California Environmental Protection Agency
AIR RESOURCES BOARD

Part 2

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017~~AND SUBSEQUENT~~ MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: December 17, 2008
Amended: December 2, 2009
Amended: March 22, 2012

Note: Set forth below are the 2012 amendments to the California zero emission vehicle (ZEV) regulation. The text of the amendments is shown in underline to indicate additions and ~~strikeout~~ to indicate deletions, compared to the preexisting regulatory language.

NOTE: This document is incorporated by reference in section 1962.1, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of zero-emission vehicles and hybrid electric vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” (incorporated by reference in section 1961(d), title 13, CCR);

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

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

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

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

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

7. “Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR);

8. Guidelines for Certification of Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by section 1960.5, title 13, CCR); and

9. “California Non-Methane Organic Gas Test Procedures,” (incorporated by reference in section 1961(d), title 13, CCR).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017~~AND SUBSEQUENT~~ MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

A. Applicability

The emission standards and test procedures in this document are applicable to 2009 through 2017~~and subsequent~~ model-year zero-emission passenger cars, light-duty trucks, and medium-duty vehicles, and 2009 through 2017~~and subsequent~~ model-year hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles. The general procedures and requirements necessary to certify a vehicle for sale in California are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (hereinafter "LDV/MDV TPs"), and apply except as amended herein.

B. Definitions and Terminology.

1. Definitions.

In addition to the following, these test procedures incorporate by reference the definitions and abbreviations set forth in the Title 40 Code of Federal Regulations (CFR) §86.1803-01, the definitions and abbreviations set forth in the LDV/MDV TPs, and the definitions set forth in section 1900, title 13, CCR.

"Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier.

"All-Electric Range" means the total miles driven electrically (with the engine off) before the engine turns on for the first time, after the battery has been fully charged. ~~For a blended off-vehicle charge capable hybrid electric vehicle, the equivalent all-electric range shall be considered the "all-electric range" of the vehicle.~~

"All-Electric Range Test" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see section E of these test procedures).

"Alternate Continuous Urban Test Schedule" means a series of the following sequence: UDDS, 10 minute key-off hot soak, UDDS, and 10-20 minute key-off hot soak. This alternate procedure may be substituted for the Continuous Urban Test Schedule when the Continuous Urban Test Schedule cannot be performed.

"Alternate Continuous Highway Test Schedule" means a series of the following sequence: HFEDS, 15 second key-on pause, HFEDS, and 10-20 minute key-off hot soak or a 15 second key-on pause. This alternate procedure may be substituted for the Continuous Highway Test Schedule when the Continuous Highway Test Schedule cannot be performed.

"Auxiliary power unit" **or "APU"** 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. For the purposes of range extended battery electric vehicles, auxiliary power unit means any device that provides electrical or mechanical energy, meeting the requirements of subdivision C.3.2, to a Type I.5x or Type IIx vehicle, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.

"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 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 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.

"Blended off-vehicle charge capable hybrid electric vehicle" means an off-vehicle charge capable hybrid electric vehicle that uses the engine to supplement battery/electric motor power during charge depleting operation.

"Blended operation mode" means an operating mode in which the energy storage state-of-charge decreases, on average, while the vehicle is driven and the engine is used occasionally to support power requests.

"Charge-depleting net energy consumption" means the net electrical energy, E_{cd}, measured in watt-hours consumed by vehicle over the charge depleting cycle range, R_{cdc}. E_{cd} can be expressed as AC or DC watt hours, where appropriate.

"Charge-depleting (CD) mode" means an operating mode in which the energy storage state-of-charge (SOC) may fluctuate but, on average, decreases while the vehicle is driven. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Charge depleting actual range or R_{cda}" means the distance traveled on the Urban Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the two consecutive UDDS used to end the Urban Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles. (See section F.11.9.)

"Charge depleting actual range, highway or R_{cdah}" means the distance traveled on the Highway Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the HFEDS used to end the Highway Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles.

"Charge depleting cycle range or R_{cdc}" means the distance traveled on the Urban or Highway Charge Depleting Procedure up to the test cycle prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle. This range will appear as the sum of a discrete number of test cycle distances. This range shall be reported to the nearest 0.1 miles. (See section F.11.8.)

"Charge-sustaining net energy consumption" means the net electrical energy, Ecs, measured in watt-hours consumed by vehicle during charge sustaining operation. For charge sustaining operation, this number should be ~ 0.

"Charge-sustaining (CS) mode" means an operating mode in which the energy storage SOC may fluctuate but, on average, is maintained at a certain level while the vehicle is driven. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

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

"Continuous Urban Test Schedule" means a repeated series comprised of an Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference; each test is followed by a 10 minute key-off soak period.

"Continuous Highway Test Schedule" means a repeated series comprised of four consecutive key-on Highway Fuel Economy Driving Schedules (HFEDS) with a 15 second key-on pause in-between each HFEDS. If this schedule cannot be performed continuously, a key-off soak up to 30 minutes is permitted after every fourth HFEDS.

"Continuous US06 Test Schedule" means a repeated series of US06 driving schedules (US06) with a key-on idle period of not less than one minute and not greater than two minutes between each US06.

"**Conventional rounding method**" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

"**East Region pool**" means the combination Section 177 states east of the Mississippi River.

"Electric drive system" means an electric motor and associated power electronics, which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

"Electric range fraction" means the fraction of electrical energy derived from off-vehicle charging and regenerative braking energy relative to total traction energy used over the charge depletion range on a specified drive cycle.

"Enhanced AT PZEV" means any model year 2009 through 2011 PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel. Enhanced AT PZEV means Transitional Zero Emission Vehicle.

"Equivalent all-electric range" means the portion of the total charge depleting range attributable to the use of electricity from the battery over the charge depleting range test.

"Fuel cell vehicle" or "FCV" means any vehicle that receives propulsion solely from an onboard fuel cell power system.

"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.

"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.

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

"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.

"Neighborhood Electric Vehicle" or "NEV" means a motor vehicle that meets the definition of "low-speed vehicle" either in section 385.5 of the Vehicle Code or in 49 CFR §571.500 (July 1, 2000), and is certified to zero-emission vehicle standards.

“NIST” means the National Institute of Standards and Technology.

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

“Placed in service” means having been sold or leased to an end-user and not just to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

“Proportional value” means the ratio of a manufacturer’s California applicable sales volume to the manufacturer’s Section 177 state applicable sales volume. In any given model year, the same applicable sale volume calculation method must be used to calculate proportional value.

“PZEV” means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.

“Range Extended Battery Electric Vehicle” means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision C.4.5(g),

“Regenerative braking” means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

“SAE J2572” means the “Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen,” as published by the Society of Automotive Engineers in October, 2008.

“Section 177 State” means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

“SC03” means the U.S. EPA SC03 driving schedule representing vehicle operation with air conditioning, as set forth in Appendix I of 40 CFR Part 86.

“SOC Net Change Tolerance” means the state-of-charge net change tolerance that is applied to the SOC Criterion for charge-sustaining hybrid electric vehicles when validating an emission test. See section E.9 and F.10 of these procedures for tolerance specifications.

“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 Change Tolerance shall be applied to the SOC Criterion.

“Transitional Zero Emission Vehicle” means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

“Type 0, I, I.5, II, III, IV, and V ZEV” all have the meanings set forth in section C.4.4(a).

“Type I.5x” means range extended 75 mile to 100 mile all electric range battery electric vehicle.

"Type IIx" means range extended 100 mile or greater all electric range battery electric vehicle.

"US06" means the US06 driving schedule for aggressive driving as set forth in Appendix I of 40 CFR Part 86.

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

"**West Region pool**" means the combination of Section 177 states west of the Mississippi River.

"Zero-emission vehicle" or "**ZEV"** means any vehicle certified to zero-emission standards.

"Zero-emission Vehicle Miles Traveled" or zero emission VMT" means the vehicle miles traveled with zero exhaust emissions of any criteria pollutant (or precursor pollutant).

"ZEV fuel" means a fuel that provides traction energy in on-road ZEVs. Examples of current technology ZEV fuels include electricity, hydrogen, and compressed air.

2. Terminology.

	Abbreviation	Units
Charge Depleting Actual Range (urban cycle)	R_{cda}	mi
Charge Depleting to Charge Sustaining Range	R_{cdcs}	mi
Charge Depleting Net Energy Consumption	E_{cd}	wh
Charge Depleting CO_2 Produced	M_{cd}	g/mi
Charge Sustaining CO_2 Produced	M_{cs}	g/mi
Highway Charge Depleting Actual Range	R_{cdah}	mi
Highway Charge Depleting Cycle Range	R_{cdch}	mi
Highway Electric Range Fraction	ERF_h	%
Highway Equivalent All-Electric Range	$EAER_h$	mi
Highway Equivalent All-Electric Range Energy Consumption	$EAEREC_h$	wh/mi
Urban Charge Depleting Cycle Range	R_{cdcu}	mi
Urban Electric Range Fraction	ERF_u	%
Urban Equivalent All-Electric Range	$EAER_u$	mi
Urban Equivalent All-Electric Range scaled to 40 mi limit	$EAER_{u40}$	mi
Urban Equivalent All-Electric Range Energy Consumption	$EAEREC_u$	wh/mi

C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2009 ~~and subsequent~~through 2017 model year passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions.

2. Percentage ZEV Requirements

2.1 General Percentage ZEV Requirement.

(a) *Basic Requirement.* The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by ~~section~~subdivision C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in ~~section~~subdivision C.2.2. The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.

Model Years	*Minimum ZEV Requirement*
2009 through 2011	11 %
2012 through 2014	12 %
2015 through 2017	14 %
2018 and subsequent	16 %

(b) *Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.* For purposes of calculating a manufacturer's requirement in subdivision C.2.1 for model years 2009 through 2017, a manufacturer may use a three year average method or same model year method, as described below in sections 1. and 2. A manufacturer may switch methods on an annual basis. This production averaging is used to determine ZEV requirements specified in subdivision C.2.1(a) only, and has no effect on a manufacturer's size determination, specified in section 1900. For example, in applying the ZEV requirement, a PC, LDT1, or LDT2, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).

(1) For the 2009 through 2011 model years, a manufacturer's production volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California will be based on the three-year average of the manufacturer's volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California in the 2003 through 2005 model years. As an alternative to the three-year averaging of prior year production described above, a manufacturer may elect to base its ZEV obligation on the number of PCs and LDT1s, and LDT2s, as applicable, produced by

the manufacturer and delivered for sale in California that same model year.

(2) For 2012 ~~and subsequent~~through 2017 model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDT~~1s, and LDT2s, as applicable,~~ produced and delivered for sale in California in the prior fourth, fifth and sixth model year (for example, 2013 model year ZEV requirements will be based on California production volume of PCs and LDT~~1~~s, ~~and LDT2s as applicable,~~ for the 2007 to 2009 model years, and 2014 model year ZEV requirements will be based on California production volume of PCs and LDTs, for the 2008 to 2010 model years). ~~This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination.~~ As an alternative to the three-year averaging of prior year production described above, a manufacturer may elect to base its ZEV obligation on the number of PCs and LDT~~1s, and LDT2s, as applicable,~~ produced by the manufacturer and delivered for sale in California that same model year. ~~For 2012 and subsequent model years, a manufacturer may, on an annual basis, select either the three-year average or the same model-year calculation method. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).~~

(c) *Phase-in of ZEV Requirements for LDT2s.* Beginning with the ZEV requirements for the 2009 model year, a manufacturer's LDT2 production shall be included in determining the manufacturer's overall ZEV requirement under ~~section~~subdivision C.2.1(a) in the increasing percentages shown in the table below.

2009	*2010*	*2011*	*2012+*
51%	68%	85%	100%

(d) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating for purposes of ~~section~~subdivision C.2.1(b) and (c) the volume of PCs, LDT1s and LDT2s that a manufacturer has produced and delivered for sale in California, the manufacturer shall exclude the number of ZEVs produced by the manufacturer, or by a subsidiary in which that ~~the~~ manufacturer has a greater than 50 percent ownership interest, and delivered for sale in California.

2.2 Requirements for Large Volume Manufacturers.

(a) *Primary Requirements for Large Volume Manufacturers through Model Year 2011*. In the 2009 through 2011 model years, a manufacturer must meet at least 22.5 percent of its ZEV requirement with ZEVs or ZEV credits generated by such vehicles, and at least another 22.5 percent with ZEVs, AT PZEVs, or credits generated by such vehicles. The remainder of the manufacturer's ZEV requirement may be met using PZEVs or credits generated by such vehicles.

(b) *Alternative Requirements for Large Volume Manufacturers.*

(1) *Minimum Floor for Production of Type III ZEVs.*

(A) *[Reserved]*

(B) *Requirement For the 2009-2011 Model Years.* A manufacturer electing the alternative compliance requirements during model years 2009 through 2011 must produce ZEV credits equal to 0.82 percent of the manufacturer's average annual California sales of PCs and LDT1s, and LDT2s, as applicable, over the three year period from model years 2003 through 2005, ~~though~~through production, delivery for sale, and placement in service of ZEVs, other than NEVs and Type 0 ZEVs, using credit ratios for each ZEV Type compared to a Type III prescribed in the table below, or submit an equivalent number of credits generated by such vehicles.

ZEV Types	Credit Substitution Ratio
Type I	2
Type I.5	1.6
Type II	1.33
Type IV	0.8
Type V	0.57

(i) Manufacturers may use credits generated by 1997-2003 model-year ZEVs that qualify for an extended service multiplier under ~~section~~subdivision C.6 for a year primarily during calendar years 2009-2011, provided that 33 years of such a multiplier will equal 4 ZEV credits.

(C) *[Reserved]*

(D) *[Reserved]*

(E) *[Reserved]*

(F) *Exclusion of Additional Credits for Transportation Systems.* Any additional credits for transportation systems generated in accordance with ~~section~~subdivision C.7.5 shall not be counted towards compliance with this ~~section~~subdivision C.2.2(b)(1)(B).

(G) *Carry-over of Excess Credits.* ZEV credits generated from excess production in model years 2005 through 2008 may be carried forward and applied to the 2009 through 2011 minimum floor requirement specified in ~~section~~subdivision C.2.2(b)(1)(B) provided that the value of these carryover credits shall be based on the model year in which the credits are used. Beginning with the 2012 model year, these credits may no longer be used to meet the ZEV requirement, specified in subdivision

C.2.2(b)(1)(B); they may be used as Enhanced AT PZEV, AT PZEV, or PZEV credits. ZEV credits earned in model year 2009~~ and subsequent~~ through 2011 would be allowed to be carried forward for two years for application to the ZEV requirement. For example, ZEV credit earned in the 2010 model year would retain full flexibility through the 2012 model year. Starting 2013 model year, ~~at which time~~ that credit could only be used as ~~Enhanced AT PZEV~~TZEV, AT PZEV, or PZEV credits, and could not be used to satisfy the ZEV credit obligation, which may only be satisfied with credit generated from ZEVs.

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(H) *Failure to Meet Requirement for Production of ZEVs.* A manufacturer that, after electing the alternative requirements in ~~section~~subdivision C.2.2(b) for any model year from 2009 through 2011, fails to meet the requirement in ~~section~~subdivision C.2.2(b)(1)(B) by the end of the 2011 model year, shall be treated as subject to the primary requirements in ~~section~~subdivision C.2.1(a) for the 2009 through 2011 model years.

(I) *Rounding Convention.* The number of ZEVs needed for a manufacturer under ~~section~~subdivision C.2.2(b)(1)(B) shall be rounded to the nearest whole number.

(2) *Compliance With Percentage ZEV Requirements.* In the 2009 through 2011 model years, a manufacturer electing the alternative compliance requirements in a given model year must meet at least 45 percent of its ZEV requirement for that model year with ZEVs, AT PZEVs, or ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles. ZEV credits generated for compliance with the alternative requirements during any given model year will be applied to the 45 percent which may be met with ZEVs, AT PZEVs, ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles, but not PZEVs. The remainder of the manufacturer's ZEV requirement may be met using PZEVs or credits generated from such vehicles.

(3) *Sunset of Alternative Requirements After the 2011 Model Year.* The alternative requirements in ~~section~~subdivision C.2.2(b) are not available after the 2011

(c) *Election of the Primary or Alternative Requirements for Large Volume Manufacturers.* A manufacturer shall be subject to the primary ZEV requirements for the 2009 model year unless it notifies the Executive Officer in writing prior to the start of the 2009 model year that it is electing to be subject to the alternative compliance requirements for that model year. Thereafter, a manufacturer shall be subject to the same compliance option as applied in the previous model year unless it notifies the Executive Officer in writing prior to the start of a new model year that it is electing to switch to the other compliance option for that new model year. However, a manufacturer that has previously elected the primary ZEV requirements for one or more of the 2009 through 2011 model years may prior to the end of the 2011 model year elect the alternative compliance requirements for the 2009 through 2011 model years upon a demonstration that it has complied with all of the applicable requirements for that period in ~~section~~subdivision C.2.2(b)(1)(B).

(d) *Requirements for Large Volume Manufacturers in Model Years 2012 through 2017.*

(1) *2012 through 2014 Requirements.* On an annual basis, a~~A~~ manufacturer must meet the total ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEVs, equal to at least 0.79% of its annual sales, using either production volume determination method described in ~~section~~subdivision C.2.1(b) No more than 50% of the total obligation may be met with credits generated from PZEVs, No more than 75% of the total obligation may be met with credits generated from AT PZEVs. No more than 93.4% may be met with Enhanced AT PZEVs, Type 0 ZEVs, and NEVs, other than limits described in ~~section~~subdivision C.7.6. The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

(2) *2015 through 2017 Requirements.* On an annual basis, a~~A~~ manufacturer must meet its ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEVs, equal to at least 3% of its annual sales, using either production volume determination method described in ~~section~~subdivision C.2.1(b). No more than 42.8% of the total obligation may be met with credits generated from PZEVs. No more than 57.1% of the total obligation may be met with credits generated from AT PZEVs. No more than 78.5% may be met with ~~Enhanced AT PZEVs~~ credits generated from TZEVs, Type 0 ZEVs, and NEVs, other than limits described in ~~section~~subdivision C.7.6. The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

(3) The following table enumerates a manufacturer's annual percentage obligation for the 2012 though 2017 model years if the manufacturer produces the minimum number of credits required to meet its ZEV obligation and the maximum percentage for the Enhanced AT PZEV, AT PZEV, and PZEV categories.

Years	Total ZEV Percent Requirement	Minimum ZEV floor	~~Enhanced AT PZEVs~~ TZEVs, Type 0s,or NEVs	AT PZEVs	PZEVs
2012 – 2014	12	0..79	2.21	3.0	6.0
2015 – 2017	14	3.0	3.0	2.0	6.0

(4) *Use of Additional Credits for Transportation Systems.* Any additional credits for transportation systems generated from ZEVs in accordance with ~~section~~subdivision C.7.5 may be used to meet up to one tenth of the portion of the ZEV obligation which must be met with ZEVs, specified in ~~section~~subdivision C.2.2(d)(1).

(e) *[Reserved]* ~~*Requirements for Large Volume Manufacturers in Model Year 2018 and Subsequent.* In the 2018 and subsequent model years, a manufacturer must meet a ZEV total percent requirement of 16 percent. The maximum portion of a manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not Enhanced AT PZEVs or AT PZEVs, or credits generated by such vehicles, is limited to 6 percent of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; Enhanced AT PZEVs and AT PZEVs or credits generated by such vehicles may be used either alone or in combination, to meet up to one-half of the manufacturer's remaining ZEV requirement.~~

2.3 Requirements for Intermediate Volume Manufacturers. ~~In~~ For 2009 ~~and~~ through 2017~~subsequent~~ model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles. For 2015 through 2017 model years, the overall credit percentage requirement for an intermediate volume manufacturer will be 12% instead of 14%.

2.4 Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers. A small volume manufacturer or an independent low volume manufacturer is not required to meet the percentage ZEV requirements. However, a small volume manufacturer or an independent low volume manufacturer may earn and market credits for the ZEVs, TZEVs, AT PZEVs, or PZEVs it produces and delivers for sale in California.

2.5 *[Reserved]* ~~Counting ZEVs and PZEVs in Fleet Average NMOG Calculations~~. ~~For purposes of calculating a manufacturer's fleet average NMOG value and NMOG credits under sections 1961(b) and (c), title 13, CCR, a vehicle certified as a ZEV is counted as one ZEV, and a PZEV is counted as one SULEV certified to the 150,000 mile standards, regardless of any ZEV or PZEV multipliers.~~

2.6 *[Reserved]*

2.7 Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.

(a) *Increases in California Production Volume.* In 2009 ~~and subsequent~~ through 2017 model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an independent low volume manufacturer's average California production volume exceeds 10,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume, or independent low volume manufacturer, as applicable, and shall comply with the ZEV requirements for intermediate volume manufacturers, as applicable, beginning with the sixth model year after the last of the three consecutive model years.

If an intermediate volume manufacturer's average California production volume exceeds 60,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years (i.e., total production volume exceeds 180,000 vehicles in a three year period), the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall, beginning with the sixth model year after the last of the three consecutive model years, or in model year 2018 (whichever occurs first), comply with all ZEV requirements for large volume manufacturers

Requirements will begin in the sixth model year, or in model year 2018 (whichever occurs first) when a manufacturer ceases to be an intermediate volume manufacturer in 2003 or subsequent years due to the aggregation requirements in majority ownership situation.

(b) *Decreases in California Production Volume.* If a manufacturer's average California production volume falls below 4,500, 10,000 or 60,000 units of new PCs, LDTs, and MDVs, ~~as applicable,~~ based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume, independent low volume, or intermediate volume manufacturer beginning with the next model year.

(c) *Calculating California Production Volume in Change of Ownership Situations.* Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier model year. The manufacturer's small, independent low, or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2010 calendar year occurs and the manufacturer is producing both 2010 and 2011 model year vehicles results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and B in the 2008-2010 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2010 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and C in the 2008-2010 model years. In either case, the lead time provisions in ~~section~~subdivisions C2.7(a) and (b) will apply.

3. Partial ZEV Allowance Vehicles (PZEVs).

3.1 Introduction. This ~~section~~subdivisions C.3 sets forth the criteria for identifying vehicles delivered for sale in California as PZEVs. A PZEV is a vehicle that cannot be certified as a ZEV but qualifies for a PZEV allowance of at least 0.2.

