6	654	28	714	29.2	774	18.4	834	3.5	894	66.4	954	8.4
535	9.6	595	28.8	655	29.6	715	28.8	775	16.9	835	4.6	895	66	955	5.8
536	11.1	596	30.3	656	30.7	716	28.8	776	16.9	836	5.8	896	65.7	956	1.2
537	11.1	597	30.7	657	32.3	717	28	777	16.5	837	3.5	897	65.3	957	0
538	10.4	598	31.5	658	33	718	28	778	16.9	838	0.8	898	65.3	958	0
539	8.8	599	31.1	659	34.2	719	27.6	779	16.9	839	3.5	899	64.5	959	0
540	9.2	600	31.1	660	34.6	720	26.5	780	16.9	840	3.8	900	64.5	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	1021	0	1081	1.9	1141	42.6	1201	27.3	1261	40.7	1321	31.5	1381	3.5
962	5	1022	0	1082	2.3	1142	42.2	1202	28.8	1262	40.7	1322	29.6	1382	2.7
963	8.4	1023	0.4	1083	2.7	1143	43	1203	30	1263	40.7	1323	29.2	1383	2.3
964	11.5	1024	2.7	1084	3.5	1144	43.4	1204	29.6	1264	41.5	1324	28.8	1384	1.5
965	14.6	1025	6.1	1085	6.5	1145	43	1205	29.6	1265	42.6	1325	28.8	1385	1.2
966	16.9	1026	9.2	1086	10.8	1146	42.6	1206	28.8	1266	43	1326	28	1386	0
967	18.8	1027	11.5	1087	13.8	1147	41.9	1207	26.1	1267	44.5	1327	28	1387	1.2
968	21.1	1028	14.2	1088	16.1	1148	40.7	1208	22.3	1268	45.3	1328	28.4	1388	4.2
969	23.8	1029	16.1	1089	18.4	1149	36.9	1209	19.2	1269	45.3	1329	29.6	1389	7.3
970	26.5	1030	18	1090	20.4	1150	32.6	1210	16.5	1270	44.9	1330	30	1390	8.8
971	28	1031	20	1091	21.9	1151	28	1211	12.7	1271	43.4	1331	30.3	1391	10.8
972	29.6	1032	21.5	1092	21.9	1152	23.4	1212	9.6	1272	40.3	1332	29.2	1392	12.3
973	30.7	1033	23	1093	20.7	1153	18.4	1213	6.9	1273	38	1333	26.5	1393	13.1
974	32.6	1034	24.2	1094	17.3	1154	14.6	1214	4.2	1274	36.1	1334	25.3	1394	12.3
975	34.2	1035	25	1095	13.1	1155	12.3	1215	2.3	1275	36.5	1335	25	1395	12.3
976	35.3	1036	25.7	1096	9.6	1156	9.2	1216	0.8	1276	38	1336	24.6	1396	11.5
977	36.1	1037	26.9	1097	8.8	1157	5.8	1217	0	1277	39.2	1337	24.6	1397	11.5
978	36.9	1038	27.6	1098	10.8	1158	1.9	1218	0	1278	40.7	1338	25.3	1398	11.1
979	38	1039	27.6	1099	12.7	1159	0.4	1219	0	1279	42.2	1339	26.1	1399	11.1
980	38	1040	28.4	1100	14.2	1160	0	1220	0	1280	43.4	1340	27.3	1400	11.1
981	38	1041	29.2	1101	14.6	1161	0	1221	0	1281	44.9	1341	28.4	1401	13.1
982	38	1042	29.2	1102	13.1	1162	0	1222	0	1282	45.7	1342	29.2	1402	15
983	38	1043	30	1103	11.1	1163	0	1223	0	1283	46.1	1343	29.2	1403	16.9
984	37.2	1044	29.6	1104	11.1	1164	0	1224	0	1284	46.8	1344	29.6	1404	16.9
985	36.9	1045	29.6	1105	11.1	1165	0.4	1225	0	1285	46.5	1345	30	1405	16.1
986	36.1	1046	28.8	1106	13.1	1166	4.2	1226	0	1286	46.5	1346	31.1	1406	15.7
987	35.7	1047	28	1107	15.7	1167	9.2	1227	0	1287	46.5	1347	32.6	1407	15.4
988	34.9	1048	23.8	1108	18.4	1168	11.9	1228	0	1288	46.1	1348	33.8	1408	15
989	34.9	1049	18.8	1109	20.7	1169	14.2	1229	0	1289	46.1	1349	34.6	1409	13.8
990	33.8	1050	11.9	1110	23.8	1170	15.7	1230	0	1290	46.1	1350	34.9	1410	10.8