3.2 Baseline PZEV Allowance. In order for a vehicle to be eligible to receive a PZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements. A qualifying vehicle will receive a baseline PZEV allowance of 0.2.

(a) *SULEV Standards.* For 2009 through 2013 model years, ~~C~~certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in ~~section~~subdivision 1961(a)(1), title 13, CCR. Bi-fuel, fuel-flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV exhaust emission standards when operating on both fuels. For 2014 through 2017 model years, certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1). Bi-fuel, fuel flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV 20 or 30 exhaust emission standards when operating on both fuels;

(b) *Evaporative Emissions.* For 2009 through 2014 model years, ~~C~~certify the vehicle to the evaporative emission standards in ~~section~~subdivision 1976(b)(1)(E), title 13, CCR (zero-fuel evaporative emissions standards). For 2014 through 2017 model years, certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G) or subdivision 1976(b)(1)(E);

(c) *OBD.* Certify that the vehicle will meet the applicable on-board diagnostic requirements in sections 1968.1 or 1968.2, title 13, CCR, as applicable, for 150,000 miles; and

(d) *Extended Warranty.* Extend the performance and defects warranty period set forth in ~~sections~~subdivisions 2037(b)(2) and 2038(b)(2) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

3.3 Zero-Emission VMT PZEV Allowance.

(a) *Calculation of Zero Emission VMT Allowance.* A vehicle that meets the requirements of ~~section~~subdivision C.3.2 and has zero-emission vehicle miles traveled (“VMT”) capability will generate an additional zero emission VMT PZEV allowance, calculated as follows:

Range	*Zero-emission VMT Allowance*
$EAER_u$ < 10 miles	0.0
$EAER_u$ ≥10 ~~miles~~ to 40 miles ~~and~~ ~~R_{cda} = 10 miles to 40 miles~~	$EAER_u$ x (1 – UF_{Rcda})/11.028
~~R_{cda}~~ $EAER_u$ > 40 miles	~~$EAER_{u40}$/ 29.63~~ ($EAER_{u40}$) x [1 – (UF_{40}*R_{cda}/$EAER_u$)]/ 11.028 Where, UF_{40}= utility factor at 40 miles $EAER_{u40}$= 40 miles

A vehicle cannot generate more than 1.39 zero-emission VMT PZEV allowance.

The urban equivalent all-electric range ($EAER_u$) and urban charge ~~depleting~~ depletion ~~actual~~ range actual ~~(urban cycle)~~ (R_{cda}) shall be determined in accordance with section ~~F.12~~G.5.4 and ~~F.5.5~~G.11.9, respectively, of these test procedures. The utility Factor (UF) based on the charge depleting actual range (urban cycle) (R_{cda}) shall be determined according to Section 4.5.2 Equation 6 and the “Fleet UF” Utility Factor Equation Coefficients in Section 4.5.2, Table 3 of SAE J2841 March 2009.

(b) *Alternative Procedures.* As an alternative to determining the zero-emission VMT allowance in accordance with the preceding section C.3.3(a), a manufacturer may submit for Executive Officer approval an alternative procedure for determining the zero-emission VMT potential of the vehicle as a percent of total VMT, along with an engineering evaluation that adequately substantiates the zero-emission VMT determination. For example, an alternative procedure may provide that a vehicle with zero-emissions of one regulated pollutant (e.g., NOx) and not another (e.g., NMOG) will qualify for a zero-emission VMT allowance of 1.5.

~~(c) *[RESERVED].*~~

3.4 PZEV Allowance for Advanced ZEV Componentry. A vehicle that meets the requirements of ~~section~~subdivision C.3.2 may qualify for an advanced componentry PZEV allowance as provided in this section 3.4.

(a) *Use of High Pressure Gaseous Fuel or Hydrogen Storage System.* A vehicle equipped with a high pressure gaseous fuel storage system capable of refueling at 3600 pounds per square inch or more and operating exclusively on this gaseous fuel shall qualify for an advanced componentry PZEV allowance of 0.2. A vehicle capable of operating exclusively on hydrogen stored in a high pressure system capable of refueling at 5000 pounds per square inch or more, stored in nongaseous form, or at cryogenic temperatures, shall instead qualify for an advanced componentry PZEV allowance of 0.3.

(b) *Use of a Qualifying HEV Electric Drive System*

(1) *Classification of HEVs.* HEVs qualifying for additional advanced componentry PZEV allowance or allowances that may be used in the AT PZEV category are classified in one of ~~five~~four types of HEVs based on the criteria in the following table.

Characteristics	~~*Type C*~~	*Type D*	*Type E*	*Type F*	*Type G*
Electric Drive System Peak Power Output	~~≥ 10 kW~~	≥ 10 kW	≥ 50 kW	Zero Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~UDDS ~~drive cycle)~~range	Zero-Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~US06 ~~drive cycle)~~ range
Traction Drive System Voltage	~~< 60 Volts~~	≥ 60 Volts	≥ 60 volts	≥ 60 volts	≥ 60 volts
Traction Drive Boost	~~Yes~~	Yes	Yes	Yes	Yes
Regenerative Braking	~~Yes~~	Yes	Yes	Yes	Yes
Idle Start/Stop	~~Yes~~	Yes	Yes	Yes	Yes

(2) *[Reserved].*

(3) *[Reserved].*

(4) *[Reserved].*~~*Type C HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type C HEV, and that is equipped with an advanced traction energy storage system – such as lithium ion batteries, nickel metal-hydride batteries, ultracapacitors, or other similar systems – with a design lifetime of at least 10 years, qualifies for an additional advanced componentry allowance of 0.2 in the 2009 through 2011 model years, 0.15 in the 2012 through 2014 model years, and 0.1 in the 2015 and subsequent model years.~~

(5) *Type D HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type D HEV qualifies for an additional advanced componentry allowance of 0.4 in the 2009 through 2011 model years, 0.35 in the 2012 through 2014 model years, and 0.25 in the 2015 ~~and subsequent model years~~through 2017 model years.

(6) *Type E HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type E HEV qualifies for an additional advanced componentry allowance of 0.5 in the 2009 through 2011 model years, 0.45 in the 2012 through 2014 model years, and 0.35 in the 2015 ~~and subsequent model years~~through 2017 model years.

(7) *Type F HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type F HEV, including achieving 10 miles or more of all-electric UDDS range, qualifies for an additional advanced componentry allowance of 0.72 in the 2009 through 2011 model years, 0.67 in the 2012 through 2014 model years, and 0.57 in the 2015 ~~and subsequent model years~~through 2017 model years.

(8) *Type G HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type G HEV, including achieving 10 miles or more of all-electric US06 range, qualifies for an additional advanced componentry allowance of 0.95 in the 2009 through 2011 model years, 0.~~8~~9 in the 2012 through 2014 model years, and 0.~~7~~8 in the 2015 ~~and subsequent model years~~through 2017 model years.

(9) *Severability.* In the event that all or part of ~~section~~subdivision C.3.4(b)(1)-(8) is found invalid, the remainder of these standards and test procedures~~, including the remainder of section C.3.4(b)(1)-(8),~~ remains in full force and effect.

3.5 PZEV Allowance for Low Fuel-Cycle Emissions. A vehicle that makes exclusive use of fuel(s) with very low fuel-cycle emissions shall receive a PZEV allowance of 0.3. In order to receive the PZEV low fuel-cycle emissions allowance, a manufacturer must demonstrate to the Executive Officer, using peer-reviewed studies or other relevant information, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions, and the uncertainty in the results must be quantified.

3.6 Calculation of PZEV Allowance.

(a) *Calculation of Combined PZEV Allowance for a Vehicle*. The combined PZEV allowance for a qualifying vehicle in a particular model year is the sum of the PZEV allowances listed in this ~~section~~subdivision C.3.6, multiplied by any PZEV introduction phase-in multiplier listed in ~~section~~subdivision C.3.7, subject to the cap in ~~section~~subdivision C.3.6(b).

(1) *Baseline PZEV Allowance.* The baseline PZEV allowance of 0.2 for vehicles meeting the criteria in ~~section~~subdivision C.3.2;

(2) *Zero Emission VMT PZEV Allowance.* The zero-emission VMT PZEV allowance, if any, determined in accordance with ~~section~~subdivision C.3.3.;

(3) *Advanced ZEV Componentry PZEV Allowance.* The advanced ZEV componentry PZEV allowance, if any, determined in accordance with ~~section~~subdivision C.3.4; and

(4) *Fuel-cycle Emissions PZEV Allowance.* The fuel-cycle emissions PZEV allowance, if any, determined in accordance with ~~section~~subdivision C.3.5.

(b) *Caps on the Value of an AT PZEV Allowance.*

(1) *Cap for 2009 ~~and Subsequent~~through 2017 Model-Year Vehicles.* The maximum value an AT PZEV may earn before phase-in multipliers, including the baseline PZEV allowance, is 3.0.

(2) *[Reserved].*

3.7 PZEV Multipliers

(a) *[Reserved].*

(b) *Introduction Phase-In Multiplier for PZEVs That Earn a Zero Emission VMT Allowance*. Each 2009 through 2011 model year PZEV that earns a zero-emission VMT allowance under section C.3.3 and is sold to a California motorist or is leased for three or more years to a California motorist who is given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term, qualifies for a phase-in multiplier of 1.25. This subdivision C.3.7(b) multiplier will no longer be available after model year 2011.

4. Qualification for ZEV Multipliers and Credits.

4.1 [Reserved].

4.2 [Reserved].

4.3 [Reserved].

4.4 ~~ZEV~~ Credits for 2009 through 2017~~and Subsequent~~ Model Years ZEVs.

(a) *ZEV Tiers for Credit Calculations*. ~~ZEV c~~Credits from a particular ZEV are based on the assignment of a given ZEV into one of the following eight ZEV tiers:

ZEV Tier	*UDDS ZEV Range (miles)*	*Fast Refueling Capability*
NEV	No minimum	N/A
Type 0	< 50	N/A
Type I	≥ 50, <75	N/A
Type I.5	≥ 75, <100	N/A
Type II	≥ 100	N/A
Type III	≥ 100	Must be capable of replacing 95 miles (UDDS ZEV range) in ≤ 10 minutes per section C.4.4(b)
	≥ 200	N/A
Type IV	≥ 200	Must be capable of replacing 190 miles (UDDS ZEV range) in ≤ 15 minutes per section C.4.4(b)
Type V	≥ 300	Must be capable of replacing 285 miles (UDDS ZEV range) in ≤ 15 minutes per section C.4.4(b)

Type I.5x and Type IIx vehicles are defined in subdivision C.4.5(g) and C.9.10.

(b) *Fast Refueling*. The “fast refueling capability” requirement for a 2009 ~~and subsequent~~through 2017 model year Type III, IV, or V ZEV in ~~section~~subdivision C.4.4.(a) will be considered met if the Type III ZEV has the capability to accumulate at least 95 miles of UDDS range in 10 minutes or less and the Type IV or V ZEV has the capability to accumulate at least 190 or 285 miles, respectively, in 15 minutes or less. For ZEVs that utilize more than one ZEV fuel, such as plug-in fuel cell vehicles, the Executive Officer may choose to waive these ~~section~~subdivision C.4.4.(b) fast fueling requirements and base the amount of credit earned on UDDS ZEV range, as specified in ~~section~~subdivision C.4.4.(a).

(c) *ZEV Credits for 2009 ~~and Subsequent~~ through 2017 Model-Year ZEVs.* A 2009 ~~and subsequent~~through 2017 model-year ZEV, other than a NEV or Type 0, earns 1 ZEV credit when it is produced and delivered for sale in California. A 2009 ~~and subsequent~~through 2017 model-year ZEV earns additional credits based on the earliest year in which the ZEV is placed in service (not earlier than the ZEV’s model year). The vehicle must be delivered for sale and placed in service in a Section 177 state or in California in order to earn the total credit amount. The total credit amount will be earned in the state (i.e. California or a Section 177 state) in which the vehicle was delivered for sale. The following table identifies the total credits that a ZEV in each of the eight ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified calendar year or by June 30 after the end of the specified calendar year. A vehicle is not eligible to receive credits if it is placed in service after December 31, five calendar years after the model year. For example, if a vehicle is produced in 2012, but does not get placed until January 1, 2018, the vehicle would no longer be eligible for ZEV credits.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement		
Tier	*Calendar Year in Which ZEV is Placed in Service*	
	2009-201~~7~~1	2012 - 2017~~2018+~~
NEV	0.30	0.30
Type 0	1	1
Type I	2	2
Type I.5	2.5	2.5
Type I.5x	n/a	2.5
Type II	3	3
Type IIx	n/a	3
Type III	4	~~3~~4
Type IV	5	~~3~~5
Type V	7	~~3~~2012-2014: 7 2015-2017: 9

(d) *Multiplier for Certain ZEVs.* 2009 through 2011 model-year ZEVs, excluding NEVs or Type 0 ZEVs, shall qualify for a multiplier of 1.25 if it is either sold to a motorist or is leased for three or more years to a motorist who is given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term. This subdivision C.4.4(d) multiplier will no longer be available after model year 2011.

(e) *Counting Specified ZEVs Placed in a Section 177 State and in California.*

(1) *Provisions for 2009 Model Year.*

(A) Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in a section 177 state, may be counted towards compliance with the California percentage ZEV requirements in ~~section~~subdivision C.2, including the requirements in ~~section~~subdivision C.2.2(b), as if they were delivered for sale and placed in service in California.

(B) Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs that are certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in California may be counted towards compliance with the percentage ZEV requirements of ~~any~~all section 177 state, including requirements based on ~~section~~subdivision C.2.2(B).

(2) *Provisions for 2010 and Subsequent Model Years.* Large volume manufacturers and intermediate volume manufacturers with credits earned from ~~Specified model year~~ ZEVs, including Type I.5xs and Type IIxs, and excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards applicable for the ZEV's model year or approved as part of an advanced technology demonstration program and are placed in service in California or in a section 177 state may be counted towards compliance in California and in all section 177 states, with the percentage ZEV requirements in ~~section~~subdivision C.2, provided that the credits are multiplied by the ratio of a~~n LVM's~~manufacturer's applicable production volume for a model year, as specified in ~~section~~subdivision C.2.1(b) in the state receiving credit to the ~~LVM's~~manufacturer's applicable production volume (hereafter, "proportional value"), as specified in ~~section~~subdivision C.2.1(b) for the same model year in California. Credits generated in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in ~~section~~subdivision C.4.5(d) However, credits generated by 2010 and 2011 model-year vehicles produced, delivered for sale, and placed in service, or as part of an advanced technology demonstration program in California to meet any section 177 state's requirements that implement ~~section~~subdivision C.2.2(b) requirements are exempt from proportional value, with the maximum number of credits allowed to be counted towards compliance in a section 177 state being limited to the number of credits needed to satisfy a manufacturer's section 177 state's requirements to implement ~~section~~subdivision C.2.2(b)(1)(B). The table below specifies the qualifying model years for each ZEV type that may be counted towards compliance in all section 177 states.

Vehicle Type	**Model Years:**
Type I, I.5, or II ZEV	2009 – ~~2014~~2017
Type III, IV, or V ZEV	2009 – 2017
Type I.5x or Type IIx	2012 – 2017

(3) *Optional Section 177 State Compliance Path.* Large volume

manufacturers and intermediate volume manufacturers that choose to elect the optional section 177 state compliance path must notify the Executive Officer and each section 177 state in writing no later than September 1, 2014.

(A) *Additional 2016 and 2017 Model Year ZEV Requirements.* Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path must generate additional 2012 through 2017 model year ZEV credits, including no more than 50% Type 1.5x and Type IIx vehicle credits and excluding all NEV and Type 0 ZEV credits, in each section 177 state equal to the following percentages of their sales volume determined under subdivision C.4.5(e)(3)(A)1.:

Model Years	Additional Section 177 State ZEV Requirements
2016	0.75%
2017	1.50%

Subdivision C.4.5(e)(2) shall not apply to any ZEV credits used to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision C.4.5(e)(3)(A). ZEVs produced to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision C.4.5(e)(3)(A) must be placed in service in the section 177 states no later than June 30, 2018.

1. *Trading and Transferring ZEV Credits within the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified model year ZEV credits used to meet the same model year requirements in subdivision C.4.5(e)(3)(C), within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State X, the manufacturer may transfer 100 (2016 model year) ZEV credits, from State Y, within the West Region pool. Manufacturers may trade or transfer specified model year ZEV credits, used to meet the same model year requirements in subdivision C.4.5(e)(3)(C), within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2016 model year) ZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring ZEV Credits between the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specific model year ZEV credits used to meet the same model year requirements in subdivision C.4.5(e)(3)(C) between the West Region pool and the East Region pool; however, any credits traded or transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2016 model year

shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2016 model year) ZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(B) *Reduced TZEV Percentages.* Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path and that fully comply with the additional 2016 and 2017 model year ZEV requirements in this subdivision C.4.5(e)(3)(A). are allowed to meet TZEV percentages reduced from the allowed TZEV percentages in subdivision C.2.2(d)(2) and (3) in 2015 through 2017 model year in each section 177 state as enumerated below:

Model Year	2015	2016	2017
Existing TZEV Percentage	3.00%	3.00%	3.00%
Section 177 State Adjustment for Optional Compliance Path for TZEVs	75.00%	80.00%	85.00%
New Section 177 State Optional Compliance Path TZEV Percentage	2.25%	2.40%	2.55%

Manufacturers may meet the reduced TZEV percentages above with credits from ZEVs or credits from TZEVs. These reduced TZEV percentages also reduce the total ZEV percent requirement, as illustrated in subdivision C.4.5(e)(3)(C).

1. *Trading and Transferring TZEV Credits within the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified TZEV credits to meet the same model year subdivision C.4.5(e)(3)(C) percentages within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 shortfall of 100 credits in State X, the manufacturer may transfer 100 (2016 model year) TZEV credits from State Y, within the West Region pool. Manufacturers may trade or transfer TZEV credits to meet the same model year subdivision C.4.5(e)(3)(C) within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2016 model year) TZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring TZEV Credit between the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified TZEV credits used to meet the same model year percentages in subdivision C.4.5(e)(3)(C) between the West

Region pool and the East Region pool; however, any credits transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2016 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2016 model year) TZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(C) *Total Requirement Percentages.* Requirements for the minimum ZEV floor, and allowed percentages for AT PZEVs and PZEVs in subdivision C.2 remain in effect for large and intermediate volume manufacturers choosing the optional section 177 state compliance path in each section 177 state. However, the optional section 177 compliance path requires manufacturers to meet additional ZEV requirements and allows manufacturers to meet reduced TZEV percentages as described above in subdivision C.4.5(e)(3)(A) and (B). The table below enumerates the total annual percentage obligation in each section 177 state for the 2015 through 2017 model years if the manufacturer elects the optional section 177 state compliance path and produces the minimum number of credits required to meet its minimum ZEV floor and the maximum percentage allowed to be met with credits from TZEVs, AT PZEVs and PZEVs.

Years	Total ZEV Percent Requirement for Optional Compliance Path	Minimum ZEV Floor for Optional Compliance Path	TZEVs for Optional Compliance Path	AT PZEVs (no change)	PZEVs (no change)
2015	13.25%	3.00%	2.25%	2.00%	6.00%
2016	14.15%	3.75%	2.40%	2.00%	6.00%
2017	15.05%	4.50%	2.55%	2.00%	6.00%

d. ***Reporting Requirements.*** On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path shall submit, in writing, to the Executive Officer and each section 177 state a report, including an itemized list, that demonstrates the manufacturer has met the requirements of this subdivision C.4.5(e)(3)(C) in each section 177 state as well as in the East Region pool and in the West Region pool. The itemized list shall include the following:

i. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the pool, as determined under subdivision C.2.1(b).

ii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale and placement in service for ZEV occurred to meet the manufacturer's additional ZEV obligation under subdivision C.4.5(e)(3)(A)

iii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV occurred and section 177 state where delivery for sale and placement in service of each ZEV occurred to meet manufacturer's requirements under subdivision C.4.5(e)(3)(C)

e. ***Failure to Meet Optional Section 177 State Compliance Path Requirements.*** A manufacturer that elects the optional section 177 state compliance path and does not meet the requirements in subdivision C.4.5(e)(3)(A) by June 30, 2018 in all section 177 states within an applicable pool shall be treated as subject to the total ZEV percentage requirements in section C.2 for the 2015 through 2017 model years in each section 177 state and the pooling provisions in subdivision C.4.5(e)(3)(A) shall not apply. Any transfers of ZEV credits between section 177 states will be null and void, and ZEV credits will return to the section 177 state in which the credits were earned. A manufacturer that elects the optional section 177 state compliance path and does not meet the percentages in subdivision C.4.5(e)(3)(B) in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision C.7.7(a) in all section 177 states within an applicable pool shall be treated as subject to the ZEV percentage requirements in section C.2 for the 2015 through 2017 model years and the pooling provisions in subdivision C.4.5(e)(3)(B) shall not apply. Any transfers of TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

f. The provisions in section C shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision C.4.5(e)(3).

(f) *NEV Test Procedures.* Beginning in 2010 model year, to be eligible for the credit amount in ~~section~~subdivision C.4.4.(c), NEVs must meet the following specifications and requirements in this ~~section~~subdivision C.4.4(f):

(1) *Specifications.* A 2010 through 2017~~and subsequent~~ model-year NEV, earns credit when it meets all the following specifications:

(A) *Acceleration.* The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge.

(B) *Top Speed.* The vehicle has a minimum top speed of 20 mph when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

(C) *Constant Speed Range.* The vehicle has a minimum 25 mile range when operating at constant top speed with a payload of 332 pounds and starting with the battery at 100% state of charge.

(2) *Battery Requirement*. A qualifying NEV must be equipped with sealed, maintenance-free batteries.

(3) *Warranty Requirement*. A 2010 through 2017~~and subsequent~~ model year NEV drive train, including battery packs, must be covered for a period of at least 24 months. ~~At least~~ The first 6 months ~~of the first 12 months~~ of the NEV warranty period must be covered by a full warranty; the ~~remainder of the first 12 months and all of the second 12 months of the~~ remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

(4) Prior to allowance approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

(5) *NEV Charging Requirements.* Model year 2014 through 2017 NEVs must meet charging connection standard portion of the requirements specified in subdivision 1962.3(c)(2).