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)
991	31.5	1051	6.1	1111	25.7	1171	15	1231	0	1291	46.8	1351	34.6	1411	8.4
992	28.8	1052	1.5	1112	28	1172	14.2	1232	0	1292	47.6	1352	34.9	1412	6.1
993	25.7	1053	1.5	1113	30	1173	13.4	1233	0	1293	48	1353	34.6	1413	4.2
994	24.6	1054	4.2	1114	31.1	1174	13.8	1234	0	1294	48.4	1354	34.9	1414	3.5
995	23.4	1055	8.1	1115	32.3	1175	14.6	1235	0	1295	48	1355	34.9	1415	3.5
996	22.3	1056	10.4	1116	34.2	1176	14.6	1236	0	1296	48	1356	34.9	1416	1.5
997	21.5	1057	13.1	1117	35.7	1177	14.2	1237	0	1297	47.2	1357	34.2	1417	0
998	20	1058	15.4	1118	36.9	1178	16.1	1238	0	1298	46.5	1358	33.8	1418	0
999	20	1059	18	1119	38.8	1179	15.7	1239	0	1299	46.8	1359	32.6	1419	0
1000	19.2	1060	20.4	1120	40.3	1180	15.7	1240	3.5	1300	47.2	1360	31.5	1420	0
1001	19.2	1061	23	1121	41.5	1181	14.6	1241	10.4	1301	48.4	1361	30	1421	0
1002	18	1062	25.3	1122	42.2	1182	13.1	1242	15.4	1302	48.4	1362	28.8	1422	0
1003	11.9	1063	27.3	1123	43	1183	10	1243	17.3	1303	48.8	1363	27.3	1423	0
1004	6.9	1064	28.8	1124	43.8	1184	7.3	1244	17.3	1304	48.4	1364	23.8	1424	0
1005	2.7	1065	30.3	1125	43.8	1185	3.5	1245	18.4	1305	47.6	1365	23	1425	0
1006	0.8	1066	31.1	1126	43.4	1186	0.8	1246	21.5	1306	46.5	1366	23	1426	0
1007	0.4	1067	32.3	1127	43	1187	0	1247	24.6	1307	44.2	1367	22.3	1427	0
1008	0	1068	31.9	1128	42.2	1188	0	1248	27.3	1308	42.2	1368	20.4	1428	0
1009	0	1069	32.3	1129	41.9	1189	0	1249	30	1309	41.5	1369	18.8	1429	0
1010	0	1070	31.9	1130	41.5	1190	0	1250	31.5	1310	41.1	1370	17.7	1430	0
1011	0	1071	31.1	1131	41.9	1191	0.4	1251	31.9	1311	40.7	1371	16.1	1431	0
1012	0	1072	28.8	1132	41.9	1192	2.7	1252	32.6	1312	40.3	1372	14.6	1432	0
1013	0	1073	25	1133	41.9	1193	7.3	1253	33.4	1313	39.6	1373	12.7	1433	0
1014	0	1074	22.7	1134	42.2	1194	11.5	1254	34.9	1314	39.2	1374	11.1	1434	0
1015	0	1075	18.8	1135	42.6	1195	15.4	1255	36.5	1315	38.8	1375	9.2	1435	0
1016	0	1076	15.4	1136	42.6	1196	19.2	1256	37.6	1316	38	1376	8.8		
1017	0	1077	13.4	1137	42.6	1197	21.9	1257	39.2	1317	37.6	1377	7.3		
1018	0	1078	11.9	1138	42.6	1198	23.8	1258	40.3	1318	37.2	1378	6.1		
1019	0	1079	8.8	1139	42.6	1199	25	1259	40.7	1319	36.5	1379	5		
1020	0	1080	5	1140	42.6	1200	26.1	1260	41.1	1320	34.6	1380	4.2		

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)	Time (sec.)	Speed (mph)
0	0	58	24.6	116	0	174	17.7	232	56.5	290	48.1	348	30.8	406	29.3
1	0	59	25.1	117	0	175	17.2	233	56.5	291	47.2	349	31.6	407	28.8
2	0	60	25.6	118	0	176	18.1	234	56.5	292	46.1	350	32.1	408	28.0
3	0	61	25.7	119	0	177	18.6	235	56.5	293	45.0	351	32.8	409	25.0
4	0	62	25.4	120	0	178	20.0	236	56.4	294	43.8	352	33.6	410	21.7
5	0	63	24.9	121	0	179	22.2	237	56.1	295	42.6	353	34.5	411	18.4
6	0	64	25.0	122	0	180	24.5	238	55.8	296	41.5	354	34.6	412	15.1
7	0	65	25.4	123	0	181	27.3	239	55.1	297	40.3	355	34.9	413	11.8
8	0	66	26.0	124	0	182	30.5	240	54.6	298	38.5	356	34.8	414	8.5
9	3.0	67	26.0	125	0	183	33.5	241	54.2	299	37.0	357	34.5	415	5.2
10	5.9	68	25.7	126	0	184	36.2	242	54.0	300	35.2	358	34.7	416	1.9
11	8.6	69	26.1	127	0	185	37.3	243	53.7	301	33.8	359	35.5	417	0
12	11.5	70	26.7	128	0	186	39.3	244	53.6	302	32.5	360	36.0	418	0
13	14.3	71	27.5	129	0	187	40.5	245	53.9	303	31.5	361	36.0	419	0
14	16.9	72	28.6	130	0	188	42.1	246	54.0	304	30.6	362	36.0	420	0
15	17.3	73	29.3	131	0	189	43.5	247	54.1	305	30.5	363	36.0	421	0
16	18.1	74	29.8	132	0	190	45.1	248	54.1	306	30.0	364	36.0	422	0
17	20.7	75	30.1	133	0	191	46.0	249	53.8	307	29.0	365	36.0	423	0
18	21.7	76	30.4	134	0	192	46.8	250	53.4	308	27.5	366	36.1	424	0
19	22.4	77	30.7	135	0	193	47.5	251	53.0	309	24.8	367	36.4	425	0
20	22.5	78	30.7	136	0	194	47.5	252	52.6	310	21.5	368	36.5	426	0
21	22.1	79	30.5	137	0	195	47.3	253	52.1	311	20.1	369	36.4	427	0
22	21.5	80	30.4	138	0	196	47.2	254	52.4	312	19.1	370	36.0	428	0
23	20.9	81	30.3	139	0	197	47.0	255	52.0	313	18.5	371	35.1	429	0
24	20.4	82	30.4	140	0	198	47.0	256	51.9	314	17.0	372	34.1	430	0
25	19.8	83	30.8	141	0	199	47.0	257	51.7	315	15.5	373	33.5	431	0
26	17.0	84	30.4	142	0	200	47.0	258	51.5	316	12.5	374	31.4	432	0
27	14.9	85	29.9	143	0	201	47.0	259	51.6	317	10.8	375	29.0	433	0
28	14.9	86	29.5	144	0	202	47.2	260	51.8	318	8.0	376	25.7	434	0
29	15.2	87	29.8	145	0	203	47.4	261	52.1	319	4.7	377	23.0	435	0

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)
30	15.5	88	30.3	146	0	204	47.9	262	52.5	320	1.4	378	20.3	436	3.3
31	16.0	89	30.7	147	0	205	48.5	263	53.0	321	0	379	17.5	437	6.6
32	17.1	90	30.9	148	0	206	49.1	264	53.5	322	0	380	14.5	438	9.9
33	19.1	91	31.0	149	0	207	49.5	265	54.0	323	0	381	12.0	439	13.2
34	21.1	92	30.9	150	0	208	50.0	266	54.9	324	0	382	8.7	440	16.5
35	22.7	93	30.4	151	0	209	50.6	267	55.4	325	0	383	5.4	441	19.8
36	22.9	94	29.8	152	3.3	210	51.0	268	55.6	326	0	384	2.1	442	23.1
37	22.7	95	29.9	153	6.6	211	51.5	269	56.0	327	0	385	0	443	26.4
38	22.6	96	30.2	154	9.9	212	52.2	270	56.0	328	0	386	0	444	27.8
39	21.3	97	30.7	155	13.2	213	53.2	271	55.8	329	0	387	0	445	29.1
40	19.0	98	31.2	156	16.5	214	54.1	272	55.2	330	0	388	0	446	31.5
41	17.1	99	31.8	157	19.8	215	54.6	273	54.5	331	0	389	0	447	33.0
42	15.8	100	32.2	158	22.2	216	54.9	274	53.6	332	0	390	0	448	33.6
43	15.8	101	32.4	159	24.3	217	55.0	275	52.5	333	0	391	2.6	449	34.8
44	17.7	102	32.2	160	25.8	218	54.9	276	51.5	334	0	392	5.9	450	35.1
45	19.8	103	31.7	161	26.4	219	54.6	277	51.5	335	1.0	393	9.2	451	35.6
46	21.6	104	28.6	162	25.7	220	54.6	278	51.5	336	4.3	394	12.5	452	36.1
47	23.2	105	25.3	163	25.1	221	54.8	279	51.1	337	7.6	395	15.8	453	36.0
48	24.2	106	22.0	164	24.7	222	55.1	280	50.1	338	10.9	396	19.1	454	36.1
49	24.6	107	18.7	165	25.0	223	55.5	281	50.0	339	14.2	397	22.4	455	36.2
50	24.9	108	15.4	166	25.2	224	55.7	282	50.1	340	17.3	398	25.0	456	36.0
51	25.0	109	12.1	167	25.4	225	56.1	283	50.0	341	20.0	399	25.6	457	35.7
52	24.6	110	8.8	168	25.8	226	56.3	284	49.6	342	22.5	400	27.5	458	36.0
53	24.5	111	5.5	169	27.2	227	56.6	285	49.5	343	23.7	401	29.0	459	36.0
54	24.7	112	2.2	170	26.5	228	56.7	286	49.5	344	25.2	402	30.0	460	35.6
55	24.8	113	0	171	24.0	229	56.7	287	49.5	345	26.6	403	30.1	461	35.5
56	24.7	114	0	172	22.7	230	56.5	288	49.1	346	28.1	404	30.0	462	35.4
57	24.6	115	0	173	19.4	231	56.5	289	48.6	347	30.0	405	29.7	463	35.2