(g) *Type I.5x and Type IIx Vehicles.* Beginning in 2012 model year, to be eligible for the credit amount in subdivision C.4.4(c), Type I.5x and Type IIx vehicles must meet the following specifications and requirements:

(1) *PZEV Requirements.* Type I.5x and Type IIx vehicles must meet all PZEV requirements, specified in subdivision C.3.2 (a) through (d).

(2) *Type G Requirements.* Type I.5x and Type IIx vehicles must meet the requirements for Type G advanced componentry allowance, specified in subdivision C.3.4(b).

(3) *APU Operation.* The vehicle's UDDS range after the APU first starts and enters "charge sustaining hybrid operation" must be less than or equal to the vehicle's UDDS all-electric test range prior to APU start. The vehicle's APU cannot start under any user-selectable driving mode unless the energy storage system used for traction

power is fully depleted.

(4) *Minimum Zero Emission Range Requirements.*

Vehicle Category	Zero Emission UDDS Range
Type I.5x	≥ 75 miles, < 100 miles
Type IIx	≥ 100 miles

5. [Reserved]

6. *Extended Service Multiplier for 1997-2003 Model-Year ZEVs and PZEVs With ≥ 10 Mile Zero Emission Range.* Except in the case of a NEV, an additional ZEV or PZEV multiplier will be earned by the manufacturer of a 1997 through 2003 model-year ZEV, or PZEV with ≥ 10 mile zero emission range for each full year it is registered for operation on public roads in California beyond its first three years of service, in the 2009 through 2011 calendar years. For additional years of service starting earlier than April 24, 2003, the manufacturer will receive 0.1 times the ZEV credit that would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the fourth year after the vehicle is initially placed in service. For additional years of service starting April 24, 2003 or later, the manufacturer will receive 0.2 times the ZEV credit that would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the fourth year after the vehicle is initially placed in service. The extended service multiplier is reported and earned in the year following each continuous year of service. Additional credit cannot be earned after model year 2011.

7. Generation and Use of ZEV Credits; Calculation of Penalties

7.1 Introduction. A manufacturer that produces and delivers for sale in California ZEVs or PZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in ~~section~~subdivision C.2 shall earn ZEV credits in accordance with this ~~section~~subdivision C.7.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs*. For model years 2009 through 2014, ~~T~~the amount of g/mi ~~ZEV~~ credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of g/mi NMOG, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s, or LDT2s as applicable, for 2009 through 2011 model years , and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements, or, if applicable, requirements specified under subdivision C.4.5(e)(3) for the model year subtracted from the number of ZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(b) *Credits from PZEVs.* For model years 2009 through 2014, ~~T~~the amount of g/mi ~~ZEV~~ credits from PZEVs earned by a manufacturer in a given model year shall be expressed in units of g/mi NMOG, and shall be equal to the total number of PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement for the model year subtracted from the total number of PZEV allowances from PZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s, or LDT2s as applicable, for 2009 through 2011 model years , and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from PZEVs shall be expressed in units of credits, and shall be equal to the number of credits from PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements, or, if applicable, requirements specified under subdivision C.4.5(e)(3), for the model year subtracted from the number of PZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(c) *Separate Credit Accounts.* The number of credits from a manufacturer's [i] ZEVs, [ii] Type I.5x and Type IIx vehicles, [~~ii~~iii] ~~Enhanced AT PZEVs~~TZEVs, [~~iii~~iv] AT PZEVs, [~~i~~v] all other PZEVs, and [vi] NEVs shall each be maintained separately.

(d) *Rounding Credits.* For model year 2012 through 2014, ZEV credits and debits shall be rounded to the nearest 1/1000th only on the final credit and debit totals using the conventional rounding method. For model year 2015 through 2017, ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

(e) *Converting g/mi NMOG ZEV Credit to ZEV Credits.* After model year 2014 compliance, all manufacturer ZEV, Type I.5x and Type IIx, TZEV, AT PZEV, PZEV, and NEV accounts will be converted from g/mi NMOG to credits. Each g/mi NMOG account balance will be divided by 0.035. Starting in model year 2015, credits will no longer be expressed in terms of g/mi credits, but only as credits.

(f) *Converting PZEV and AT PZEV Credits after Model Year 2017.* After model year 2017 compliance, a manufacturer's PZEV and AT PZEV credit accounts will be converted to be used for compliance with requirements specified in subdivision C.2. For LVMs, PZEV accounts will be discounted 93.25%, and AT PZEV accounts will be discounted 75%. For IVMs, PZEV accounts and AT PZEV accounts will be discounted 75%. This will be a one time calculation after model year 2017 compliance is complete.

7.3 ZEV Credits for MDVs and LDTs Other Than LDT1s. ZEVs and PZEVs classified as MDVs or as LDTs other than LDT1s may be counted toward the ZEV requirement for PCs, LDT1s and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this ~~section~~subdivision C.4 if the manufacturer so designates.

7.4 ZEV Credits for Advanced Technology Demonstration Programs.

(a) *TZEVs.* ~~In model years~~ For 2009 through 2014 model years, ~~ZEVs and Enhanced AT PZEVs, excluding NEVs,~~ TZEVs placed in a California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if it is not "delivered for sale" or registered with the California Department of Motor Vehicles (DMV). To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for 50 percent or more of the first two years of placement the vehicle will be operated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model-year designation for a demonstration vehicle shall be consistent with the model-year designation for conventional vehicles placed in the same timeframe. Manufacturers may earn credit for as many as 25-vehicles per model, per ZEV state, per year under this section C.7.4. A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

(b) *ZEVs.* In model years 2009 through 2017, ZEVs, including Type I.5x and IIx vehicles, excluding NEVs and Type 0 ZEVs, placed in a California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if it is not "delivered for sale" or registered with the California DMV. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for 50 percent or more of the first two years of placement the vehicle will be operated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model year designation for a demonstration vehicle shall be consistent with the model year designation for conventional vehicles placed in the same timeframe. Manufacturers may earn credit for as many as 25 vehicles per model, per ZEV state, per year under this subdivision C.7.4. A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

7.5 ZEV Credits for Transportation Systems.

(a) *General.* In model years 2009 through 2011, a ZEV placed, for two or more years, as part of a transportation system may earn additional ZEV credits, which may be used in the same manner as other credits earned by vehicles of that category, except as provided in subdivision C.7.5(c) below. In model years 2012~~09~~ ~~and subsequent~~ through 2017, a ZEV, Type I.5x and Type IIx vehicles, or TZEV placed, for two or more years, as part of a transportation system may earn additional ZEV credits, which may be used in the same manner as other credits earned by vehicles of that category, except as provided in subdivision C.4.5(e)(2) and as provided in ~~section~~subdivision C.7.5(c) below. In model years 2009 through 2011, an ~~Enhanced AT PZEV,~~ AT PZEV or PZEV placed as part of a transportation system may earn additional ZEV credits, which may be used in the same manner as other credits earned by vehicles of that category, except as provided in ~~section~~subdivision C.7.5(c) below. A NEV is not eligible to earn credit for transportation systems. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicle will be used as a part of a project that uses an innovative transportation system as described in ~~section~~subdivision C.7.5(b) below.

(b) *Credits Earned.* In order to earn additional credit under this section C.7.5, a project must at a minimum demonstrate [i] shared use of ZEVs Type I.5x and Type IIx vehicles, ~~Enhanced AT PZEVs~~TZEV, AT PZEVs or PZEVs, and [ii] the application of "intelligent" new technologies such as reservation management, card systems, depot management, location management, charge billing and real-time wireless information systems. If, in addition to factors [i] and [ii] above, a project also features linkage to transit, the project may receive further additional credit. For ZEVs only, not including NEVs, a project that features linkage to transit, such as dedicated parking and charging facilities at transit stations, but does not demonstrate shared use or the application of intelligent new technologies, may also receive additional credit for linkage to transit. The maximum credit awarded per vehicle shall be determined by the Executive Officer, based upon an application submitted by the manufacturer and, if appropriate, the project manager. The maximum credit awarded shall not exceed the following:

Type of Vehicle	*Model Year*	*Shared Use, Intelligence*	*Linkage to Transit*
PZEV	through 2011	2	1
AT PZEV	through 2011	4	2
Enhanced AT PZEV	2009 through 2011	4	2
ZEV	2009 through 2011	6	3
~~Enhanced AT PZEV~~ TZEV	2012 ~~and subsequent~~through 2017	~~1~~0.5	~~1~~0.5
ZEV and Type I.5x and Type IIx vehicles	2012 ~~and subsequent~~through 2017	~~2~~0.75	~~1~~0.75

(c) *Cap on Use of Credits.*

(1) *ZEVs.* Credits earned or allocated by ZEVs ZEVs or Type I.5x and Type IIx vehicles pursuant to this ~~section~~subdivision C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in ~~section~~subdivision C.2.2(d)(3).

(2) *~~Enhanced AT PZEVs~~TZEVs*. Credits earned or allocated by ~~Enhanced AT PZEVs~~TZEVs pursuant to this ~~section~~subdivision C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year, or, if applicable, requirements specified under subdivision 4.5(e)(3), but may only be used in the same manner as other credits earned by vehicles of that category.

(3) *AT PZEVs.* Credits earned or allocated by AT PZEVs pursuant to this ~~section~~subdivision C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-twentieth of a manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(4) *PZEVs.* Credits earned or allocated by PZEVs pursuant to this ~~section~~subdivision C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-fiftieth of the manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(d) *Allocation of Transportation System Credits.* Credits shall be assigned by the Executive Officer to the project manager or, in the absence of a separate project manager, to the vehicle manufacturers upon demonstration that a vehicle has been placed in a project for the time specified in subdivision C.7.5(a). Credits shall be allocated to vehicle manufacturers by the Executive Officer in accordance with a recommendation submitted in writing by the project manager and signed by all manufacturers participating in the project, and need not be allocated in direct proportion to the number of vehicles placed. Credits will no longer be allocated for vehicles placed in transportation systems after 2017 model year.

7.6 Use of ZEV Credits. For model years 2009 through 2014, ~~A~~a manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits, consistent with ~~section~~subdivision C.2. For model years 2015 through 2017, a manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision C.2. Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category. For example, credits produced from ~~Enhanced AT PZEVs~~TZEVs may be used to comply with AT PZEV requirements, but not with the portion that must be satisfied by ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(a) *NEVs.* Credits earned from NEVs offered for sale or placed in service in model years 2001 through 2005 cannot be used to satisfy more than the percentage limits described in the following table:

Model Years	ZEV Obligation that:	Percent limit for NEVs allowed to meet each Obligation[1]:
2009 – 2011	Must be met with ZEVs	50%
2009	May be met with AT PZEVs but not PZEVs	75%
2010 – 2011		50%
2009 – 2011	May be met with PZEVs	No Limit
2012 – ~~2014~~2017	Must be met with ZEVs	0%
	May be met with ~~Enhanced AT PZEVs~~TZEVs and AT PZEVs	50%
	May be met with PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 4.5(e)(3).

Additionally, credits earned from NEVs ~~offered for sale or~~ placed in service in model years 2006 through 2017 ~~or later~~ can be used to meet the percentage limits described in the following table:

Model Years	ZEV Obligation that:	Percent Limit for NEVs allowed to meet each Obligation[1]:
2009 - 2011	May be met through compliance with Primary Requirements	No Limit
	May be met through compliance with Alternative Requirements, and must be met with ZEVs	0%
	May be met through compliance Alternative Requirements, and may be met with AT PZEVs or PZEVs	No Limit
2012 – ~~2014~~2017	Must be met with ZEVs	0%
	May be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 4.5(e)(3).

This limitation applies to credits earned by the same manufacturer or earned by another manufacturer and acquired.

(b) *Carry forward provisions for Large Volume Manufacturers for 2009-2011 Model Years.* ~~ZEV c~~Credits from ZEVs, excluding credits generated from NEVs generated from excess production in ~~model years~~ 2009 through 2011 model years~~and subsequent~~, including those acquired from another party, may be carried forward and applied to the ZEV minimum floor requirement specified in ~~section~~subdivisions C.2.2(b)(1)(B) and (d) for two subsequent model years. Beginning with the third subsequent model year, those earned ZEV credits may no longer be used to satisfy the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs, but may be used to satisfy the manufacturer's percentage ZEV obligation that may be satisfied by credits from ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, after which time that credit could only be used as ~~Enhanced AT PZEVs~~TZEVs, AT PZEV, or PZEV credits.

(c) *Carry forward provisions for manufacturers other than Large Volume Manufacturers for 2009-2011 Model Years.* ~~ZEV c~~Credits generated from ZEVs, excluding credits generated from NEVs, from 2009 through 2011~~and subsequent~~ model year production by manufacturers that are not large volume manufacturers may be carried forward by the manufacturer producing the ~~ZEV~~ credit until the manufacturer becomes subject to the large volume manufacturer requirements, after the transition period permitted in ~~section~~subdivision C.2.7(a). When subject to the large volume manufacturer requirements, a manufacturer must comply with the provisions of ~~section~~subdivision C.7.6(b).

~~ZEV c~~Credits traded by a manufacturer other than a large volume manufacturer to any other manufacturer, including a large volume manufacturer, are subject to ~~section~~subdivision C.7.6(b), beginning in the model year in which they were produced (e.g., a 2009 model year ZEV credit traded in calendar year 2010 can only be applied towards the portion of the manufacturer's requirement that must be met with ZEVs through model year 2011; beginning in model year 2012, the credit can only be applied to the portion of the manufacturer's requirement that may be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs).

(d) *Type I.5x and Type IIx vehicles.* Credits earned from Type I.5x and Type IIx vehicles offered for sale or placed in service may meet up to 50% of the portion of a manufacturer's requirement that must be met with credits from ZEVs.

7.7 Requirement to Make Up a ZEV Deficit.

(a) *General*. A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the third model year by submitting to the Executive Officer a commensurate amount of g/mi ~~ZEV~~ credits generated by ZEVs, for model year 2009 through 2014, and the commensurate amount of credits generated by ZEVs for model year 2015 through 2017. The amount of ~~g/mi ZEV~~ credits required to be submitted shall be calculated by [i] adding the number of credits from ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a large volume manufacturer, not to exceed that permitted under ~~section~~subdivision C.2.1), [ii] subtracting that total from the number of ZEVs credits required to be produced and delivered for sale in California by the manufacturer for the model year, and, for model year 2009 through 2014 compliance, [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred. Credits earned by delivery for sale of Type I.5x and Type IIx vehicles, TZEV, NEV, AT PZEV, and PZEV are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

7.8 ***Penalty for Failure to Meet ZEV Requirements.*** Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs and submit an appropriate amount of g/mi ~~ZEV~~ credits, for model years 2009 through 2014, and credits for model years 2015 through 2017, and does not make up ZEV deficits within the specified time allowed by ~~section~~subdivision C.7.7(a) shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time allowed by ~~section~~subdivision

C.7.7(a). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the to the nearest 1/1000th for model years 2009 through 2014 and rounded to the nearest 1/100th for model years 2015 through 2017, calculated according to the following equation, provided that the percentage of a ~~large volume~~ manufacturer's ZEV requirement for a given model year that may be satisfied with PZEV allowance vehicles or credits from such vehicles may not exceed the percentages permitted under ~~section~~subdivision C.2.1(a):

For 2009 through 2014 model years:

(No. of ~~ZEVs~~ credits required to be ~~produced and delivered for sale in California~~ generated for the model year) – (~~No. of ZEVs produced and delivered for sale in California for the model year) – (No. of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California for the model year) - [(~~Amount of ~~ZEV~~ credits submitted for compliance for the model year) / (the fleet average requirement for PCs and LDT1s for the model year)~~]~~

For 2015 through 2017 model years:

(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

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

9. Public Disclosure. Records in the Board's possession for the vehicles subject to the requirements of section C shall be subject to disclosure as public records as follows:

(a) Each manufacturer's annual production data and the corresponding credits per vehicle earned for ZEVs (including ZEV type), ~~Enhanced AT PZEVs~~ TZEVs, AT PZEVs, and PZEVs for the 2009 through 2017~~and subsequent~~ model years; and

(b) Each manufacturer's annual credit balances for 2010 through 2017 ~~and subsequent~~ years for:

(1) Each type of vehicle: ZEVs (minus NEVs), Type I.5x, and Type IIx vehicles, NEVs, ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, and PZEVs; and

(2) Advanced technology demonstration programs; and

(3) Transportation systems; and

(4) Credits earned under section C.4.4(c), including credits acquired from, or transferred to another party.

D. Certification Requirements.

1. Durability and Emission Testing Requirements. All ZEVs, excluding Type I.5x and Type IIx vehicles, are exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

2. Information Requirements: Application for Certification. Except as noted below, the Part I (40 CFR §86.1843-01(c)) certification application shall include the following:

2.1 Identification and description of the vehicle(s) covered by the application.

2.2 Identification of the vehicle weight category to which the vehicle is certifying: PC, LDT 0-3750 lbs. LVW, LDT 3751-5750 lbs. LVW, LDT 3751 lbs. LVW - 8500 lbs. GVW, or MDV (state test weight range), and the curb weight and gross vehicle weight rating of the vehicle.

2.3 Identification and description of the propulsion system for the vehicle.

2.4 Identification and description of the climate control system used on the vehicle.

2.5 Projected number of vehicles produced and delivered for sale in California, and projected California sales.

2.6 Identification of the energy usage in kilowatt-hours per mile from:

(a) the battery output (DC energy) (to be submitted with the Part II certification application (40 CFR §86.1843-01(d));

(b) the point when electricity is introduced from the electrical outlet (AC energy); and

(c) the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test set forth in section ~~E~~F, below. For off-vehicle charge capable hybrid electric vehicles certifying to section ~~F~~G, the manufacturer shall provide the energy usage in kilowatt hours per mile from the Urban Equivalent All-Electric Range and the Highway Equivalent All-Electric Range.

2.7 For those vehicles that use fuel-fired heaters, the manufacturer shall provide:

(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.

2.8 All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel.

2.9 Method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

2.10 Battery specific energy data and calculations as specified in section ~~E~~F.4 of these procedures including the weight of the battery system and the three hour discharge rate (C/3) energy capacity.

2.11 Vehicle and battery break-in period, and the method used to determine them, as specified in sections ~~E~~F.2 and ~~F~~G.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in section 1965, title 13, CCR and the “California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles” (incorporated by reference therein).

2.13 For a ZEV, extended range HEV or PZEV that qualifies to receive one or more multipliers under sections C.3 - C.7, the manufacturer shall provide all information relevant to the vehicle’s qualification for, and the estimated value of, the multiplier(s). The Executive Officer may request additional information needed to appropriately characterize the vehicle. Based on the submitted information and other relevant data, the Executive Officer shall assign to the vehicle the highest multiplier(s) for which the manufacturer has demonstrated the vehicle qualifies at that time.

2.14 When a manufacturer plans to require any scheduled maintenance for a PZEV before 150,000 miles, the manufacturer must submit information demonstrating the need for each scheduled maintenance item before 150,000 miles, including actual in-use data, engineering evaluation of the durability of the part, or other relevant information. The manufacturer may require such maintenance for a PZEV only upon the Executive Officer’s determination, prior to certification, the manufacturer has demonstrated the need for the scheduled maintenance; this determination may not unreasonably be denied.

2.15 For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the Urban Charge Depleting Cycle Range, the Urban Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Urban

Range, the Highway Charge Depleting Cycle Range, the Highway Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Highway Range, the Urban Equivalent All-Electric Range, the Highway Equivalent All-Electric Range, the Urban Electric Range Fraction, and the Highway Electric Range Fraction.

3. ZEV Reporting Requirements. In order to verify the status of each manufacturer's compliance with the ZEV requirements for a given calendar year, each manufacturer shall submit a report to the Executive Officer at least annually, by May 1 of the calendar year following the close of the model year, that identifies the necessary delivery and placement data of all vehicles generating ZEV credits or allowances, and all transfers and acquisitions of ZEV credits. The manufacturer may update the report by September 1 to cover activities occurring between April 1 and June 30. <u>If a manufacturer updates their annual California production numbers in their ZEV report, the annual NMOG production must also be updated.</u>

E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

The acceleration and constant speed range for a NEV shall be determined as specified in "Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure," ETA-NTP002 Revision 3, February 1, 2008, and "Electric Vehicle Constant Speed Range Tests," ETA-NTP004 Revision 3, February 1, 2008.

~~E~~F. Test Procedures for 2012 through 2017~~and Subsequent~~ Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2012 through 2017~~and Subsequent~~ Model Hybrid-Electric Vehicles, Except Off-Vehicle Charge Capable Hybrid Electric Vehicles.

The "as adopted or amended dates" of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." Unless otherwise noted, these requirements shall apply to all ZEVs (including fuel cell vehicles and hybrid fuel cell vehicles) and all HEVs, except off-vehicle charge capable HEVs. A manufacturer may elect to certify a 2009, 2010, or 2011 model-year zero-emission vehicle or hybrid electric vehicle, except an off-vehicle charge capable hybrid electric vehicle, using this section ~~E~~F.

1. Electric Dynamometer. All ZEVs and HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

2. 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 section D.2.11 above.

3. All-Electric Range Test for Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles). All 2012 and subsequent ZEVs shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of the ZEV.

3.1 **Determination of Urban All-Electric Range for Zero-Emission Vehicles.**

3.1.1 **Determination of Urban All-Electric Range for Battery Electric Vehicles.**

(a) **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I [July 13, 2005], which is incorporated herein by reference. A 10-minute soak shall follow each UDDS.

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the UDDS, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR §86.115-00(b)(1) and (2) [October 22, 1996]. The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the UDDS or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first.

3.1.2 **Determination of Urban All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The urban all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the urban all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F~~E~~.3.1.1 above.

3.2 **Determination of Highway All-Electric Range for Zero-Emission Vehicles and Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

3.2.1 **Determination of Highway All-Electric Range for Battery Electric Vehicles.**

(a) **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be either placed or pushed onto a dynamometer and operated through Continuous Highway Test Schedules of the Highway Fuel Economy Driving Schedule (HFEDS).

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the HFEDS, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR §86.115-00(b)(1) and (2) [October 22, 1996]. The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the HFEDS or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first.