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)	Time (sec.)	Speed (mph)
464	35.2	522	19.0	580	17.7	638	0	696	4.4	754	23.5	812	34.0	870	25.1
465	35.2	523	20.1	581	17.5	639	0	697	6.5	755	21.5	813	33.9	871	25.5
466	35.2	524	21.0	582	17.0	640	0	698	9.2	756	19.0	814	33.6	872	25.7
467	35.2	525	22.0	583	16.9	641	0	699	11.3	757	16.5	815	33.1	873	26.2
468	35.2	526	23.0	584	16.6	642	0	700	13.5	758	14.9	816	33.0	874	26.9
469	35.0	527	23.8	585	17.0	643	0	701	14.6	759	12.5	817	32.5	875	27.5
470	35.1	528	24.5	586	17.1	644	0	702	16.4	760	9.4	818	32.0	876	27.8
471	35.2	529	24.9	587	17.0	645	0	703	16.7	761	6.2	819	31.9	877	28.4
472	35.5	530	25.0	588	16.6	646	2.0	704	16.5	762	3.0	820	31.6	878	29.0
473	35.2	531	25.0	589	16.5	647	4.5	705	16.5	763	1.5	821	31.5	879	29.2
474	35.0	532	25.0	590	16.5	648	7.8	706	18.2	764	1.5	822	30.6	880	29.1
475	35.0	533	25.0	591	16.6	649	10.2	707	19.2	765	0.5	823	30.0	881	29.0
476	35.0	534	25.0	592	17.0	650	12.5	708	20.1	766	0	824	29.9	882	28.9
477	34.8	535	25.0	593	17.6	651	14.0	709	21.5	767	3.0	825	29.9	883	28.5
478	34.6	536	25.6	594	18.5	652	15.3	710	22.5	768	6.3	826	29.9	884	28.1
479	34.5	537	25.8	595	19.2	653	17.5	711	22.5	769	9.6	827	29.9	885	28.0
480	33.5	538	26.0	596	20.2	654	19.6	712	22.1	770	12.9	828	29.6	886	28.0
481	32.0	539	25.6	597	21.0	655	21.0	713	22.7	771	15.8	829	29.5	887	27.6
482	30.1	540	25.2	598	21.1	656	22.2	714	23.3	772	17.5	830	29.5	888	27.2
483	28.0	541	25.0	599	21.2	657	23.3	715	23.5	773	18.4	831	29.3	889	26.6
484	25.5	542	25.0	600	21.6	658	24.5	716	22.5	774	19.5	832	28.9	890	27.0
485	22.5	543	25.0	601	22.0	659	25.3	717	21.6	775	20.7	833	28.2	891	27.5
486	19.8	544	24.4	602	22.4	660	25.6	718	20.5	776	22.0	834	27.7	892	27.8
487	16.5	545	23.1	603	22.5	661	26.0	719	18.0	777	23.2	835	27.0	893	28.0
488	13.2	546	19.8	604	22.5	662	26.1	720	15.0	778	25.0	836	25.5	894	27.8
489	10.3	547	16.5	605	22.5	663	26.2	721	12.0	779	26.5	837	23.7	895	28.0
490	7.2	548	13.2	606	22.7	664	26.2	722	9.0	780	27.5	838	22.0	896	28.0
491	4.0	549	9.9	607	23.7	665	26.4	723	6.2	781	28.0	839	20.5	897	28.0
492	1.0	550	6.6	608	25.1	666	26.5	724	4.5	782	28.3	840	19.2	898	27.7
493	0	551	3.3	609	26.0	667	26.5	725	3.0	783	28.9	841	19.2	899	27.4

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)
494	0	552	0	610	26.5	668	26.0	726	2.1	784	28.9	842	20.1	900	26.9
495	0	553	0	611	27.0	669	25.5	727	0.5	785	28.9	843	20.9	901	26.6
496	0	554	0	612	26.1	670	23.6	728	0.5	786	28.8	844	21.4	902	26.5
497	0	555	0	613	22.8	671	21.4	729	3.2	787	28.5	845	22.0	903	26.5
498	0	556	0	614	19.5	672	18.5	730	6.5	788	28.3	846	22.6	904	26.5
499	0	557	0	615	16.2	673	16.4	731	9.6	789	28.3	847	23.2	905	26.3
500	0	558	0	616	12.9	674	14.5	732	12.5	790	28.3	848	24.0	906	26.2
501	0	559	0	617	9.6	675	11.6	733	14.0	791	28.2	849	25.0	907	26.2
502	0	560	0	618	6.3	676	8.7	734	16.0	792	27.6	850	26.0	908	25.9
503	0	561	0	619	3.0	677	5.8	735	18.0	793	27.5	851	26.6	909	25.6
504	0	562	0	620	0	678	3.5	736	19.6	794	27.5	852	26.6	910	25.6
505	0	563	0	621	0	679	2.0	737	21.5	795	27.5	853	26.8	911	25.9
506	0	564	0	622	0	680	0	738	23.1	796	27.5	854	27.0	912	25.8
507	0	565	0	623	0	681	0	739	24.5	797	27.5	855	27.2	913	25.5
508	0	566	0	624	0	682	0	740	25.5	798	27.5	856	27.8	914	24.6
509	0	567	0	625	0	683	0	741	26.5	799	27.6	857	28.1	915	23.5
510	0	568	0	626	0	684	0	742	27.1	800	28.0	858	28.8	916	22.2
511	1.2	569	3.3	627	0	685	0	743	27.6	801	28.5	859	28.9	917	21.6
512	3.5	570	6.6	628	0	686	0	744	27.9	802	30.0	860	29.0	918	21.6
513	5.5	571	9.9	629	0	687	0	745	28.3	803	31.0	861	29.1	919	21.7
514	6.5	572	13.0	630	0	688	0	746	28.6	804	32.0	862	29.0	920	22.6
515	8.5	573	14.6	631	0	689	0	747	28.6	805	33.0	863	28.1	921	23.4
516	9.6	574	16.0	632	0	690	0	748	28.3	806	33.0	864	27.5	922	24.0
517	10.5	575	17.0	633	0	691	0	749	28.2	807	33.6	865	27.0	923	24.2
518	11.9	576	17.0	634	0	692	0	750	28.0	808	34.0	866	25.8	924	24.4
519	14.0	577	17.0	635	0	693	0	751	27.5	809	34.3	867	25.0	925	24.9
520	16.0	578	17.5	636	0	694	1.4	752	26.8	810	34.2	868	24.5	926	25.1
521	17.7	579	17.7	637	0	695	3.3	753	25.5	811	34.0	869	24.8	927	25.2