(e) NEVs are exempt from the all-electric range highway test.

3.2.2 **Determination of Highway All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the highway all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section ~~E~~F.3.2.1 above.

3.3 **Recording requirements.**

For all battery electric vehicles and hybrid electric vehicles, except off-vehicle charge capable hybrid electric vehicles: Once the vehicle is no longer able to maintain the speed and time requirements specified in ~~E~~F.3.1 or ~~E~~F.3.2 above, the vehicle shall be brought to an immediate stop and the following data shall be recorded:

(a) mileage accumulated during the All-Electric Range Test;
(b) Net DC energy from the battery that was expended during the All-Electric Range Test (may be reported as the total DC battery energy output and the total DC battery energy input during the All-Electric Range Test);
(c) AC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the electric outlet to the battery charger;
(d) DC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the battery charger to the battery; and
(e) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.4 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in ~~E~~F.3.1 or ~~E~~F.3.2 shall not be exceeded due to the operation of the regenerative braking system.

3.5 **Measurement Accuracy**. For battery electric vehicles, the overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.6 **Watt Hour Calculation for Battery Electric Vehicles.**

DC energy (watt-hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.7 **Charger Requirements for Battery Electric Vehicles.**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. Determination of Battery Specific Energy for ZEVs.

Determine the specific energy of batteries used to power a ZEV in accordance with the U.S. Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in the Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

5. Determination of the Emissions of the Fuel-fired Heater for Vehicles Other Than ZEVs.

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile to obtain a grams per mile value.

6. Urban Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

6.1 Vehicle Preconditioning.

To be conducted pursuant to the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” with the following supplemental requirements:

6.1.1 For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

6.1.2 For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the UDDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the UDDS, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in urban driving conditions.

6.1.3 After setting battery state-of-charge, 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.1.4. of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

6.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours. After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

6.1.5 Within five minutes of completing preconditioning drive, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-sustaining over the UDDS, then set battery state-of-charge to a level such that the SOC criterion in section ~~F~~G.10 would be satisfied for the dynamometer procedure (section ~~E~~F.6.2 of these procedures). If off-vehicle charging is required to increase battery state-of-charge for proper setting, off-vehicle charging shall occur during the second soak period of 12 to 36 hours.

(ii) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-depleting over the UDDS, then no battery state-of-charge adjustment is permissible.

(iii) If the hybrid electric vehicle does allow manual activation of the auxiliary power unit, then set battery state-of-charge to manufacturer recommended level for activating the auxiliary power unit when the hybrid electric vehicle is operating in urban driving conditions.

6.2 Urban Dynamometer Procedure for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.2.1 Amend subparagraph (a).

Overview. The dynamometer run shall consist of two tests, a “cold” start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” and a “hot” start test following the “cold” start test by 10 minutes. Vehicle startup (with all accessories turned off), operation over the UDDS and vehicle shutdown make a complete cold start test. Vehicle startup and operation over the UDDS and vehicle shutdown make a complete hot start test.

For all UDDS tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6

(§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. Four particulate samples are collected on filters for weighing; the first sample plus backup is collected during the cold start test (including shutdown); the second sample plus backup is collected during the hot start test (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles that are not "off-vehicle charge capable," and are equipped with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with alcohol-fueled auxiliary power units, alcohol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

6.2.2 Subparagraphs (b) through (c). [No change.]

6.2.3 Subparagraph (d). [No change.]

6.2.4 Subparagraphs (e) through (g). [No change.]

6.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the cold start test and hot start test. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

6.2.6 Subparagraph (i). [No change.]

6.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

6.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of two tests, a "cold" start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" and a "hot" start test following the cold start test by 10 minutes. The complete dynamometer test consists of a cold start drive of 7.5 miles (12.1 km) and a hot start drive of 7.5 miles (12.1 km). The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The vehicle is allowed to stand on the dynamometer during the 10 minute time period between each test.

6.3.2 Amend subparagraph (b) as follows.

6.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample (turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, start particulate sample pump No. 1, and record both gas meter or flow measurement instrument readings, if applicable), and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

6.3.2.2 Delete subparagraph (b)(13).

6.3.2.3 Amend subparagraph (b)(14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 1 and if applicable, turn off the hydrocarbon integrator No. 1, mark the hydrocarbon recorder chart, turn off the No. 1 particulate sample pump and close the valves isolating particulate filter No. 1, and position the sample selector valves to the "standby" position. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain alcohol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the alcohol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4□C to 10□C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start test. The step in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

6.3.2.6 Delete subparagraph (b)(19).

6.3.2.7 Delete subparagraph (b)(20).

6.3.2.8 Amend subparagraph (b)(21): As soon as possible, and in no case longer than one hour after the end of the hot start phase of the test, transfer the four particulate filters to the weighing chamber for post-test conditioning, if applicable. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the UDDS, a valid test shall satisfy the SOC criterion in section ~~F~~G.10.

6.3.2.9 Amend subparagraph (b)(24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

6.4 Calculations - Exhaust Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

(1) 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.

(2) Y_c = Mass emissions as calculated from the cold start test, in grams per test.

(3) Y_h = Mass emissions as calculated from the hot start test, in grams per test.

(4) D_c = The measured driving distance from the cold start test, in miles.

(5) D_h = The measured driving distance from the hot start test, in miles.

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

6.5 Calculations - Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.5.1 Amend subparagraph (a): The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:

(1) M_{pc} = Mass of particulate determined from the cold start test, in grams per vehicle mile. (See §86.110-94 for determination.)

(2) M_{ph} = Mass of particulate determined from the hot start test, in grams per vehicle mile. (See §86.110-94 for determination.)

(3) D_c = The measured driving distance from the cold start test, in miles.

(4) D_h = The measured driving distance from the hot start test, in miles.

6.5.2 Subparagraph (b). [No change.]

7. Highway Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions.

7.1 Subparagraph (a). [not applicable - delete]

7.2 Amend subparagraph (b) as follows:

7.2.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO, CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

7.2.2 Amend subparagraph (b)(7)(i): The dynamometer procedure shall consist of two cycles of the Highway Fuel Economy Driving Schedule (§600.109(b)) separated by 15 seconds of idle. The first cycle of the Highway Fuel Economy Driving Schedule is driven to precondition the test vehicle and the second is driven for the fuel economy measurement.

7.2.3 Amend subparagraph (b)(7)(iii): Only one exhaust sample and one background sample shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

7.2.4 Add subparagraph(b)(7)(v): For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the HFEDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the HFEDs, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions.

7.2.5 Amend subparagraph (b)(9)(v): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

7.2.6 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed at the end of the HFEDS preconditioning cycle, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. Reset and enable the roll revolution counter. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.2.7 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). A total of three highway emission tests shall be allowed to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the emission test is completed.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the emission test is completed.

7.2.8 Delete subparagraph (b)(10).

7.3 Delete subparagraphs (c) through (e).

8. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.1.1 Subparagraphs (a) through (m). [No change.]

8.1.2 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning.

8.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at according to the following conditions:

If the hybrid electric vehicle is charge-sustaining over the US06, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

If the hybrid electric vehicle is charge-depleting over the US06, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

8.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

8.1.2.2 Subparagraph (2). [No change.]

8.1.3 Subparagraph (o). [No change.]

8.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions.

8.2.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.9.

8.2.2 Amend subparagraph (b) as follows.

8.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.2.3 Subparagraph (c). [No change.]

8.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

8.2.5 Subparagraph (e). [No change.]

8.2.6 Amend subparagraph (f) as follows.

8.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the US06 preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the US06, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

8.2.6.2 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the US06, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i) without the preconditioning cycle. A total of three US06 emission tests shall be allowed to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

8.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.3.1 Subparagraphs (a) through (n). [No change.]

8.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

8.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

If the hybrid electric vehicle is charge-sustaining over the SC03, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

If the hybrid electric vehicle is charge-depleting over the SC03, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

8.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

8.3.2.2 Subparagraphs (2) through (3). [No change.]

8.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions.

8.4.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulate testing in an environmental test cell (see §86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95^{o}F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.-9.

8.4.2 Amend subparagraph (b) as follows.

8.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c) as follows.

8.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.4 Amend subparagraph (d) as follows.

8.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then turn off the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the SC03, turn off the vehicle two seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

8.4.5 Subparagraph (e). [No change.]

9. State-of-Charge Net Change Tolerances for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Capable Hybrid Electric Vehicles.

9.1 For hybrid electric vehicles that use a battery as an energy storage device, the following state-of-charge net 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 Air Resources Board.

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

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

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

Where:

$(V_{final})_{max}$	=	The stored capacitor voltage allowed at the end of the test
$(V_{final})_{min}$	=	The stored capacitor voltage allowed at the end of the test

$V^2_{initial}$ = 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

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

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

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

Where:
$(rpm_{final})_{max}$ = The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})_{min}$ = The minimum flywheel rotational speed allowed at the end of the test
$rpm^2_{initial}$ = 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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

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

~~F~~G. Test Procedures for 2012 through 2017 ~~and Subsequent~~ Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

The "as adopted or amended dates" of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," unless otherwise noted. A manufacturer may elect to certify a 2009, 2010, or 2011 model-year off-vehicle charge capable hybrid electric vehicle using this section ~~F~~G.

1. Electric Dynamometer.

All off-vehicle charge capable HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

2. 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 section D.2.11 above.

3. General Testing Requirements.

3.1 Recording requirements.

For off-vehicle charge capable hybrid electric vehicles: The following data shall be recorded for all tests and for each individual test cycle therein, except for the 20°F and 50°F tests, conducted in accordance with section ~~F~~G.8:

(a) mileage accumulated during the All-Electric Range portion of the test, where applicable;

(b) Net DC energy from the battery that was expended during the test (may be reported as the total DC battery energy output and the total DC battery energy input);

(c) AC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the electric outlet to the battery charger;

(d) DC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the battery charger to the battery;

(e) Net DC amp-hrs from the battery that was expended during the test (may be reported as the total DC amp-hrs output and the total DC amp-hrs input); and

(f) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

3.2 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in this section ~~F~~G shall not be exceeded due to the operation of the regenerative braking system.

3.3 **Measurement Accuracy**. The overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.4 **Watt Hour Calculation.**

DC energy (watt hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\,dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\,dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.5 **Charger Requirements**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. Determination of the Emissions of the Fuel-fired Heater.

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile to obtain a grams per mile value.

5. Urban Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

The criteria certification emissions for the Urban test shall be the worst case emissions of NMOG, CO, NOx, and PM from either the charge depleting or charge sustaining tests. The sum of NMOG + NOx emissions shall constitute the worst case for the urban charge sustaining or charge depleting modes of operation.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

5.1 Vehicle Preconditioning.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" with the following supplemental requirements:

5.1.1 For vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

5.1.2 For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

5.1.3 After setting battery state-of-charge, the vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4 of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours.

5.1.5 After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned.

5.1.6 If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

5.1.7 For the charge depleting range test and the charge sustaining emission test, the preconditioning cycle shall be the UDDS. The vehicle must be in charge sustaining operation during the preconditioning drive. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section

~~F~~<u>G</u>.10 from the start to the end of the two consecutive UDDSs. As an option, charge sustaining operation can be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. The vehicle must meet the SOC criterion in section ~~F~~<u>G</u>.10 from the start to the end of a single UDDS. Alternative procedures may be used to determine charge sustain operation for the precondition drive if the alternate procedure demonstrates charge sustaining operation based on section ~~F~~<u>G</u>.10 and is approved in advance by the Executive Officer of the Air Resources Board.

5.1.8 A fuel drain and fill shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.1.9 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 2001 and Subsequent Model Motor Vehicles."

5.1.10 For the urban charge depleting range test, the highway charge depleting range test, and the cold start US06 range test, charge the vehicle to full state-of-charge as specified by the vehicle manufacturer. The vehicle must be turned off during charging and charge time shall not exceed soak time.

5.2 Urban Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.2.1 Amend subparagraph (a).

Overview. The charge depleting range test dynamometer run shall consist of a series of charge depleting UDDSs, each followed by a 10 minute key-off hot soak period until charge sustaining operation is achieved for two consecutive UDDSs. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~<u>G</u>.10 from the start of the first UDDS until the end of the second UDDS. As an option, charge sustaining operation may be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. To determine charge sustaining operation, in this case, the vehicle shall meet SOC criterion in section ~~F~~<u>G</u>.10 from the start to the end of a single UDDS. Emissions are measured for all UDDSs when the auxiliary power unit is operating.

The vehicle shall be turned off and stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. At the end of this cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

The charge sustaining emission test dynamometer run shall consist of two consecutive UDDSs with a 10 minute key-off hot soak in between. Vehicle emissions shall be measured over two UDDSs during charge sustaining operation, and the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS.

Vehicle charging shall be initiated within three hours after either the charge depleting range test or the charge sustaining emission test pursuant to section ~~F~~G.5.4.2 or ~~F~~G.5.4.3, as applicable. During charging, all requirements in section ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

For all exhaust emission tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. For UDDSs, particulate samples are collected on filters for weighing during each UDDS. Each sample plus backup is collected during each UDDS (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each UDDS. For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For vehicles with alcohol-fueled auxiliary power units, alcohol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

5.2.2 Subparagraphs (b) through (c). [No change.]

5.2.3 Subparagraph (d). [No change.]

5.2.4 Subparagraphs (e) through (g). [No change.]

5.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for all charge depleting and exhaust emission tests. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

5.2.6 Subparagraph (i). [No change.]

5.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

5.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of a series of UDDSs, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles." The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The vehicle is allowed to stand on the dynamometer during the 10 minute time period between each UDDS.

5.3.2 Amend subparagraph (b) as follows.

5.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample, and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

5.3.2.2 Delete subparagraph (b)(13).

5.3.2.3 Subparagraph (b)(14). [No change.]

5.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off the gas flow measuring device and particulate sample pump. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the UDDS. Obtain alcohol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the alcohol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4°C to 10°C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

5.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start UDDS. The steps in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start UDDS.

5.3.2.6 Delete subparagraph (b)(19).

5.3.2.7 Delete subparagraph (b)(20).

5.3.2.8 Amend subparagraph (b)(21): As soon as possible, transfer the particulate filters to the weighing chamber for post-test conditioning, if applicable. For vehicles undergoing a cold start charge sustaining test, a valid test shall satisfy the SOC criterion in section ~~F~~G.10.

5.3.2.9 Amend subparagraph (b)(24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.4 Determination of Urban All-Electric Range and Urban Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

5.4.1 The **Urban All-Electric Range** shall be shall be defined as the distance that the vehicle is driven from the start of Urban Charge Depleting Range Test until the internal combustion engine first starts.

5.4.2 **Urban Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned according to ~~F~~G.5.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.

The Alternative Continuous Urban Test Schedule may be substituted for the Continuous Urban Test Schedule if the test facility is unable to perform the Continuous Urban Test Schedule. Refer to sections ~~F~~G.5.5, ~~F~~G.5.6, and ~~F~~G.11, for calculations of urban exhaust emissions, urban particulate emissions, and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after either the charge depleting range test or the charge sustaining emission test, and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

5.4.3 **Urban Charge Sustaining Emission Test.** The Urban Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

(i) **Vehicle preconditioning.** If the Urban Charge Sustaining Emission Test is performed within 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9. If the Urban Charge Sustaining Emission Test is performed more than 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1, except for vehicle charging. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and two UDDSs shall be performed during charge sustaining operation, each separated by a 10 minute key-off hot soak period. The vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS. If the SOC criterion is not satisfied, the test shall be stopped, the vehicle cold soak shall be conducted again, and the dynamometer test run shall be conducted again.

(iii) **Vehicle charging after testing.** If the vehicle was not charged after the Urban Charge Depleting Range Test, then vehicle charging shall begin within three hours after the Urban Charge Sustaining Emission Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all requirements in ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

5.5 Calculations - Urban Exhaust Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

5.5.1 Amend subparagraph (a):

Gaseous Emissions – Urban Charge Depleting Range Test.

For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43*\left(\frac{Y_c}{D_c}\right) + 0.57*\left(\frac{\Sigma Y_n}{\Sigma D_n}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NOx, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Gaseous Emissions – Urban Charge Sustaining Emission Test.

For light-duty vehicles and light-duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

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_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

Y_h = Mass emissions as calculated from the hot start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

D_h = The measured driving distance from the hot start UDDS, in miles.

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

5.6 Calculations - Urban Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.6.1 Amend subparagraph (a):

Particulate Emissions – Urban Charge Depleting Range Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{\Sigma M_{pn}}{\Sigma D_n}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

D_c = The measured driving distance from the cold start UDDS, in miles.

n	=	number of hot start UDDSs in Charge Depleting operation If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Particulate Emissions – Urban Charge Sustaining Emission Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:

M_{pc}	=	Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
M_{ph}	=	Mass of particulate determined from the hot start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
D_c	=	The measured driving distance from the cold start UDDS, in miles.
D_h	=	The measured driving distance from the hot start UDDS, in miles.

5.6.2 Subparagraph (b). [No change.]

5.6.3 **Equivalent All-Electric Range** shall be calculated in accordance with section ~~F~~G.11 of these test procedures.

6. Highway Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

The third emission test HFEDS of the Highway Charge Sustaining Test shall be used to calculate highway NOx emissions and must be within the SOC criterion in section ~~F~~G.10. As an option, the manufacturer may perform the Highway Charge Sustaining Test with two emission test HFEDSs provided that the second HFEDS meets the SOC criterion in section ~~F~~G.10. In this case, the second HFEDS shall be used to calculate emissions.

Highway NOx emissions may be determined from the HFEDS in the Highway Charge Depleting Range Test that demonstrates charge sustaining operation.

6.1 Vehicle Preconditioning.

If the Highway Charge Depleting Range Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to sections ~~F~~G.5.1.9 through ~~F~~G.5.1.10, without canister preconditioning. If the Highway Charge Depleting Range Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1, without canister preconditioning. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

If the Highway Charge Sustaining Emission Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9 without canister preconditioning. If the Highway Charge Sustaining Emissions Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1 without canister precondition and vehicle charging. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

6.2 Highway Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions. This section ~~F~~G.6.2 shall apply during both charge sustaining and charge depleting operation.

6.2.1 Subparagraph (a). [n/a]

6.2.2 Amend subparagraph (b) as follows:

6.2.2.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO, CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

6.2.2.2 Replace subparagraph (b)(6) with: Cold soak: The vehicle shall be stored at an ambient temperature not less than 68^oF (20^oC) and not more than 86^oF (30^oC) for 12 to 36 hours. At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

6.2.2.3 Amend subparagraph (b)(7)(i): The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section ~~F~~G.10 for the third emission measurement HFEDS. As an option the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second emission measurement HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section ~~F~~G.6.2.2.2.

6.2.2.4 Amend subparagraph (b)(7)(iii): One exhaust sample and one background sample per each HFEDS shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

6.2.2.5 Add subparagraph (b)(7)(v): For vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

6.2.2.6 Amend subparagraph (b)(9)(v): Operate the vehicle over the continuous highway test schedule, consisting of repeated HFEDSs according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

6.2.2.7 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed between each HFEDS, the driver has 17 seconds to prepare for the

HFEDS emission measurement cycle of the test. During the idle period, one of the following conditions shall apply:

(a) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on during the idle period.

(b) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

6.2.2.8 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, the following conditions shall apply: For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). Up to three highway emission tests shall be allowed to satisfy the SOC criterion.

6.2.2.9 Delete subparagraph (b)(10).

6.2.3 Delete subparagraphs (c) through (e).

6.3 Determination of Highway All-Electric Range and Highway Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

6.3.1 The **Highway All-Electric Range** shall be defined as the distance that the vehicle is driven from the start of test until the internal combustion engine starts.

6.3.2 **Highway Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section ~~F~~G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Highway Test Schedule until the State–of-Charge Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation is met for one HFEDS. The Alternative Continuous Highway Test Schedule may be substituted for the Continuous Highway Test Schedule if the test facility is unable to perform the Continuous Highway Test Schedule. Refer to section ~~F~~G.11, for calculations of highway exhaust emissions and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after the Highway Charge Depleting Range Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in section ~~F~~G.3 must be met, and energy consumption shall be calculated according to the requirements in section ~~F~~G.11.7. If the manufacturer provides supplemental data demonstrating that the energy required to charge the vehicle from highway charge sustaining operation to full charge is equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from urban charge sustaining operation to full charge, then the energy required to charge the vehicle from urban charge sustaining operation to full charge may be used to determine highway energy consumption pursuant to section ~~F~~G.11.7. Data shall be approved in advance by the Executive Officer of the Air Resources Board.

6.3.3 **Highway Charge Sustaining Emission Test.** The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed:

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section ~~F~~G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section ~~F~~G.10 for the third emission measurement HFEDS. As an option, the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second HFEDS. If the

SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section ~~F~~G.6.3.3.

6.3.4 **Equivalent All-Electric Range** shall be calculated in accordance with section ~~F~~G.11 of these test procedures.

7. SFTP Emission Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

7.1 US06 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section ~~F~~G.1 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.1.1 Subparagraphs (a) through (m). [No change.]

7.1.2 Amend subparagraph (n) *Aggressive Driving Test (US06) Preconditioning*. as follows:

7.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

7.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

7.1.2.2 Subparagraph (2). [No change.]

7.1.3 Subparagraph (o). [No change.]

7.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions. This section 7.2 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.2.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The vehicle is preconditioned in accordance with §86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~F~~G.10.

7.2.2 Amend subparagraph (b) as follows.

7.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.2.3 Subparagraph (c). [No change.]

7.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

7.2.5 Subparagraph (e). [No change.]

7.2.6 Amend subparagraph (f) as follows.

7.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.2.6.2 Amend subparagraph (f)(2)(ix): At the completion of the test US06 cycle, determine if the SOC criterion in section ~~F~~G.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (f)(2)(i), without the preconditioning cycle. Up to three US06 emission tests shall be allowed to satisfy the SOC criterion. The idle period between multiple test cycles shall not to be less than one minute and not greater than two minutes. For the final test cycle, turn off the vehicle two seconds after the end of the last deceleration. During the idle period between multiple test cycles, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section 7.3 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.3.1 Subparagraphs (a) through (n). [No change.]

7.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

7.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

7.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

7.3.2.2 Subparagraphs (2) through (3). [No change.]

7.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions. This section 7.4 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed. References to §86.162-03 shall mean §86.162-03 as adopted October 22, 1996.