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)	Time (sec.)	Speed (mph)
928	25.3	984	26.0	1040	0	1096	5.0	1152	0.8	1208	13.1	1264	10.5	1320	0
929	25.5	985	25.7	1041	0	1097	4.2	1153	0	1209	14.0	1265	9.5	1321	0
930	25.2	986	25.2	1042	0	1098	2.6	1154	0	1210	15.5	1266	8.5	1322	0
931	25.0	987	24.0	1043	0	1099	1.0	1155	0	1211	17.0	1267	7.6	1323	0
932	25.0	988	22.0	1044	0	1100	0	1156	0	1212	18.6	1268	8.8	1324	0
933	25.0	989	21.5	1045	0	1101	0.1	1157	0	1213	19.7	1269	11.0	1325	0
934	24.7	990	21.5	1046	0	1102	0.6	1158	0	1214	21.0	1270	14.0	1326	0
935	24.5	991	21.8	1047	0	1103	1.6	1159	0	1215	21.5	1271	17.0	1327	0
936	24.3	992	22.5	1048	0	1104	3.6	1160	0	1216	21.8	1272	19.5	1328	0
937	24.3	993	23.0	1049	0	1105	6.9	1161	0	1217	21.8	1273	21.0	1329	0
938	24.5	994	22.8	1050	0	1106	10.0	1162	0	1218	21.5	1274	21.8	1330	0
939	25.0	995	22.8	1051	0	1107	12.8	1163	0	1219	21.2	1275	22.2	1331	0
940	25.0	996	23.0	1052	0	1108	14.0	1164	0	1220	21.5	1276	23.0	1332	0
941	24.6	997	22.7	1053	1.2	1109	14.5	1165	0	1221	21.8	1277	23.6	1333	0
942	24.6	998	22.7	1054	4.0	1110	16.0	1166	0	1222	22.0	1278	24.1	1334	0
943	24.1	999	22.7	1055	7.3	1111	18.1	1167	0	1223	21.9	1279	24.5	1335	0
944	24.5	1000	23.5	1056	10.6	1112	20.0	1168	0	1224	21.7	1280	24.5	1336	0
945	25.1	1001	24.0	1057	13.9	1113	21.0	1169	2.1	1225	21.5	1281	24.0	1337	0
946	25.6	1002	24.6	1058	17.0	1114	21.2	1170	5.4	1226	21.5	1282	23.5	1338	1.5
947	25.1	1003	24.8	1059	18.5	1115	21.3	1171	8.7	1227	21.4	1283	23.5	1339	4.8
948	24.0	1004	25.1	1060	20.0	1116	21.4	1172	12.0	1228	20.1	1284	23.5	1340	8.1
949	22.0	1005	25.5	1061	21.8	1117	21.7	1173	15.3	1229	19.5	1285	23.5	1341	11.4
950	20.1	1006	25.6	1062	23.0	1118	22.5	1174	18.6	1230	19.2	1286	23.5	1342	13.2
951	16.9	1007	25.5	1063	24.0	1119	23.0	1175	21.1	1231	19.6	1287	23.5	1343	15.1
952	13.6	1008	25.0	1064	24.8	1120	23.8	1176	23.0	1232	19.8	1288	24.0	1344	16.8
953	10.3	1009	24.1	1065	25.6	1121	24.5	1177	23.5	1233	20.0	1289	24.1	1345	18.3
954	7.0	1010	23.7	1066	26.5	1122	25.0	1178	23.0	1234	19.5	1290	24.5	1346	19.5
955	3.7	1011	23.2	1067	26.8	1123	24.9	1179	22.5	1235	17.5	1291	24.7	1347	20.3
956	0.4	1012	22.9	1068	27.4	1124	24.8	1180	20.0	1236	15.5	1292	25.0	1348	21.3
957	0	1013	22.5	1069	27.9	1125	25.0	1181	16.7	1237	13.0	1293	25.4	1349	21.9