7.4.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulate testing in an environmental test cell (see §86.162-03 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95°F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~F~~<u>G</u>.10.

7.4.2 Amend subparagraph (b) as follows.

7.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.4.3 Amend subparagraph (c) as follows.

7.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

7.4.4 Amend subparagraph (d) as follows.

7.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03 test, record the battery state-of-charge to determine if the SOC criterion in section ~~F~~G.10 is satisfied. If the SOC criterion is not satisfied , then turn off the engine and the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

7.4.5 Subparagraph (e). [No change.]

7.5 Optional Cold Start US06 Range Test.

7.5.1 **Cold soak and vehicle charging.** The vehicle shall be stored at an ambient temperature not less than 68^{o}F (20^{o}C) and not more than 86^{o}F (30^{o}C) for 12 to 36 hours. During this time, the vehicle battery shall be charged to a full state-of-charge. The vehicle must be turned off during charging. Charge time shall not exceed soak time.

7.5.2 At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and shall be driven on a continuous US06 test cycle until either:

(a) the auxiliary power unit starts, or

(b) the vehicle can no longer meet the speed trace limits of the US06 driving schedule as specified in CFR 86 Appendix I to within 2 mph higher than the highest point on the trace within 1 second for the upper limit or within 2 mph lower than the lowest point on the trace within 1 second for the lower limit.

When either of these conditions is met, the test shall be ended. The range for this test, in miles, shall be the distant driven from the start of the test to when condition (a) or (b) is met. Emission sampling is not required for this test.

8. 50^{o}F and 20^{o}F Test Provision for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

50 ^{o}F testing shall be conducted pursuant to section ~~F~~G.5 with the modifications in Part II, Section C of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles" and the additional following revisions.

20 ^{o}F testing shall be conducted pursuant to section ~~F~~G.5 and shall include the temperature provisions in 40 CFR Part 86 Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

For 50 ^{o}F and 20 ^{o}F charge depleting testing, vehicle charging, prior to emissions testing, shall be performed during the soak period at 50 ^{o}F and 20 ^{o}F, respectively.

8.1 To satisfy test requirements for the 50^{o}F emission test, the vehicle shall be tested in the worst case (NMOG + NOx) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. To satisfy test requirements for the 20^{o}F emission test, the vehicle shall be tested in the worst case (CO) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. For the 20^{o}F and 50^{o}F emission tests, the vehicle is not required to meet SOC net tolerances.

8.2 If the worst case for emissions is charge sustaining operation, the vehicle shall be preconditioned, and 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 UDDS, phase two as 506 seconds to the end of the UDDS, a 10 minute key-off soak period, and phase three the first 505 seconds of the UDDS. The first two phases test shall be counted as the first UDDS and the second and third phases will constitute the second UDDS. 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, a 10 minute key-off soak period, and phase two as a UDDS. Emission weighting for the four phase test will follow the procedure outlined in section ~~F~~G.5.5.1.

8.3 If measurement of worst case emissions requires the urban charge depleting range test to be performed, the vehicle shall be preconditioned and fully charged. The continuous urban test schedule shall then be performed. The UDDS, in which the auxiliary power unit first starts, shall be the cold UDDS. Emissions shall be sampled according to one of the options in section ~~F~~G.8.2. For the three phase test option, if the auxiliary power unit starts in phase two of the UDDS, phase one emissions are considered zero for emission calculation purposes. Emissions are weighted according to section ~~F~~G.8.2.

9. Additional Provisions.

9.1 Confirmatory testing may be performed on all tests to establish if higher emissions occur at different states-of-charge in charge depleting mode. This is to ensure that cold start and other emissions standards are not exceeded at other operating SOCs.

9.2 Confirmatory testing may be performed on the US06 test or the manufacturer may provide data to show that potential cold start off-cycle emissions are controlled to the extent that they are controlled for the UDDS.

9.3 Confirmatory testing may be performed on vehicles equipped with an optional charge sustaining operation mode selector with selector set to simulate charge sustaining operation or in actual charge sustaining operation in accordance with section F of these test procedures.

9.4 For an example of an off-vehicle charge capable hybrid electric vehicle with all-electric range and blended operation that has charge depleting actual range and charge depleting cycle range, please see section ~~H~~I, Figure 1.

9.5 For an example of charge depleting to charge sustaining range with and without transitional range and end of test conditions, please see section ~~H~~I, Figure 2.

9.6 When determining the SOC tolerance during testing, the current drive cycle may be aborted if the SOC tolerance is met for previous drive cycle.

9.7 If the manufacturer determines there is insufficient fuel to run the subsequent test, the manufacturer may perform a fuel drain and fill or add fuel pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

10. State-of-Charge Net Change Tolerances.

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

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

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

Where:

$(\text{Amp-hr}_{\text{final}})_{\text{max}}$	=	Maximum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{final}})_{\text{min}}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{initial}})$	=	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 Air Resources Board.

An alternate state-of-charge net tolerance may be used if shown to be technically necessary and if approved in advance by the Executive Officer of the Air Resources Board.

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

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

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

Where:

$(V_{final})_{max}$	=	The stored capacitor voltage allowed at the end of the test
$(V_{final})_{min}$	=	The 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

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

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

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

Where:

$(rpm_{final})_{max}$	=	The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})_{min}$	=	The minimum flywheel rotational speed allowed at the end of the test
$rpm_{initial}^2$	=	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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

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

11. Calculations – Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

11.1 Charge Depleting CO_2 Produced means the cumulative tailpipe CO_2 emissions produced, M_{cd}, in grams per mile during the charge depleting cycle range.

$$M_{cd} = \Sigma Y_i$$

where:

Y_i = The sum of the CO_2 grams per mile in the charge depleting mode from each test cycle (UDDS or HFEDS)

i = Number (UDDS or HFEDS) of the test over the charge depleting cycle range, R_{cdc}

11.2 Charge Sustaining CO_2 Produced - urban means the cumulative tailpipe CO_2 emissions produced, M_{cs}, in grams per mile, during the cold start charge sustaining urban test.

$$M_{cs} = Y_c + Y_h * \left[\frac{(R_{cdcu} - D_c)}{D_c}\right]$$

where:

R_{cdcu} = Urban Charge Depleting Cycle Range, in miles

D_c = The measured driving distance from the cold start UDDS, in miles

Y_c = Grams per mile CO_2 emissions as calculated from the cold start UDDS

Y_h = Grams per mile CO_2 emissions as calculated from the hot start UDDS

11.3 Charge Sustaining CO_2 Produced - highway means the grams per mile tailpipe CO_2 emissions produced, M_{cs}, during the cold start charge sustaining highway test.

$$M_{cs} = \left(\frac{R_{cdch}}{D_h} \right) * Y_h$$

where:

R_{cdch} = Highway Charge Depleting Cycle Range, in miles

D_h = The measured driving distance from the hot start HFEDS, in miles

Y_h = Grams per mile emissions as calculated from the hot start HFEDS

11.4 Urban Equivalent All-Electric Range ($EAER_u$) shall be calculated as follows:

$$EAER_u = \left(\frac{M_{cs} - M_{cd}}{M_{cs}} \right) * R_{cdcu}$$

where:

M_{cs} is as defined in ~~F~~G.11.2.

M_{cd} is as defined in ~~F~~G.11.1, using the UDDS test cycle.

11.5 Highway Equivalent All-Electric Range ($EAER_h$) shall be calculated as follows:

$$EAER_h = \left[\frac{M_{cs} - M_{cd}}{M_{cs}} \right] * R_{cdch}$$

where:

M_{cs} is as defined in ~~F~~G.11.3.

M_{cd} is as defined in ~~F~~G.11.1, using the HFEDS test cycle.

R_{cdch} is as defined in ~~F~~G.11.3

11.6 Electric Range Fraction (%).

The Electric Range Fraction means fraction of the total miles driven electrically (with the engine off) for blended operation hybrid electric vehicles.

The Urban Electric Range Fraction (ERF_u) is calculated as follows:

$$ERF_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

The Highway Electric Range Fraction (ERF_h) is calculated as follows:

$$ERF_h\ (\%) = \left(\frac{EAER_h}{R_{cdah}}\right) * 100$$

11.7 Equivalent All-Electric Range Energy Consumption.

The Urban Equivalent All-Electric Range Energy Consumption ($EAEREC_u$) shall be calculated as follows:

$$EAEREC_u\ (wh/mi) = \frac{E_{cd}}{EAER_u}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

The Highway Equivalent All-Electric Range Energy Consumption ($EAEREC_h$) shall be calculated as follows:

$$EAEREC_h\ (wh/mi) = \frac{E_{cd}}{EAER_h}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

11.8 The Urban Charge Depleting Cycle Range, R_{cdcu}, (see section H for an illustration of R_{cdcu}) shall be defined as the distance traveled on the Urban Charge Depleting Procedure up to the UDDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

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

Where:

$(\text{Amp-hr}_{final})_{min}$ = 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 Air Resources Board.

11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be reported to the nearest 0.1 miles. For an illustration of R_{cda} see section ~~H~~I.

11.10 The Charge Depleting to Charge Sustaining Urban Range shall be defined as the distance driven in miles from the start of the Urban Charge Depleting Test through the UDDS preceding the one or two UDDSs used to end the Urban Charge Depleting Test.

11.11 The Highway Charge Depleting Cycle Range, R_{cdch}, shall be defined as the sum of the distance traveled on the Highway Charge Depleting Test up to the HFEDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

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

Where:
$(\text{Amp-hr}_{final})_{min}$ = 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 Air Resources Board.

11.12 The Charge Depleting to Charge Sustaining Highway Range shall be defined as the distance driven in miles from the start of the Highway Charge Depleting Test through the HFEDS preceding the final HFEDS.

11.13 The Urban Equivalent All Electric Range for vehicles with an urban charge depleting actual range greater than 40 miles, $EAER_{u40}$, is determined through the following equation:

$$EAER_{u40}\text{ (miles)} = \left(\frac{ERF_u \times 40\,mi}{100}\right)$$

12. The Calculations of the Combined Green House Gas Regulatory Rating of Off-vehicle Charge Capable Hybrid Electric Vehicles

12.1 The combined Greenhouse Gas (GHG) emissions value is determined by the following equation.

$GHG_{PHEV,\ combined}$ = 0.55 * (GHG_{urban}) + 0.45 * ($GHG_{highway}$) (Eq. 1)

12.2 The urban GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equations.

12.2.1 The urban GHG emissions value is determined by the following equation.

$$GHG_{urban} = \sum_{i=1}^{N_{urban}} (UF_i) * \left(\frac{Y_{CD.i}}{D_i} + GHG_{cd.AC.i}\right) - \sum_{i=1}^{N_{urban}} (UF_i) * G_{upstream} + \left(1 - \sum_{i=1}^{N_{urban}} (UF_i)\right) * (Y_{cs.urban}) \quad \text{(Eq. 2)}$$

Where,

GHG_{urban} = Rated urban GHG emissions for PHEV, in gCO_2e/mile
i = Number of charge-depleting urban test cycle
N_{urban} = Total number of urban test cycles in charge depleting to charge sustaining range (R_{cdtcs})
UF_i = Utility factor for urban test cycle i
$Y_{CD.i}$ = Mass emissions of CO_2 in grams per vehicle mile, for the "i"th test in the charge depleting test
D_i = Distance of the "i"th urban test cycle, in miles.
$GHG_{cd.AC.i}$ = Rated GHG emissions for test cycle i, in gCO_2e/mile
$Y_{cs.urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.
$G_{upstream}$ = Gasoline upstream factor = $0.25 * GHG_{target}$.

12.2.2 The Charge Depleting to Charge Sustaining Range (R_{cdtcs}) is the total number of cycles driven at least partially in charge depleting mode times the cycle distance. Cycles meets charge sustaining criterion are not included in the R_{cdtcs}. The R_{cdtcs} includes the transitional cycle, where the vehicle may have operated in both depleting and sustaining modes.

12.2.3 The utility factors for urban and highway cycles are provided in the following table.

Utility factors for each PHEV drive cycle test with charge-depletion operation

Test cycle number	Test cycle utility factor	
	Urban, UF_i	Highway, UF_j
1	0.176	0.233
2	0.141	0.172
3	0.112	0.127
4	0.091	0.095
5	0.074	0.071
6	0.059	0.054
7	0.049	0.041
8	0.039	0.032
9	0.033	0.025
10	0.027	0.020
11	0.023	0.017
12	0.019	0.013

12.2.4 This charge-depleting GHG rate from electricity use in each test cycle is defined by the following equation:

$$GHG_{cd.AC.i} = GHG_{grid} * E_{cd.AC.i} \qquad \text{(Eq. 3)}$$

Where,

$GHG_{cd.AC.i}$ = Rated GHG emissions for charge-depleting PHEV, in gCO_2e/mile
$E_{cd.AC.i}$ = Urban or highway charge depleting electricity use, in kWh/mile
GHG_{grid} = Lifecycle California electricity GHG intensity, 270 gCO_2e/kWh

12.2.5 The urban or highway charge depleting electricity use is defined by the following formula:

$$E_{cd.AC.i} = \frac{E_{cd.DC.i}}{\sum_{i=1}^{N} E_{cd.DC.i}} * E_{cd.AC.total} \qquad \text{(Eq. 4)}$$

Where,

N = Total number of test cycles in the charge depleting to charge sustaining range (R_{cdtcs}) of the urban or highway charge depleting test.
$E_{cd.AC.i}$ = AC kWh consumed in the "i"th cycle of the charge depleting test.

$E_{cd.DC.i}$ = Depleted DC energy for the “i”th cycle in the charge depleting test. It is defined in section F.3.4 of these test procedures.

$E_{cd.AC.total}$ = Charge-depleting net AC energy consumption is determined according to section F.3.4 of these test procedures.

12.2.6 The $Y_{cs.urban}$, which is the weighted CO_2 mass emissions of the charge-sustaining test, is determined by the following equation, which can be found in section F.5.5 of these test procedures.

$$Y_{CS.Urban} = 0.43 * \frac{Y_C}{D_C} + 0.57 * \frac{Y_H}{D_H} \qquad \text{(Eq. 5)}$$

Where,

$Y_{CS.Urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.

Y_C = Mass emissions as calculated from the cold start UDDS, in grams per cycle.

Y_H = Mass emissions as calculated from the hot start UDDS, in grams per cycle.

D_C = The measured driving distance from the cold start UDDS, in miles.

D_H = The measured driving distance from the hot start UDDS, in miles.

12.3 The highway GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equation.

$$GHG_{highway} = \sum_{j=1}^{N_{highwayn}} (UF_j\} * (\frac{Y_{CD.j}}{D_j} + GHG_{cd.AC.j}) - \sum_{j=1}^{N_{highway}} (UF_i) * G_{upstream} + (1 - \sum_{j=1}^{N_{highway}} (UF_j)) * (Y_{cs.highway})$$

(Eq. 7)

Where,

$GHG_{highway}$= Rated highway GHG emissions for PHEV, in gCO_2e/mile

j = Number of charge-depleting highway test cycle

$N_{highway}$ = Total number of highway test cycles in charge depleting to charge sustaining range (R_{cdtcs})

UF_j = Utility factor for highway test cycle j (see Table 1)

$Y_{CD.j}$ = Mass emissions of CO_2 in grams per vehicle mile, for the “j”th test in the charge depleting test

D_j = Distance of the HFEDS cycle, in miles.

$GHG_{cd.AC.j}$ = Rated GHG emissions for test cycle j, in gCO_2e/mile (see Eq. 3)

$Y_{cs.highway}$ = Mass emissions of CO_2 in grams/mi of the highway charge sustaining emission test, which can be found in section F.6.3.3 of these test procedures.

$G_{upstream}$ = Gasoline upstream factor $0.25 * GHG_{tar}$

~~G~~H. Off-Vehicle Charge Capable Hybrid Electric Vehicle Exhaust Emission Test Sequence.

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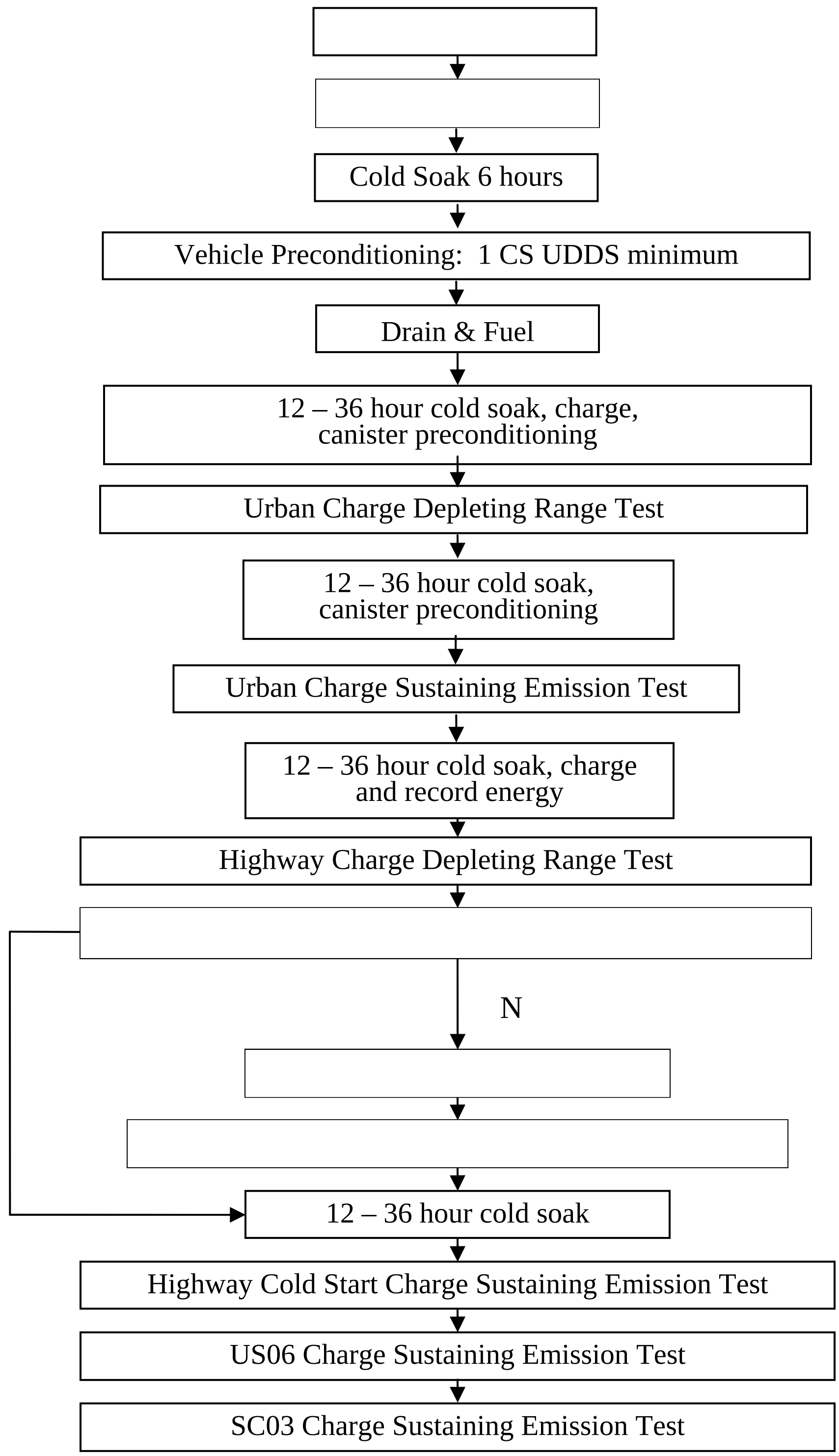
Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



~~H~~I. Examples of Off-Vehicle Charge Capable Hybrid Electric Vehicle Terminology.

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Example of an Off-Vehicle Charge Capable HEV with AER and Blended Operation Undergoing the Urban Charge Depleting Range Test

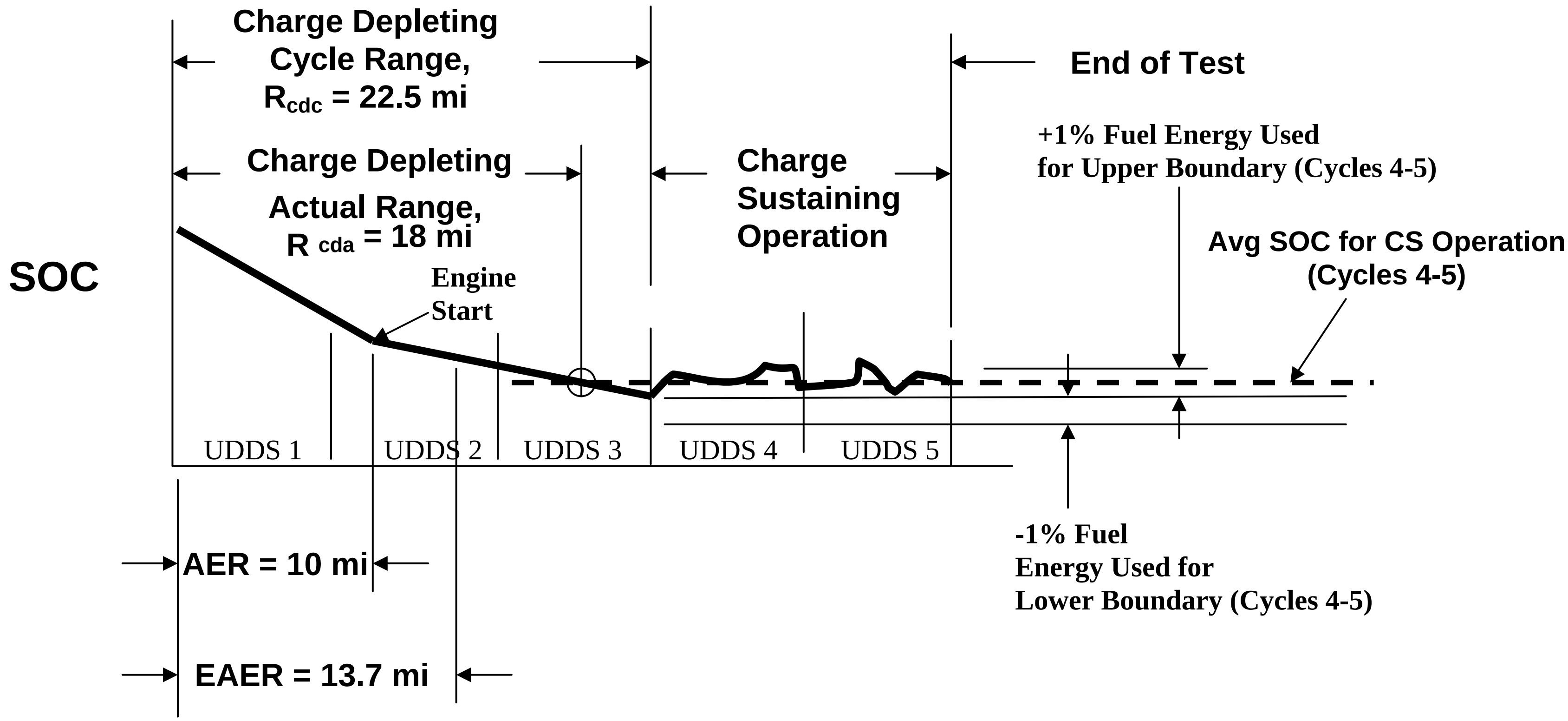
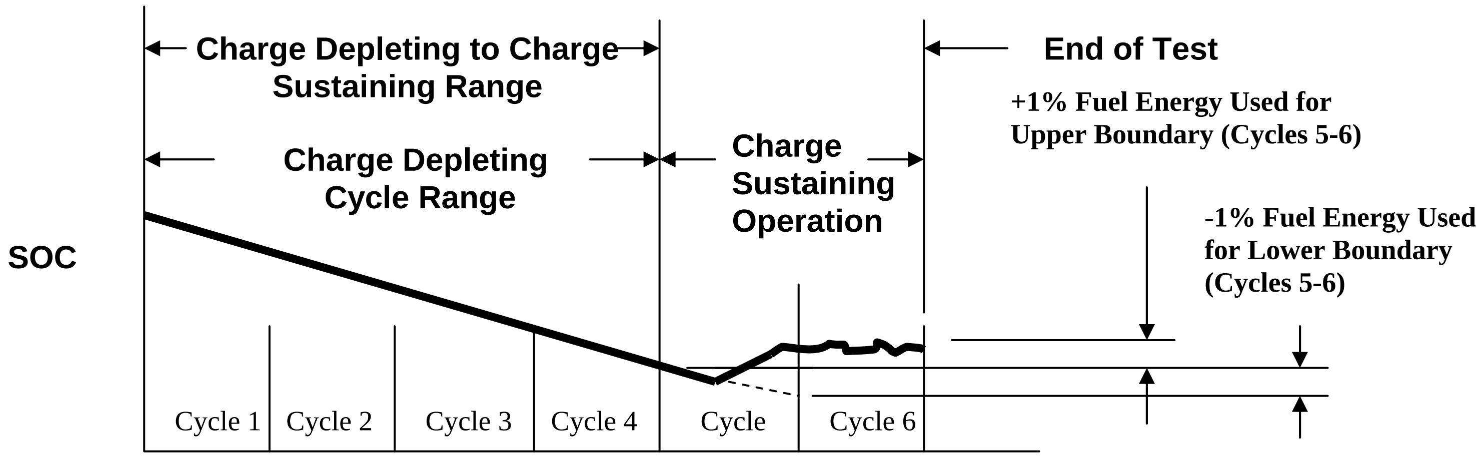
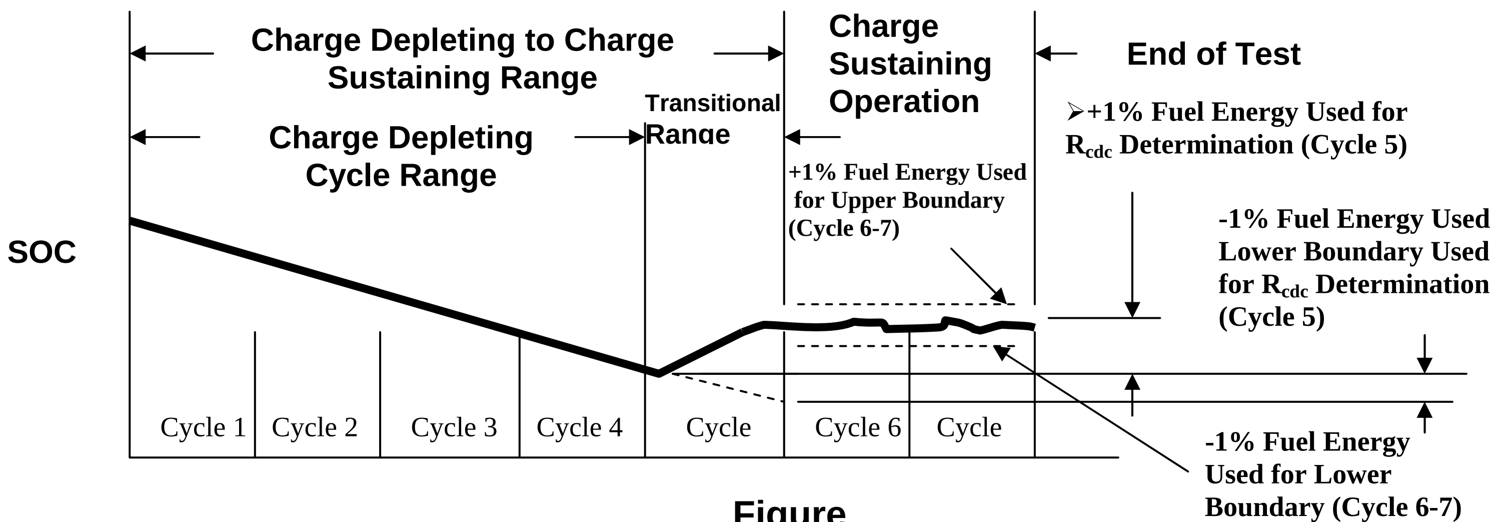


Figure 1

Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV



Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV with Transitional Range



Figure

~~I~~J. Test Procedures for 2009 through 2011 Model Zero-Emission Vehicles and Hybrid-Electric Vehicles.

The “as adopted or amended dates” of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles.”

1. Electric Dynamometer. All ZEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2).

2. 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 section D.2.11 above.

3. All-Electric Range Test. All 2009 through 2011 ZEVs and only off-vehicle charge capable hybrid electric vehicles shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of a ZEV or of an off-vehicle charge capable hybrid electric vehicle operating without the use of its auxiliary power unit. For hybrid electric vehicles, the manufacturer may elect to conduct the All-Electric Range Test prior to vehicle preconditioning in the exhaust and evaporative emission test sequence specified in the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles”.

3.1 **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle’s battery shall be charged to a full state-of-charge.

3.2 **Driving schedule.**

3.2.1 **Determination of Urban All-Electric Range.**

(a) At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference. A 10-minute soak shall follow each UDDS cycle.

(b) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS cycle, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2), or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

(c) For vehicles with a maximum speed less than the maximum speed on the UDDS cycle, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR § 86.115-00(b)(1) and (2). The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the UDDS cycle or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

3.2.2 **Determination of Highway All-Electric Range.**

(a) At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through two successive Highway Fuel Economy Driving Schedules (HFEDS), 40 CFR, Part 600, Appendix I, which is incorporated herein by reference. There shall be a 15 second zero speed with key on and brake depressed between two cycles and a 10-minute soak following the two HFEDS cycles.

(b) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS cycle, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR § 86.115-00 (b)(1) and (2), or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc. For off-vehicle charge capable hybrid electric vehicles, this determination is optional and shall be performed without the use of the auxiliary power unit.

(c) For vehicles with a maximum speed less than the maximum speed on the HFEDS cycle, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR § 86.115-00(b)(1) and (2). The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the HFEDS cycle or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

(d) NEVs are exempt from the highway all-electric range test.

3.2.3 **Recording requirements.** Once the vehicle is no longer able to maintain the speed and time requirements specified in (2) above, or once the auxiliary power unit turns on, in the case of an off-vehicle charge capable hybrid electric vehicle, the vehicle shall be brought to an immediate stop and the following data recorded:

(a) mileage accumulated during the All-Electric Range Test;
(b) Net DC energy from the battery that was expended during the All-Electric Range Test (may be reported as the total DC battery energy output and the total DC battery energy input during the All-Electric Range Test);
(c) AC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the electric outlet to the battery charger; and
(d) DC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the battery charger to the battery.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.2.4 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications prior to the commencement of the test. The driving schedule speed and time tolerances specified in (2) shall not be exceeded due to the operation of the regenerative braking system.

4. Determination of Battery Specific Energy for ZEVs.

Determine the specific energy of batteries used to power a ZEV in accordance with the U.S. Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in the Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

5. Determination of the Emissions of the Fuel-fired Heater for Vehicles Other Than ZEVs.

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile for a grams per mile value.

6. Hybrid Electric Vehicle FTP Emission Test Provisions.

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.

6.1 Vehicle Preconditioning.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" with the following supplemental requirements:

6.1.1 Battery state-of-charge shall be set prior to initial fuel drain and fill before vehicle preconditioning.

6.1.2 For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

6.1.3 For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the UDDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the UDDS, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in urban driving conditions.

6.1.4 After setting battery state-of-charge, the hybrid electric vehicle shall be pushed or towed to a work area for fuel drain and fill according to sections D.1.1. and D.1.2. of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles".

6.1.5 Following fuel drain and fill, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

6.1.6 Within five minutes of completing preconditioning drive, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-sustaining over the UDDS, then set battery state-of-charge to a level such that the SOC Criterion (see section B., Definitions, of these procedures) would be satisfied for the dynamometer procedure (section 6.2 of these procedures). If off-vehicle charging is required to increase battery state-of-charge for proper setting, off-vehicle charging shall occur during 12 to 36 hour soak period.

(ii) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-depleting over the UDDS, then no battery state-of-charge adjustment is permissible.

(iii) If the hybrid electric vehicle does allow manual activation of the auxiliary power unit, then set battery state-of-charge to manufacturer recommended level for activating the auxiliary power unit when the hybrid electric vehicle is operating in urban driving conditions.

6.2 Dynamometer Procedure

To be conducted pursuant to 40 CFR § 86.135-00 with the following revisions:

6.2.1 Amend subparagraph (a): Overview. The dynamometer run consists of two tests, a “cold” start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles”~~,~~ and a “hot” start test following the “cold” start test by 10 minutes. Vehicle startup (with all accessories turned off), operation over the UDDS and vehicle shutdown make a complete cold start test. Vehicle startup and operation over the UDDS and vehicle shutdown make a complete hot start test. The exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. Four particulate samples are collected on filters for weighing; the first sample plus backup is collected during the cold start test (including shutdown); the second sample plus backup is collected during the hot start test (including shutdown). Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with gasoline-fueled, natural gas-fueled and liquefied petroleum gas-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of § 86.110. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with methanol-fueled auxiliary power units, methanol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

6.2.2 Subparagraph (d). [No change.]

6.2.3 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the cold start test and hot start test. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

6.3 Dynamometer Test Run, Gaseous and Particulate Emissions

To be conducted pursuant to 40 CFR § 86.137-96 with the following revisions:

6.3.1 Amend subparagraph (a): General. The dynamometer run consists of two tests, a cold start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" and a hot start test following the cold start test by 10 minutes. The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The complete dynamometer test consists of a cold start drive of 7.5 miles (12.1 km) and a hot start drive of 7.5 miles (12.1 km). The vehicle is allowed to stand on the dynamometer during the 10 minute time period between the cold and hot start tests.

6.3.2 Amend subparagraph (b)(9): Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the exhaust sample bag, the methanol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the methanol dilution air sample and the formaldehyde dilution air sample (turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, start particulate sample pump No. 1, and record both gas meter or flow measurement instrument readings, if applicable), and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

6.3.2 Delete subparagraph (13).

6.3.3 Amend subparagraph (14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.4 Amend subparagraph (15): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 1 and if applicable, turn off the hydrocarbon integrator No. 1, mark the hydrocarbon recorder chart, turn off the No. 1 particulate sample pump and close the valves isolating particulate filter No. 1, and position the sample selector valves to the "standby" position. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to § 86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4□C to 10□C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.3 Amend subparagraph (18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start test. The step in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

6.3.4 Delete subparagraph (19).

6.3.5 Delete subparagraph (20).

6.3.6 Amend subparagraph (21): As soon as possible, and in no case longer than one hour after the end of the hot start phase of the test, transfer the four particulate filters to the weighing chamber for post-test conditioning, if applicable. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the UDDS, a valid test shall satisfy the SOC Criterion (see Definitions, section B of these procedures).

6.3.7 Amend subparagraph (24): Vehicles to be tested for evaporative emissions will proceed pursuant to the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles”.

6.4 Calculations - Exhaust Emissions

To be conducted pursuant to 40 CFR §86.144-94 with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \frac{Y_c}{D_c} + 0.57 * \frac{Y_h}{D_h}$$

Where:

(1) Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMHC, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

(2) Y_c = Mass emissions as calculated from the cold start test, in grams per test.

(3) Y_h = Mass emissions as calculated from the hot start test, in grams per test.

(4) D_c = The measured driving distance from the cold start test, in miles.

(5) D_h = The measured driving distance from the hot start test, in miles.

6.5 Calculations - Particulate Emissions

To be conducted pursuant to 40 CFR §86.145-82 with the following revisions:

6.5.1 Amend subparagraph (a): The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \frac{M_{pc}}{D_c} + 0.57 * \frac{M_{ph}}{D_h}$$

Where:

(1) M_{pc} = Mass of particulate determined from the cold start test, in grams per vehicle mile. (See § 86.110-94 for determination.)

(2) M_{ph} = Mass of particulate determined from the hot start test, in grams per vehicle mile. (See § 86.110-94 for determination.)

(3) D_c = The measured driving distance from the cold start test, in miles.

(4) D_h = The measured driving distance from the hot start test, in miles.

7. Hybrid Electric Vehicle Highway Emission Test Provisions

To be conducted pursuant to 40 CFR § 600.111-93 with the following revisions:

7.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO, CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Methanol and formaldehyde samples are collected and individually analyzed for methanol-fueled vehicles.

7.2 Amend subparagraph (f)(3): Only one exhaust sample and one background sample are collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x . Methanol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for methanol-fueled vehicles.

7.3 Add subparagraph (f)(5): Battery state-of-charge shall be set prior to performing the HFEDS preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the HFEDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the HFEDs, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions.

7.4 Amend subparagraph (h)(5): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in 600.109(b). If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

7.5 Amend subparagraph (h)(6): When the vehicle reaches zero speed at the end of the HFEDS preconditioning cycle, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. Reset and enable the roll revolution counter. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.6 Add subparagraph (h)(9): At the conclusion of the HFEDS emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then repeat dynamometer test run from subparagraph (h)(6). A total of three highway emission tests shall be allowed to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (h)(6) if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of the HFEDS emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the emission test is completed.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the emission test is completed.

8. Hybrid Electric Vehicle SFTP Emission Test Provisions

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR § 86.132-00 with the following revisions:

8.1.1 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning. (1) If the US06 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer provided that battery state-of-charge has not been set; otherwise, if battery state-of-charge is set prior to securing vehicle on dynamometer, vehicle shall be pushed or towed into position on dynamometer. Battery state-of-charge shall be set prior to performing the US06 preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the US06 preconditioning drive. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the US06, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

(ii) If the hybrid electric vehicle is charge-depleting over the US06, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

8.1.2 Delete subparagraphs (n)(1)(i) and (n)(1)(ii).

8.2 US06 Emission Test

To be conducted pursuant to 40 CFR §86.159-00 with the following revisions:

8.2.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The hybrid electric vehicle is preconditioned in accordance with § 86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of § 86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of § 86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

8.2.2 Amend subparagraph (b)(2): Position (vehicle shall be pushed or towed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle may be driven as well) the test vehicle on the dynamometer and restrain.

8.2.3 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point, provided that battery state-of-charge setting is conducted after practice and an emission sample is not taken, for the purpose of finding the appropriate throttle action to maintain the proper speed-time relationship, or to permit sampling system adjustment.

8.2.4 Amend subparagraph (f)(2)(i): Immediately after completion of the US06 preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the US06, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

8.2.5 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the US06, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i). A total of three US06 emission tests shall be allowed to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (f)(2)(i) if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of US06 emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

8.3 SC03 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 with the following revisions:

8.3.1 Amend subparagraph (o): Air Conditioning Test (SC03) Preconditioning. (1) If the SC03 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer provided that battery state-of-charge has not been set; otherwise, if battery state-of-charge is set prior to securing vehicle on dynamometer, vehicle shall be pushed or towed into position on dynamometer. Battery state-of-charge shall be set prior to performing the SC03 preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the SC03 preconditioning drive. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the SC03, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

(ii) If the hybrid electric vehicle is charge-depleting over the SC03, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

8.3.2 Delete subparagraphs (o)(1)(i) and (o)(1)(ii).

8.4 SC03 Emission Test

To be conducted pursuant to 40 CFR § 86.160-00 with the following revisions:

8.4.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulates testing in an environmental test cell (see Sec. 86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95°F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of § 86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

8.4.2 Amend subparagraph (b)(2): Position (vehicle shall be pushed or towed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle may be driven as well) the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.4 Amend subparagraph (c)(12): Turn the vehicle off 2 seconds after the end of the last deceleration.

8.4.5 Amend subparagraph (d)(7): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.6 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then turn off cooling fan(s), allow vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat dynamometer test run from subparagraph (d). A total of three SC03 emission tests shall be attempted to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (d) following a 10 ± 1 minute soak in the ambient conditions of paragraph (c)(5) of this section if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of SC03 emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the SC03, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

9. State-of-Charge Net Change Tolerances

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

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

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

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 Air Resources Board.

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

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

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

Where:

$(V_{final})_{max}$	=	The stored capacitor voltage allowed at the end of the test
$(V_{final})_{min}$	=	The 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

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

$$(rpm_{final})_{max} = \sqrt{(\mathrm{rpm}_{\mathrm{initial}})^2 + 0.01 * \frac{(2 * \mathrm{NVH}_{\mathrm{fuel}} * \mathrm{m}_{\mathrm{fuel}})}{(1 * \mathrm{K}_3)}}$$

$$(rpm_{final})_{min} = \sqrt{(\mathrm{rpm}_{\mathrm{initial}})^2 - 0.01 * \frac{(2 * \mathrm{NVH}_{\mathrm{fuel}} * \mathrm{m}_{\mathrm{fuel}})}{(1 * \mathrm{K}_3)}}$$

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, $4\square^2/(3600\ sec^2\text{-}rpm^2)$
I	=	Rated moment of inertia of the flywheel, in $kg\text{-}m^2$

K. Advanced Technology Demonstration Program data requirements.

A vehicle placed in a California advanced technology demonstration program may earn ZEV credits even if it is not "delivered for sale" in accordance with the ZEV regulation section 1962.1(g)(4). Approval by the ARB's Executive Officer is required for Advanced Technology Demonstration Program credits. The following data shall be provided in order to evaluate applications for an Executive Order:

1. Project Description

(a) General description
(b) Goal
(c) Specific objectives (e.g. durability tests, customer marketability)
(d) Location (include state, city, and agency/organization)

2. Vehicle data

(a) Model
(b) Model year
(c) Date placed in program
(d) Vehicle Identification Number (VIN)

3. Vehicle specifications

(a) Passenger car (PC) or light duty truck (LDT)
(b) Curb weight – pounds (lbs)
(c) Payload (lbs)
(d) City/highway range – miles (mi)
(e) Estimated fuel economy or EPA fuel economy city/highway – miles per gallon (mpg)
(f) Fuel type
(g) Refueling time
(h) Electric motor output – kilowatts (kW)
(i) Hybrid energy storage; type, capacity and peak power
(j) For Fuel Cell Vehicles (FCVs), fuel cell stack: type, peak output, manufacturer and estimated design life.

L. Fast refueling capability

The "fast refueling capability" criterion for a 2009 through 2017 model-year Type III, IV and V ZEV in CCR, Title 13, Section 1962.1(d)(5)(A), "ZEV Tiers for Credit Calculations," will be considered met for a particular ZEV if the manufacturer declares that this ZEV can be fast refueled at an "ideal" or prototype refueling or charging station and provides the documentation described below.

The fast refueling description shall include (but not necessarily be limited to):

(a) Tank or battery specifications
(b) Ambient and tank conditions prior to the qualifying fill/charge
(c) Plot or table of kilograms (kg) (or kilowatt-hour (kw-hr)) versus time for this "ideal" fill or charge
(d) A general description of the fill or charge type.

California Environmental Protection Agency
AIR RESOURCES BOARD

Part 4

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: March 22, 2012

Note: Set forth below are the 2012 amendments to the California zero emission vehicle (ZEV) regulation. This is a newly adopted test procedure, shown without underline as permitted by California Code of Regulations, title 1, section 8.

NOTE: This document is incorporated by reference in section 1962.2, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of zero-emission vehicles and hybrid electric vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” (incorporated by reference in section 1961(d), title 13, CCR);

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

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

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

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

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

7. “Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR);

8. Guidelines for Certification of Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by section 1960.5, title 13, CCR); and

9. “California Non-Methane Organic Gas Test Procedures,” (incorporated by reference in section 1961(d), title 13, CCR).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

A. Applicability

The emission standards and test procedures in this document are applicable to 2018 and subsequent model-year zero-emission passenger cars, light-duty trucks, and medium-duty vehicles, and 2018 and subsequent model-year hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles. The general procedures and requirements necessary to certify a vehicle for sale in California are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (hereinafter "LDV/MDV TPs"), and apply except as amended herein.

B. Definitions and Terminology.

1. Definitions.

In addition to the following, these test procedures incorporate by reference the definitions and abbreviations set forth in the Title 40 Code of Federal Regulations (CFR) §86.1803-01, the definitions and abbreviations set forth in the LDV/MDV TPs, and the definitions set forth in section 1900, title 13, CCR.

"Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier.

"All-Electric Range" or "AER" means the total miles driven electrically (with the engine off) before the engine turns on for the first time, after the battery has been fully charged.

"All-Electric Range (AER) Test" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see section E of these test procedures).