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)
958	0	1014	22.0	1070	28.3	1126	25.4	1182	13.4	1238	10.0	1294	25.6	1350	22.1
959	0	1015	21.6	1071	28.0	1127	25.8	1183	10.1	1239	8.0	1295	25.7	1351	22.4
960	2.0	1016	20.5	1072	27.5	1128	26.0	1184	6.8	1240	6.0	1296	26.0	1352	22.0
961	5.3	1017	17.5	1073	27.0	1129	26.4	1185	3.5	1241	4.0	1297	26.2	1353	21.6
962	8.6	1018	14.2	1074	27.0	1130	26.6	1186	0.2	1242	2.5	1298	27.0	1354	21.1
963	11.9	1019	10.9	1075	26.3	1131	26.9	1187	0	1243	0.7	1299	27.8	1355	20.5
964	15.2	1020	7.6	1076	24.5	1132	27.0	1188	0	1244	0	1300	28.3	1356	20.0
965	17.5	1021	4.3	1077	22.5	1133	27.0	1189	0	1245	0	1301	29.0	1357	19.6
966	18.6	1022	1.0	1078	21.5	1134	27.0	1190	0	1246	0	1302	29.1	1358	18.5
967	20.0	1023	0	1079	20.6	1135	26.9	1191	0	1247	0	1303	29.0	1359	17.5
968	21.1	1024	0	1080	18.0	1136	26.8	1192	0	1248	0	1304	28.0	1360	16.5
969	22.0	1025	0	1081	15.0	1137	26.8	1193	0	1249	0	1305	24.7	1361	15.5
970	23.0	1026	0	1082	12.3	1138	26.5	1194	0	1250	0	1306	21.4	1362	14.0
971	24.5	1027	0	1083	11.1	1139	26.4	1195	0	1251	0	1307	18.1	1363	11.0
972	26.3	1028	0	1084	10.6	1140	26.0	1196	0	1252	1.0	1308	14.8	1364	8.0
973	27.5	1029	0	1085	10.0	1141	25.5	1197	0.2	1253	1.0	1309	11.5	1365	5.2
974	28.1	1030	0	1086	9.5	1142	24.6	1198	1.5	1254	1.0	1310	8.2	1366	2.5
975	28.4	1031	0	1087	9.1	1143	23.5	1199	3.5	1255	1.0	1311	4.9	1367	0
976	28.5	1032	0	1088	8.7	1144	21.5	1200	6.5	1256	1.0	1312	1.6	1368	0
977	28.5	1033	0	1089	8.6	1145	20.0	1201	9.8	1257	1.6	1313	0	1369	0
978	28.5	1034	0	1090	8.8	1146	17.5	1202	12.0	1258	3.0	1314	0	1370	0
979	27.7	1035	0	1091	9.0	1147	16.0	1203	12.9	1259	4.0	1315	0	1371	0
980	27.5	1036	0	1092	8.7	1148	14.0	1204	13.0	1260	5.0	1316	0	1372	0
981	27.2	1037	0	1093	8.6	1149	10.7	1205	12.6	1261	6.3	1317	0		
982	26.8	1038	0	1094	8.0	1150	7.4	1206	12.8	1262	8.0	1318	0		
983	26.5	1039	0	1095	7.0	1151	4.1	1207	13.1	1263	10.0	1319	0		

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 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.

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 + NOx 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 + NOx 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.

Confirmatory testing and/or in-use compliance testing may be performed in any driver-selectable mode to ensure compliance with emission standards.

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 ±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 ±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 ±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 ±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, ($Amp\text{-}hr_{initial}$) is the stored charge at the beginning of the cold-start UDDS cycle, and ($Amp\text{-}hr_{final}$) is the stored battery charge at the end of the subsequent hot-start UDDS cycle. The final stored battery charge, ($Amp\text{-}hr_{final}$), shall not exceed either $(Amp\text{-}hr_{final})_{max}$ or $(Amp\text{-}hr_{final})_{min}$ 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 $(V_{final})_{max}$ 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 cold-start UDDS cycle, and (rpm_{final}) is the flywheel rotational speed at the end of the subsequent hot-start UDDS cycle. The final flywheel rotational speed, (rpm_{final}), shall not exceed either $(rpm_{final})_{max}$ or $(rpm_{final})_{min}$ 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 ±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:

$$e_{[\text{emission }]-\text{FTPcomp}} = 0.43\left(\frac{m_{\text{c}}}{D_{\text{c}}}\right) + 0.57\left(\frac{m_{\text{h}}}{D_{\text{h}}}\right)$$

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, $e_{\text{PM-FTPcomp}}$, in grams per mile as follows:

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

$$e_{\text{PM}-\text{FTPcomp}} = 0.43\left(\frac{m_{\text{PM}-\text{cUDDS}}}{D_{\text{c}}}\right) + 0.57\left(\frac{m_{\text{PM}-\text{hUDDS}}}{D_{\text{h}}}\right)$$

Where:

$m_{\text{PM-cUDDS}}$ = 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.

$m_{\text{PM-hUDDS}}$ = 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):

$$e_{\mathrm{PM-FTPcomp}} = \frac{m_{\mathrm{PM}}}{0.43(D_{\mathrm{c}}) + 0.57(D_{\mathrm{h}})}$$

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 + NOx 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 + NOx 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. Additional preconditioning UDDS cycles may be approved in advance by the Executive Officer if the need for additional preconditioning is demonstrated by the manufacturer.

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, (Amp-$hr_{initial}$) is the stored charge at the beginning of the HFEDS cycle with emission sampling, and (Amp-hr_{final}) is the stored battery charge at the end of the same HFEDS cycle with emission sampling. The final stored battery charge, (Amp-hr_{final}), shall not exceed either (Amp-$hr_{final})_{max}$ or (Amp-$hr_{final})_{min}$ 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 $(V_{final})_{max}$ 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 HFEDS cycle with emission sampling, and (rpm_{final}) is the flywheel rotational speed at the end of the same HFEDS 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.