"Alternate Continuous Urban Test Schedule" means a series of the following sequence: UDDS, 10 minute key-off hot soak, UDDS, and 10-20 minute key-off hot soak. This alternate procedure may be substituted for the Continuous Urban Test Schedule when the Continuous Urban Test Schedule cannot be performed.

"Alternate Continuous Highway Test Schedule" means a series of the following sequence: HFEDS, 15 second key-on pause, HFEDS, and 10-20 minute key-off hot soak or a 15 second key-on pause. This alternate procedure may be substituted for the Continuous Highway Test Schedule when the Continuous Highway Test Schedule cannot be performed.

"Auxiliary power unit" or "APU" 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. For the purposes of range extended battery electric vehicles, auxiliary power unit means any device that provides electrical or mechanical energy, meeting the requirements of subdivision C.3.2, to a BEVx, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.

"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 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 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.

"Blended off-vehicle charge capable hybrid electric vehicle" means an off-vehicle charge capable hybrid electric vehicle that uses the engine to supplement battery/electric motor power during charge depleting operation.

"Blended operation mode" means an operating mode in which the energy storage state-of-charge decreases, on average, while the vehicle is driven and the engine is used occasionally to support power requests.

"Charge-depleting net energy consumption" means the net electrical energy, E_{cd}, measured in watt-hours consumed by vehicle over the charge depleting cycle range, R_{cdc}. E_{cd} can be expressed as AC or DC watt hours, where appropriate.

"Charge-depleting (CD) mode" means an operating mode in which the energy storage state-of-charge (SOC) may fluctuate but, on average, decreases while the vehicle is driven. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Charge depleting actual range" or "R_{cda}" means the distance traveled on the Urban Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the two consecutive UDDS used to end the Urban Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles. (See section F.11.9.)

"Charge depleting actual range, highway" or "R_{cdah}" means the distance traveled on the Highway Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the HFEDS used to end the Highway Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles.

"Charge depleting cycle range" or "R_{cdc}" means the distance traveled on the Urban or Highway Charge Depleting Procedure up to the test cycle prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle. This range will appear as the sum of a discrete number of test cycle distances. This range shall be reported to the nearest 0.1 miles. (See section F.11.8.)

"Charge-sustaining net energy consumption" means the net electrical energy, Ecs, measured in watt-hours consumed by vehicle during charge sustaining operation. For charge sustaining operation, this number should be ~ 0.

"Charge-sustaining (CS) mode" means an operating mode in which the energy storage SOC may fluctuate but, on average, is maintained at a certain level while the vehicle is driven. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

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

"Continuous Urban Test Schedule" means a repeated series comprised of an Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference; each test is followed by a 10 minute key-off soak period.

"Continuous Highway Test Schedule" means a repeated series comprised of four consecutive key-on Highway Fuel Economy Driving Schedules (HFEDS) with a 15 second key-on pause in-between each HFEDS. If this schedule cannot be performed continuously, a key-off soak up to 30 minutes is permitted after every fourth HFEDS.

"Continuous US06 Test Schedule" means a repeated series of US06 driving schedules (US06) with a key-on idle period of not less than one minute and not greater than two minutes between each US06.

"**Conventional rounding method**" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

"**Discounted PZEV and AT PZEV credits**" means credits earned under section 1962 and 1962.1 by delivery for sale of PZEVs and AT PZEVs, discounted according to subdivision C.7.2(f).

"**East Region pool**" means the combination of Section 177 states east of the Mississippi River.

"Electric drive system" means an electric motor and associated power electronics, which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

"Electric range fraction" means the fraction of electrical energy derived from off-vehicle charging and regenerative braking energy relative to total traction energy used over the charge depletion range on a specified drive cycle.

"**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 mode driving capability. In the case of TZEVs, a minimum range threshold relative to certified, new-vehicle range capability is not specified or required.

"Enhanced AT PZEV" means any model year 2009 through 2011 PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel. Enhanced AT PZEV means Transitional Zero Emission Vehicle.

"Equivalent all-electric range" or "EAER" means the portion of the total charge depleting range attributable to the use of electricity from the battery over the charge depleting range test.

"Fuel cell vehicle" or "FCV" means any vehicle that receives propulsion solely from an onboard fuel cell power system.

"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.

"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.

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

"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.

"**Hydrogen fuel cell vehicle**" means a ZEV that is fueled primarily by hydrogen, but may also have off-vehicle charge capability.

"**Hydrogen internal combustion engine vehicle**" means a TZEV that is fueled exclusively by hydrogen.

"Majority ownership situations" means when one manufacturer owns another manufacturer more than 33.4%, for determination of size under CCR Section 1900.

"Manufacturer US PC and LDT Sales" means a manufacturer's total passenger car and light duty truck (up to 8,500 pounds loaded vehicle weight) sales sold in the United States of America in a given model year.

"Neighborhood Electric Vehicle" or "NEV" means a motor vehicle that meets the definition of "low-speed vehicle" either in section 385.5 of the Vehicle Code or in 49 CFR §571.500 (July 1, 2000), and is certified to zero-emission vehicle standards.

"NIST" means the National Institute of Standards and Technology.

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

"Placed in service" means having been sold or leased to an end-user and not just to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

"Proportional value" means the ratio of a manufacturer's California applicable sales volume to the manufacturer's Section 177 state applicable sales volume. In any given model year, the same applicable sale volume calculation method must be used to calculate proportional value.

"Partial Zero Emission Vehicle" or "PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2, under section 1962.1.

"Range Extended Battery Electric Vehicle" or "BEVx" means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision C.4.5(g),

"Regenerative braking" means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

"SAE J2572" means the "Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen," as published by the Society of Automotive Engineers in October, 2008.

"Section 177 State" means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

"SC03" means the U.S. EPA SC03 driving schedule representing vehicle operation with air conditioning, as set forth in Appendix I of 40 CFR Part 86.

“State of Charge (SOC) Net Change Tolerance” means the state-of-charge net change tolerance that is applied to the SOC Criterion for charge-sustaining hybrid electric vehicles when validating an emission test. See section E.9 and F.10 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 Change Tolerance shall be applied to the SOC Criterion.

“Transitional Zero Emission Vehicle” or “TZEV” means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

“US06” means the US06 driving schedule for aggressive driving as set forth in Appendix I of 40 CFR Part 86.

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

“**West Region pool**” means the combination of Section 177 states west of the Mississippi River.

“Zero-emission vehicle” or “**ZEV”** means a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas under any possible operational modes or conditions.

“Zero-emission Vehicle Miles Traveled” or “zero emission VMT” means the vehicle miles traveled with zero exhaust emissions of any criteria pollutant (or precursor pollutant).

“ZEV fuel” means a fuel that provides traction energy in on-road ZEVs. Examples of current technology ZEV fuels include electricity, hydrogen, and compressed air.

2. Terminology.

	Abbreviation	Units
Charge Depleting Actual Range (urban cycle)	R_{cda}	mi
Charge Depleting to Charge Sustaining Range	R_{cdcs}	mi
Charge Depleting Net Energy Consumption	E_{cd}	wh
Charge Depleting CO_2 Produced	M_{cd}	g/mi
Charge Sustaining CO_2 Produced	M_{cs}	g/mi
Highway Charge Depleting Actual Range	R_{cdah}	mi
Highway Charge Depleting Cycle Range	R_{cdch}	mi
Highway Electric Range Fraction	ERF_h	%
Highway Equivalent All-Electric Range	$EAER_h$	mi
Highway Equivalent All-Electric Range Energy Consumption	$EAEREC_h$	wh/mi
Urban Charge Depleting Cycle Range	R_{cdcu}	mi
Urban Electric Range Fraction	ERF_u	%
Urban Equivalent All-Electric Range	$EAER_u$	mi
Urban Equivalent All-Electric Range scaled to 40 mi limit	$EAER_{u40}$	mi
Urban Equivalent All-Electric Range Energy Consumption	$EAEREC_u$	wh/mi

C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2018 and subsequent passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas, excluding emissions from air conditioning systems, under any and all possible operational modes and conditions.

2. Percentage ZEV Requirements

2.1 General Percentage ZEV Requirement.

(a) *Basic Requirement.* The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by subdivision C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in subdivision C.2.2. The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.

Model Year	Credit Percentage Requirement
2018	4.5%
2019	7.0%
2020	9.5%
2021	12.0%
2022	14.5%
2023	17.0%
2024	19.5%
2025 and subsequent	22.0%

(b) *Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.* For 2018 and subsequent model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDTs, produced and delivered for sale in California in the prior second, third, and fourth model year [for example, 2019 model year ZEV requirements will be based on California production volume average of PCs and LDTs for the 2015 to 2017 model years]. This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination (eg. three-year average calculation method). In applying the ZEV requirement, a PC or LDT, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (i.e., Manufacturer B).

(1) *[Reserved]*

(2) *[Reserved]*

(3) A manufacturer may apply to the Executive Officer to be permitted to base its ZEV obligation on the number of PCs and LDTs, produced by the manufacturer and delivered for sale in California that same model year (ie, same model-year calculation method) as an alternative to the three-year averaging of prior year production described above, for up to two model years, total, between model year 2018 and model year 2025. For the same model-year calculation method to be allowed, a manufacturer's application to the Executive Officer must show that their volume of PCs and LDTs produced and delivered for sale in California has decreased by at least 30 percent from the previous year due to circumstances that were unforeseeable and beyond their control.

(c) *[Reserved]*

(d) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating a manufacturer's applicable sales, using either method described in subdivision C.2.1(b), a manufacturer shall exclude the number of NEVs produced and delivered for sale in California by the manufacturer itself, or by a subsidiary in which the manufacturer has more than 33.4% percent ownership interest.

2.2 Requirements for Large Volume Manufacturers.

(a) *[Reserved]*

(b) *[Reserved]*

(c) *[Reserved]*

(d) *[Reserved]*

(e) *Requirements for Large Volume Manufacturers in 2018 and through 2025 Model Years.* LVMs must produce credits from ZEVs equal to minimum ZEV floor percentage requirement, as enumerated below. Manufacturers may fulfill the remaining ZEV requirement with credits from TZEVs, as enumerated below.

Model Years	Total ZEV Percent Requirement	Minimum ZEV floor	TZEVs
2018	4.5%	2.0%	2.5%
2019	7.0%	4.0%	3.0%
2020	9.5%	6.0%	3.5%
2021	12.0%	8.0%	4.0%
2022	14.5%	10.0%	4.5%
2023	17.0%	12.0%	5.0%

2024	19.5%	14.0%	5.5%
2025	22.0%	16.0%	6.0%

(f) *Requirements for Large Volume Manufacturers in Model Year 2026 and Subsequent.* In 2026 and subsequent model years, a manufacturer must meet a total ZEV credit percentage of 22%. The maximum portion of a manufacturer's credit percentage requirement that may be satisfied by TZEV credits is limited to 6% of the manufacturer's applicable California PC and LDT production volume. ZEV credits must satisfy the remainder of the manufacturer's requirement.

2.3 Requirements for Intermediate Volume Manufacturers. For 2018 and subsequent model years, an intermediate volume manufacturer may meet all of its ZEV credit percentage requirement, under subdivision C.2, with credits from TZEV.

2.4 Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers. A small volume manufacturer is not required to meet the ZEV credit percentage requirements. However, a small volume manufacturer may earn, bank, market, and trade credits for the ZEVs and TZEVs it produces and delivers for sale in California.

2.5 *[Reserved]*

2.6 *[Reserved]*

2.7 Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.

(a) *Increases in California Production Volume.* In 2018 and subsequent model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years (i.e., total production volume exceeds 13,500 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as a small volume manufacturer, and must comply with the ZEV requirements for intermediate volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (a small volume) Manufacturer A exceeds 4,500 PCs, LDTs, and MDVs for their 2018 – 2020, 2019 – 2021, and 2020 – 2022 model year averages, Manufacturer A would be subject to intermediate volume requirements starting in 2023 model year.

If an intermediate volume manufacturer's average California production volume exceeds 20,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years (i.e., total production volume exceeds 60,000 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall comply with the ZEV requirements for large volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (an intermediate volume) Manufacturer B exceeds 20,000 PCs, LDTs, and MDVs for its 2018 – 2020, 2019 – 2021, and 2020 – 2022 average, Manufacturer B would be subject to large volume manufacturer requirements starting in 2023 model year.

Any new requirement described in the this subdivision will begin with the next model year after the last model year of the third consecutive average when a manufacturer ceases to be a small or intermediate volume manufacturer in 2018 or subsequent years due to the aggregation requirements in majority ownership situations.

(b) *Decreases in California Production Volume.* If a manufacturer's average California production volume falls below 4,500 or 20,000 units of new PCs, LDT1 and 2s, and MDVs, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, for three consecutive averages, the manufacturer shall be treated as a small volume or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume or intermediate volume manufacturer beginning with the next model year. For example, if Manufacturer C falls below 20,000 PCs, LDTs, and MDVs for its 2019 – 2021, 2020 – 2022, and 2021 – 2023 averages, Manufacturer C would be subject to IVM requirements starting in 2024 model year.

(c) *Calculating California Production Volume in Change of Ownership Situations.* Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier model year. The manufacturer's small or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2019 calendar year occurs and the manufacturer is producing both 2019 and 2020 model year vehicles results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2020 model year will be based on the production volumes of Manufacturers A and B in the 2017 – 2019 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2019 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2020 model year will be based on the production volumes of Manufacturers A and C in the 2017 – 2019 model years. In either case, the lead time provisions in subdivisions 1962.2(b)(7)(A) and (B) will apply.

3. Transitional Zero Emission Vehicles (TZEV).

3.1 Introduction. This subdivision C.3 sets forth the criteria for identifying vehicles delivered for sale in California as TZEVs.

3.2 TZEV Requirements. In order for a vehicle to be eligible to receive a ZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements:

(a) *SULEV Standards.* Certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1). Bi-fuel, fuel flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV 20 or 30 exhaust emission standards when operating on both fuels. Manufacturers may certify 2018 and 2019 TZEVs to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in subdivision 1961(a)(1);

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G) . Manufacturers may certify 2018 and 2019 TZEVs to the evaporative standards for PCs and LDTs in subdivision 1976(b)(1)(E;

(c) *OBD.* Certify that the vehicle will meet the applicable on-board diagnostic requirements in sections 1968.1 or 1968.2, as applicable, for 150,000 miles; and

(d) *Extended Warranty.* Extend the performance and defects warranty period set forth in subdivisions 2037(b)(2) and 2038(b)(2) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

3.3 Allowances for TZEVs.

(a) *Zero Emission Vehicle Miles Traveled TZEV Allowance Calculation.* A vehicle that meets the requirements of subdivision C.3.2 and has zero-emission vehicle miles traveled (VMT), as defined by and calculated by this test procedure and measured as equivalent all electric range (EAER) capability will generate allowance according to the following equation:

UDDS Test Cycle Range (EAER)	*Allowance*
<10 all electric miles	0.00
≥10 miles range	TZEV Credit = [(0.01) * EAER + 0.30]
>80 miles (credit cap)	1.10

(1) Allowance for US06 Capability. TZEVs with US06 all electric range capability (AER) of at least 10 miles shall earn an additional 0.2 allowance. US06 test cycle range capability shall be determined in accordance with section E.8 of these test procedures.

(B) *[Reserved]*

(C) *[Reserved]*

(D) *[Reserved]*

(e) *Credit Hydrogen Internal Combustion Engine Vehicles.* A hydrogen internal combustion engine vehicle that meets the requirements of subdivision C.3.2 and has a total range of at least 250 UDDS miles will earn an allowance of 0.75, which may be in addition to allowances earned in subdivision C.3.3(a), and subject to an overall credit cap of 1.25

4. Qualification for Credits From ZEVs.

4.1 *[Reserved]*

4.2 *[Reserved]*

4.3 *[Reserved]*

4.4 *[Reserved]*

4.5 Credits for 2018 and Subsequent Model Years.

(a) *ZEV Credit Calculations*. Credits from a ZEV delivered for sale are based on the ZEV's UDDS all electric range, determined in accordance with these test procedures using the following equation:

ZEV Credit = (0.01) * (UDDS range) + 0.50

(1) A ZEV with less than 50 miles UDDS range will receive zero credits.

(2) Credits earned under this provision C.4.5(a) are be capped at 4 credits per ZEV.

(b) *[Reserved]*

(c) *[Reserved]*

(d) *[Reserved]*

(1) *Provisions for 2018 through 2025 Model Years.* Large volume manufacturers and intermediate volume manufacturers with credits earned from hydrogen fuel cell vehicles that are certified to the California ZEV standards applicable for the ZEV's model year, delivered for sale and placed in service in California or in a section 177 state, may be counted towards compliance in California and in all section 177 states with the percentage ZEV requirements in subdivision C.2. The credits earned are multiplied by the ratio of a manufacturer's applicable production volume for a model year, as specified in subdivision C.2.1(b), in the state receiving credit to the manufacturer's applicable production volume as specified in subdivision C.2.1(b), for the same model year in California(hereafter, "proportional value"). Credits generated from ZEV placement in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in subdivision C.4.5(a).

(2) *Optional Section 177 State Compliance Path.*

(A) *Reduced ZEV and TZEV Percentages.* Large volume manufacturers and intermediate volume manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. are allowed to meet ZEV percentage requirements and optional TZEV percentages reduced from the minimum ZEV floor percentages and TZEV percentages in subdivision C.2.2(e) in each section 177 state equal to the following percentages of their sales volume determined under subdivision 1962.2(b)(1)(B:

ZEVs

Model Year	2018	2019	2020	2021
Existing Minimum ZEV Floor	2.00%	4.00%	6.00%	8.00%
Section 177 State Adjustment for Optional Compliance Path	62.5%	75%	87.5%	100%
Minimum Section 177 State ZEV Requirement	1.25%	3.00%	5.25%	8.00%

TZEVs

Model Year	2018	2019	2020	2021
Existing TZEV Percentage	2.50%	3.00%	3.50%	4.00%
Section 177 State Adjustment for Optional Compliance Path	90.00%	100%	100%	100%
New Section 177 State TZEV Percentage	2.25%	3.00%	3.50%	4.00%

Total Percent Requirement

Model Year	2018	2019	2020	2021
New Total Section 177 State Optional Requirements	3.50%	6.00%	8.75%	12.00%

1. *Trading and Transferring ZEV and TZEV Credits within West Region Pool and East Region Pool.* Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the West Region pool to meet the same model year requirements in subdivision C.4.5(e)(2)(A) and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State X, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Y, within the West Region pool. Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the East Region pool to meet the same model year requirements in subdivision C.4.5(e)(2)(A), and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring ZEV and TZEV Credits between the West Region Pool and the East Region Pool.* Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits to meet the same model year requirements in subdivision C.4.5(e)(2)(A).a. between the West Region pool and the East Region pool; however, any credits traded will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2019 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2019 model year) credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(B) *Reporting Requirements.* On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path under subdivision 1962.1(d)(5)(E)3 shall submit, in writing, to the Executive Officer and each section 177 state a report, including an itemized list, that indicates where vehicles have been placed within the East Region pool and within the West Region pool. The itemized list shall include the following:

1. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the regional pool, as determined under subdivision C.2.1(b).

2. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV and ZEV occurred and to meet manufacturer's requirements under subdivision C.4.5(e)(2)(A).

(C) *Failure to Meet Optional Section 177 State Compliance Path Requirements.* A manufacturer that elects the optional section 177 state compliance path subdivision 1962.1(d)(5)(E)3 and does not meet the modified percentages in subdivision C.4.5(e)(2)(A) in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision C.7.7(a) in all section 177 states of the applicable pool, shall be treated as subject to the ZEV percentage requirements in section C.2 in each section 177 state. The pooling provisions in subdivision C.4.5(e)(2)(A) shall not apply. Any transfers of ZEV or TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and ZEV or TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

(D) The provisions of section C shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision C.4.5(e)(2).

(f) *NEVs.* NEVs must meet the following to be eligible for 0.15 credits:

(1) *Specifications.* A NEV earns credit when it meets all the following specifications:

(A) *Acceleration.* The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge.

(B) *Top Speed.* The vehicle has a minimum top speed of 20 mph when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

(C) *Constant Speed Range.* The vehicle has a minimum 25 mile range when operating at constant top speed with a payload of 332 pounds and starting with the battery at 100% state of charge.

(2) *Battery Requirement*. A qualifying NEV must be equipped with sealed, maintenance-free batteries.

(3) *Warranty Requirement*. A NEV drive train, including battery packs, must be covered for a period of at least 24 months. The first 6 months of the NEV warranty period must be covered by a full warranty; the remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

Prior to allowance approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

(5) *NEV Charging Requirements*. A NEV must meet charging connection standard portion of the requirements specified in subdivision 1962.3(c)(2).

(g) *BEVx.* A BEVx must meet the following in order to receive credit, based on its zero emission UDDS range, through subdivision C.4.5(a):

(1) *Emissions Requirements.* BEVxs must meet all TZEV requirements, specified in subdivision C.3.2 (a) through (d).

(2) *APU Operation.* The vehicle's UDDS range after the APU first starts and enters "charge sustaining hybrid operation" must be less than or equal to the vehicle's UDDS all-electric test range prior to APU start. The vehicle's APU cannot start under any user-selectable driving mode unless the energy storage system used for traction power is fully depleted.

(3) *Minimum Zero Emission Range Requirements.* BEVxs must have a minimum of 75 miles UDDS zero emission range.

5. [Reserved]

6. [Reserved]

7. Generation and Use of ZEV Credits; Calculation of Penalties

7.1 Introduction. A manufacturer that produces and delivers for sale in California ZEVs or TZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in subdivision C.2 shall earn ZEV credits in accordance with this subdivision C.2.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs*. The amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements, or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A) for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year.

(b) *Credits from TZEVs.* The amount of credits earned by a manufacturer in a given model year from TZEVs shall be expressed in units of credits, and shall be equal to the total number of TZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement, or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A) for the model year subtracted from the total number of ZEV allowances from TZEVs produced and delivered for sale in California by the manufacturer in the model year.

(c) *Separate Credit Accounts.* Credits from a manufacturer's ZEVs, BEVxs, TZEVs, and NEVs shall each be maintained in separate accounts.