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 ±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 + NOx 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 + NOx 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): Operate the vehicle one time over one of the driving schedules specified in this paragraph (b)(3)(ii). A particular preconditioning driving schedule that is related to fuel effects on adaptive memory systems may be requested. 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. Sampling equipment may be exercised, but emissions measured during preconditioning may not be used to determine compliance with applicable emission standards. Choose from the following driving schedules:

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, $(\text{Amp-hr}_{initial})$ is the stored charge at the beginning of the US06 cycle with emission sampling, and (Amp-hr_{final}) is the stored battery charge at the end of the same US06 cycle with emission sampling. The final stored battery charge, (Amp-hr_{final}), shall not exceed either $(\text{Amp-hr}_{final})_{max}$ or $(\text{Amp-hr}_{final})_{min}$ 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 $(V_{final})_{max}$ 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 US06 cycle with emission sampling, and (rpm_{final}) is the flywheel rotational speed at the end of the US06 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.

4.1.11 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 ±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, $(\text{Amp-hr}_{initial})$ is the stored charge at the beginning of the SC03 cycle with emission sampling, and (Amp-hr_{final}) is the stored battery charge at the end of the SC03 cycle with emission sampling. The final stored battery charge, (Amp-hr_{final}), shall not exceed either $(\text{Amp-hr}_{final})_{max}$ or $(\text{Amp-hr}_{final})_{min}$ 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 ±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
$(\text{Amp-hr}_{final})_{min}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{initial})$	=	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
K_1	=	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:

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

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

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

$V_{initial}^2$ = 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:

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

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

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

$rpm_{initial}^2$ = 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, $\frac{4\pi^2}{3600\,\text{sec}^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m^2

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

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

   20ºF 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, CH_4, NO_x, or CO_2, in grams per vehicle mile.

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

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

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

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+NOx 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, $(Amp \cdot hr_{initial})$ is the stored charge at the beginning of the Cold-Start Partial Soak Test, and $(Amp \cdot hr_{final})$ is the stored battery charge at the end of the Cold-Start Partial Soak Test. The final stored battery charge, $(Amp \cdot hr_{final})$, shall not exceed either $(Amp \cdot hr_{final})_{max}$ or $(Amp \cdot hr_{final})_{min}$ 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 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 $(V_{final})_{max}$ 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 Cold-Start Partial Soak Test, and (rpm_{final}) is the flywheel rotational speed at the end of the Cold-Start Partial Soak Test. The final flywheel rotational speed, (rpm_{final}), shall not exceed either $(rpm_{final})_{max}$ or $(rpm_{final})_{min}$ for a valid test.

7.5. **Alternative End-of-Test Criteria.**

With approval from the Executive Officer, 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 ±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. To submit an approval request, follow the procedure in Part II, section I.2.3.18.

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

The test sequence outlined in subsection 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, $e_{partial\_soak}$, in grams per mile, using the following equation:

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

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 ±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+NOx 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 subsection 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, $(Amp \cdot hr_{initial})$ is the stored charge at the beginning of the Quick Drive-Away Emission Test, and $(Amp \cdot hr_{final})$ is the stored battery charge at the end of the Quick Drive-Away Emission Test. The final stored battery charge, $(Amp \cdot hr_{final})$, shall not exceed either $(Amp \cdot hr_{final})_{max}$ or $(Amp \cdot hr_{final})_{min}$ 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 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 $(V_{final})_{max}$ 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 Quick Drive-Away Emission Test, and (rpm_{final}) is the flywheel rotational speed at the end of the Quick Drive-Away Emission Test. The final flywheel rotational speed, (rpm_{final}), shall not exceed either $(rpm_{final})_{max}$ or $(rpm_{final})_{min}$ for a valid test.

8.4. **Alternative End-of-Test Criteria.**

With approval from the Executive Officer, 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 ±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. To submit an approval request, follow the procedure in Part II, section I.2.3.18.

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, $e_{quick\_drive\_away}$, in grams per mile, using the following equation:

$$e_{quick\ \_drive\ \_away} = 0.43\left(\frac{m_{qd}}{D_{qd}}\right) + 0.57\left(\frac{m_h}{D_h}\right)$$

Where:

m_{qd} = the mass emissions determined from the Quick Drive-Away Emission Test in subsection Part II, section I.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 I.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 I.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 I.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.]