(d) *Rounding Credits.* ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

7.3 ZEV Credits for MDVs and LDTs Other Than LDT1s. Credits from ZEVs and TZEVs classified as MDVs, may be counted toward the ZEV requirement for PCs and LDTs, and included in the calculation of ZEV credits as specified in this subdivision C.7 if the manufacturer so specifies.

7.4 ZEV Credits for Advanced Technology Demonstration Programs.

(a) *[Reserved]*

(b) *ZEVs.* ZEVs, including BEVxs, excluding NEVs, placed in a small or intermediate volume manufacturer's California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if the vehicle is not "delivered for sale" or registered with the California DMV. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for 50 percent or more of the first two years of placement the vehicle will be operated in California. Such a vehicle is eligible to receive the same credit that it would have earned if delivered for sale, and for fuel cell vehicles, placed in service. To determine vehicle credit, the model year designation for a demonstration vehicle shall be consistent with the model year designation for conventional vehicles placed in the same timeframe. Manufacturers may earn credit for up to 25 vehicles per model, per section 177 state, per year under this

7.5 ZEV Credits for Transportation Systems.

(a) *[Reserved]*

(b) *[Reserved]*

(c) *Cap on Use of Transportation System Credits.*

(1) *ZEVs.* Transportation system credits earned or allocated by ZEVs or BEVxs pursuant to subdivision 1962.1(g)(5), not including any credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in subdivision C.2.2(e) , or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A).

(2) *TZEVs*. Transportation system credits earned or allocated by TZEVs pursuant to subdivision 1962.1(g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of the portion of a manufacturer's ZEV obligation that may be met with TZEVs or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision C.4.5(e)(2)(A) in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

7.6 Use of ZEV Credits. A manufacturer may meet the ZEV requirements in a given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision C.2. Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category, except for discounted PZEV and AT PZEV credits. For example, credits produced from TZEVs may be used to comply with the portion of the requirement that may be met with credits from TZEV, but not with the portion that must be satisfied with credits from ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(a) *Use of Discounted PZEV and AT PZEV Credits and NEV Credits.* For model years 2018 through 2025, discounted PZEV and AT PZEV credits, and NEV credits may be used to satisfy up to one-quarter of the portion of a manufacturer's requirement that can be met with credits from TZEVs or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision C.4.5(e)(2)(A). Intermediate volume manufacturers may fulfill their entire requirement with discounted PZEV and AT PZEV credits, and NEV credits in model years 2018 and 2019. These credits may be earned previously by the manufacturer or acquired from another party. Discounted PZEV and AT PZEV credits may no longer be used after model year 2025 compliance.

(b) *Use of BEVx Credits.* BEVx credits may be used to satisfy up to 50% of the portion of a manufacturer's requirement that must be met with ZEV credits.

(c) *GHG-ZEV Over Compliance Credits.*

(1) *Application***.** Manufacturers may apply to the Executive Officer, no later than December 31, 2016, to be eligible for this subdivision C.7.6(c), based on the following qualifications:

(A) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with sections 1961.1 and 1961.3, and

(B) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with section 1962.1, and

(C) A manufacturer must submit documentation of its projected product plans to show over compliance with the manufacturer's section 1961.3 requirements by at least 2.0 gCO_2/mile in each model year through the entire 2018 through 2021 model year period.

(2) *Credit Generation and Calculation.* Manufacturers must calculate their over compliance with section 1961.3 requirements for model years 2018 through 2021 based on compliance with the previous model year standard. For example, to generate credits for this subdivision C.7.6(c) for model year 2018, manufacturers would calculate credits based on model year 2017 compliance with section 1961.3.

(A) At least 2.0 gCO_2/mile over compliance with section 1961.3 is required in each year and the following equation must be used to calculate the amount of ZEV credits earned for purposes of this subdivision C.7.6(c):

[(Manufacturer US PC and LDT Sales) x (gCO_2/mile below manufacturer GHG standard for a given model year)] / (Manufacturer GHG standard for a given model year)

(B) Credits earned under section 1961.3(a)(9) may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A).

(C) Banked gCO_2/mile credits earned under 1961.1 and 1961.3

from previous model years or from other manufacturers may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A).

(3) *Use of GHG-ZEV Over Compliance Credits*. A manufacturer may use no more than the percentage enumerated in the table below to meet either the total ZEV requirement nor the portion of their ZEV requirement that must be met with ZEV credits, with credits earned under this subdivision C.7.6(c).

2018	**2019**	**2020**	**2021**
50%	50%	40%	30%

Credits earned in any given model year under this subdivision C.7.6(c) may only be used in the applicable model year and may not be used in any other model year.

Credits calculated under this provision must also be removed from the GHG compliance bank, and cannot be banked for future compliance toward section 1961.3.

(4) *Reporting Requirements.* Annually, manufacturers are required to submit calculations of credits for this subdivision C.7.6(c) for the model year, any remaining credits/debits from previous model years under 1961.3, and projected credits/debits for future years through 2021 under 1961.3 and this subdivision C.7.6(c).

If a manufacturer, who has been granted the ability to generate credits under this subdivision C.7.6(c), fails to over comply by at least 2.0 gCO_2/mile in any one year, the manufacturer will be subject to the full ZEV requirements for the model year and future model years, and will not be able to earn credits for any other model year under this subdivision C.7.6(c).

(5) If the Executive Officer does not make a determination that a Federal greenhouse gas fleet standard is functionally equivalent to subdivision 1961.3, than this subdivision C.7.6(c)(1) through (4) is unavailable for use by any manufacturer.

7.7 Requirement to Make Up a ZEV Deficit.

(a) *General*. A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by [i] adding the number of credits from ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of credits from TZEVs produced and delivered for sale in California by the manufacturer for the model year (for a LVM, not to exceed that permitted under subdivision C.2.2), and [ii] subtracting that total from the number of credits required to be produced and delivered for sale in California by the manufacturer for the model year. BEVx, TZEV, NEV, or converted AT PZEV and PZEV credits are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

7.8 ***Penalty for Failure to Meet ZEV Requirements.*** Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs and submit an appropriate amount of credits and does not make up ZEV deficits within the specified time allowed by subdivision C.7.7(a) shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficit is not balanced by the end of the specified time allowed by subdivision 1962.2(g)(7)(A). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the nearest 1/100th, calculated according to the following equation, provided that the percentage of a manufacturer's ZEV requirement for a given model year that may be satisfied with TZEVs or credit from such vehicles may not exceed the percentages permitted under subdivision C.2.2::

(No. of ZEV credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

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

9. Public Disclosure. Records in the Board's possession for the vehicles subject to the requirements of section C shall be subject to disclosure as public records as follows:

(a) Each manufacturer's annual production data and the corresponding credits per vehicle earned for ZEVs (including ZEV type), TZEVs, AT PZEVs, and PZEVs for the 2018 and subsequent model years; and

(b) Each manufacturer’s annual credit balances for 2018 and subsequent years for:

(1) Each type of vehicle: ZEVs (minus NEVs), BEVx, NEV, TZEV, and discounted AT PZEV and PZEV credits; and

(2) Advanced technology demonstration programs; and

(3) Transportation systems; and

(4) Credits earned under section C.4.4(c), including credits acquired from, or transferred to another party, and the parties themselves.

D. Certification Requirements.

1. Durability and Emission Testing Requirements. All ZEVs, excluding Type I.5x and Type IIx vehicles, are exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

2. Information Requirements: Application for Certification. Except as noted below, the Part I (40 CFR §86.1843-01(c)) certification application shall include the following:

2.1 Identification and description of the vehicle(s) covered by the application.

2.2 Identification of the vehicle weight category to which the vehicle is certifying: PC, LDT 0-3750 lbs. LVW, LDT 3751-5750 lbs. LVW, LDT 3751 lbs. LVW - 8500 lbs. GVW, or MDV (state test weight range), and the curb weight and gross vehicle weight rating of the vehicle.

2.3 Identification and description of the propulsion system for the vehicle.

2.4 Identification and description of the climate control system used on the vehicle.

2.5 Projected number of vehicles produced and delivered for sale in California, and projected California sales.

2.6 Identification of the energy usage in kilowatt-hours per mile from:

(a) the battery output (DC energy) (to be submitted with the Part II certification application (40 CFR §86.1843-01(d));

(b) the point when electricity is introduced from the electrical outlet (AC energy); and

(c) the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test set forth in section F, below. For off-vehicle charge capable hybrid electric vehicles certifying to section G, the manufacturer shall provide the energy usage in kilowatt hours per mile from the Urban Equivalent All-Electric Range and the Highway Equivalent All-Electric Range.

2.7 For those vehicles that use fuel-fired heaters, the manufacturer shall provide:

(a) a description of the control system logic of the fuel-fired heater, including an evaluation of the conditions under which the fuel-fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist;

(b) the exhaust emissions value per mile produced by the auxiliary fuel-fired heater operated between 68°F and 86°F; and

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

2.8 All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel.

2.9 Method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

2.10 Battery specific energy data and calculations as specified in section F.4 of these procedures including the weight of the battery system and the three hour discharge rate (C/3) energy capacity.

2.11 Vehicle and battery break-in period, and the method used to determine them, as specified in sections F.2 and G.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in section 1965, title 13, CCR and the "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" (incorporated by reference therein).

2.13 For a ZEV, extended range HEV or PZEV that qualifies to receive one or more multipliers under sections C.3 - C.7, the manufacturer shall provide all information relevant to the vehicle's qualification for, and the estimated value of, the multiplier(s). The Executive Officer may request additional information needed to appropriately characterize the vehicle. Based on the submitted information and other relevant data, the Executive Officer shall assign to the vehicle the highest multiplier(s) for which the manufacturer has demonstrated the vehicle qualifies at that time.

2.14 When a manufacturer plans to require any scheduled maintenance for a PZEV before 150,000 miles, the manufacturer must submit information demonstrating the need for each scheduled maintenance item before 150,000 miles, including actual in-use data, engineering evaluation of the durability of the part, or other relevant information. The manufacturer may require such maintenance for a PZEV only upon the Executive Officer's determination, prior to certification, the manufacturer has demonstrated the need for the scheduled maintenance; this determination may not unreasonably be denied.

2.15 For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the Urban Charge Depleting Cycle Range, the Urban Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Urban

Range, the Highway Charge Depleting Cycle Range, the Highway Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Highway Range, the Urban Equivalent All-Electric Range, the Highway Equivalent All-Electric Range, the Urban Electric Range Fraction, and the Highway Electric Range Fraction.

3. ZEV Reporting Requirements. In order to verify the status of each manufacturer's compliance with the ZEV requirements for a given calendar year, each manufacturer shall submit a report to the Executive Officer at least annually, by May 1 of the calendar year following the close of the model year, that identifies the necessary delivery and placement data of all vehicles generating ZEV credits or allowances, and all transfers and acquisitions of ZEV credits. The manufacturer may update the report by September 1 to cover activities occurring between April 1 and June 30. If a manufacturer updates their annual California production numbers in their ZEV report, the annual NMOG production must also be updated.

E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

The acceleration and constant speed range for a NEV shall be determined as specified in “Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure,” ETA-NTP002 Revision 3, December 2004, and “Electric Vehicle Constant Speed Range Tests,” ETA-NTP004 Revision 3, February 1, 2008.

F. Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2018 and Subsequent Model Hybrid-Electric Vehicles, Except Off-Vehicle Charge Capable Hybrid Electric Vehicles.

The "as adopted or amended dates" of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." Unless otherwise noted, these requirements shall apply to all ZEVs (including fuel cell vehicles and hybrid fuel cell vehicles) and all HEVs, except off-vehicle charge capable HEVs.

1. Electric Dynamometer. All ZEVs and HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

2. 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 section D.2.11 above.

3. All-Electric Range Test for Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles). All 2012 and subsequent ZEVs shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of the ZEV.

3.1 **Determination of Urban All-Electric Range for Zero-Emission Vehicles.**

3.1.1 **Determination of Urban All-Electric Range for Battery Electric Vehicles.**

(a) **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I [July 13, 2005], which is incorporated herein by reference. A 10-minute soak shall follow each UDDS.

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the UDDS, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR §86.115-00(b)(1) and (2) [October 22, 1996]. The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the UDDS or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first.

3.1.2 **Determination of Urban All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The urban all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the urban all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F.3.1.1 above.

3.2 **Determination of Highway All-Electric Range for Zero-Emission Vehicles and Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

3.2.1 **Determination of Highway All-Electric Range for Battery Electric Vehicles.**

(a) **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be either placed or pushed onto a dynamometer and operated through Continuous Highway Test Schedules of the Highway Fuel Economy Driving Schedule (HFEDS).

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the HFEDS, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR §86.115-00(b)(1) and (2) [October 22, 1996]. The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the HFEDS or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first.

(e) NEVs are exempt from the all-electric range highway test.

3.2.2 **Determination of Highway All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the highway all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F.3.2.1 above.

3.3 **Recording requirements.**

For all battery electric vehicles and hybrid electric vehicles, except off-vehicle charge capable hybrid electric vehicles: Once the vehicle is no longer able to maintain the speed and time requirements specified in F.3.1 or F.3.2 above, the vehicle shall be brought to an immediate stop and the following data shall be recorded:

(a) mileage accumulated during the All-Electric Range Test;
(b) Net DC energy from the battery that was expended during the All-Electric Range Test (may be reported as the total DC battery energy output and the total DC battery energy input during the All-Electric Range Test);
(c) AC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the electric outlet to the battery charger;
(d) DC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the battery charger to the battery; and
(e) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.4 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in F.3.1 or F.3.2 shall not be exceeded due to the operation of the regenerative braking system.

3.5 **Measurement Accuracy**. For battery electric vehicles, the overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.6 **Watt Hour Calculation for Battery Electric Vehicles.**

DC energy (watt-hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Where v = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Where v = AC instantaneous voltage
i = AC instantaneous current

3.7 **Charger Requirements for Battery Electric Vehicles.**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. Determination of Battery Specific Energy for ZEVs.

Determine the specific energy of batteries used to power a ZEV in accordance with the U.S. Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in the Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

5. Determination of the Emissions of the Fuel-fired Heater for Vehicles Other Than ZEVs.

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68^{o}F and 86^{o}F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile to obtain a grams per mile value.

6. Urban Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

6.1 Vehicle Preconditioning.

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" with the following supplemental requirements:

6.1.1 For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

6.1.2 For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the UDDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the UDDS, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in urban driving conditions.

6.1.3 After setting battery state-of-charge, 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.1.4. of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

6.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours. After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

6.1.5 Within five minutes of completing preconditioning drive, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-sustaining over the UDDS, then set battery state-of-charge to a level such that the SOC criterion in section G.10 would be satisfied for the dynamometer procedure (section F.6.2 of these procedures). If off-vehicle charging is required to increase battery state-of-charge for proper setting, off-vehicle charging shall occur during the second soak period of 12 to 36 hours.

(ii) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-depleting over the UDDS, then no battery state-of-charge adjustment is permissible.

(iii) If the hybrid electric vehicle does allow manual activation of the auxiliary power unit, then set battery state-of-charge to manufacturer recommended level for activating the auxiliary power unit when the hybrid electric vehicle is operating in urban driving conditions.

6.2 Urban Dynamometer Procedure for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.2.1 Amend subparagraph (a).

Overview. The dynamometer run shall consist of two tests, a “cold” start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” and a “hot” start test following the “cold” start test by 10 minutes. Vehicle startup (with all accessories turned off), operation over the UDDS and vehicle shutdown make a complete cold start test. Vehicle startup and operation over the UDDS and vehicle shutdown make a complete hot start test.

For all UDDS tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. Four particulate samples are collected on filters for weighing; the first sample plus backup is collected during the cold start test (including shutdown); the second sample plus backup is collected during the hot start test (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles that are not "off-vehicle charge capable," and are equipped with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with alcohol-fueled auxiliary power units, alcohol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

6.2.2 Subparagraphs (b) through (c). [No change.]

6.2.3 Subparagraph (d). [No change.]

6.2.4 Subparagraphs (e) through (g). [No change.]

6.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the cold start test and hot start test. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

6.2.6 Subparagraph (i). [No change.]

6.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

6.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of two tests, a "cold" start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" and a "hot" start test following the cold start test by 10 minutes. The complete dynamometer test consists of a cold start drive of 7.5 miles (12.1 km) and a hot start drive of 7.5 miles (12.1 km). The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The vehicle is allowed to stand on the dynamometer during the 10 minute time period between each test.

6.3.2 Amend subparagraph (b) as follows.

6.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample (turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, start particulate sample pump No. 1, and record both gas meter or flow measurement instrument readings, if applicable), and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

6.3.2.2 Delete subparagraph (b)(13).

6.3.2.3 Amend subparagraph (b)(14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 1 and if applicable, turn off the hydrocarbon integrator No. 1, mark the hydrocarbon recorder chart, turn off the No. 1 particulate sample pump and close the valves isolating particulate filter No. 1, and position the sample selector valves to the “standby” position. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain alcohol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the alcohol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4□C to 10□C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start test. The step in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

6.3.2.6 Delete subparagraph (b)(19).

6.3.2.7 Delete subparagraph (b)(20).

6.3.2.8 Amend subparagraph (b)(21): As soon as possible, and in no case longer than one hour after the end of the hot start phase of the test, transfer the four particulate filters to the weighing chamber for post-test conditioning, if applicable. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the UDDS, a valid test shall satisfy the SOC criterion in section G.10.

6.3.2.9 Amend subparagraph (b)(24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

6.4 Calculations - Exhaust Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

(1) 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.

(2) Y_c = Mass emissions as calculated from the cold start test, in grams per test.

(3) Y_h = Mass emissions as calculated from the hot start test, in grams per test.

(4) D_c = The measured driving distance from the cold start test, in miles.

(5) D_h = The measured driving distance from the hot start test, in miles.

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

6.5 Calculations - Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.5.1 Amend subparagraph (a): The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:

(1) M_{pc} = Mass of particulate determined from the cold start test, in grams per vehicle mile. (See §86.110-94 for determination.)

(2) M_{ph} = Mass of particulate determined from the hot start test, in grams per vehicle mile. (See §86.110-94 for determination.)

(3) D_c = The measured driving distance from the cold start test, in miles.

(4) D_h = The measured driving distance from the hot start test, in miles.

6.5.2 Subparagraph (b). [No change.]

7. Highway Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions.

7.1 Subparagraph (a). [not applicable - delete]

7.2 Amend subparagraph (b) as follows:

7.2.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO,

CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

7.2.2 Amend subparagraph (b)(7)(i): The dynamometer procedure shall consist of two cycles of the Highway Fuel Economy Driving Schedule (§600.109(b)) separated by 15 seconds of idle. The first cycle of the Highway Fuel Economy Driving Schedule is driven to precondition the test vehicle and the second is driven for the fuel economy measurement.

7.2.3 Amend subparagraph (b)(7)(iii): Only one exhaust sample and one background sample shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

7.2.4 Add subparagraph(b)(7)(v): For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the HFEDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the HFEDs, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions.

7.2.5 Amend subparagraph (b)(9)(v): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

7.2.6 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed at the end of the HFEDS preconditioning cycle, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. Reset and enable the roll revolution counter. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.2.7 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). A total of three highway emission tests shall be allowed to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the emission test is completed.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the emission test is completed.

7.2.8 Delete subparagraph (b)(10).

7.3 Delete subparagraphs (c) through (e).

8. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.1.1 Subparagraphs (a) through (m). [No change.]

8.1.2 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning.

8.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at according to the following conditions:

If the hybrid electric vehicle is charge-sustaining over the US06, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

If the hybrid electric vehicle is charge-depleting over the US06, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

8.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

8.1.2.2 Subparagraph (2). [No change.]

8.1.3 Subparagraph (o). [No change.]

8.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions.

8.2.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section F.9.

8.2.2 Amend subparagraph (b) as follows.

8.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.2.3 Subparagraph (c). [No change.]

8.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

8.2.5 Subparagraph (e). [No change.]

8.2.6 Amend subparagraph (f) as follows.

8.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the US06 preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the US06, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

8.2.6.2 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the US06, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i) without the preconditioning cycle. A total of three US06 emission tests shall be allowed to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

8.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.3.1 Subparagraphs (a) through (n). [No change.]

8.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

8.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

If the hybrid electric vehicle is charge-sustaining over the SC03, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

If the hybrid electric vehicle is charge-depleting over the SC03, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

8.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

8.3.2.2 Subparagraphs (2) through (3). [No change.]

8.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions.

8.4.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulate testing in an environmental test cell (see §86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95^{o}F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.~~-~~9.

8.4.2 Amend subparagraph (b) as follows.

8.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c) as follows.

8.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.4 Amend subparagraph (d) as follows.

8.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then turn off the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the SC03, turn off the vehicle two seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

8.4.5 Subparagraph (e). [No change.]

9. State-of-Charge Net Change Tolerances for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Capable Hybrid Electric Vehicles.

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

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

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

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 Air Resources Board.

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

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

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

Where:

$(V_{final})_{max}$	=	The stored capacitor voltage allowed at the end of the test
$(V_{final})_{min}$	=	The 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

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

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

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

Where:

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

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

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

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

G. Test Procedures for 2018 and Subsequent Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

The “as adopted or amended dates” of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” unless otherwise noted.

1. Electric Dynamometer.

All off-vehicle charge capable HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

2. 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 section D.2.11 above.

3. General Testing Requirements.

3.1 Recording requirements.

For off-vehicle charge capable hybrid electric vehicles: The following data shall be recorded for all tests and for each individual test cycle therein, except for the 20^{o}F and 50^{o}F tests, conducted in accordance with section G.8:

(a) mileage accumulated during the All-Electric Range portion of the test, where applicable;
(b) Net DC energy from the battery that was expended during the test (may be reported as the total DC battery energy output and the total DC battery energy input);
(c) AC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the electric outlet to the battery charger;
(d) DC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the battery charger to the battery;
(e) Net DC amp-hrs from the battery that was expended during the test (may be reported as the total DC amp-hrs output and the total DC amp-hrs input); and
(f) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

3.2 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in this section G shall not be exceeded due to the operation of the regenerative braking system.

3.3 **Measurement Accuracy**. The overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.4 **Watt Hour Calculation.**

DC energy (watt hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.5 **Charger Requirements**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. Determination of the Emissions of the Fuel-fired Heater.

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68^{o}F and 86^{o}F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile to obtain a grams per mile value.

5. Urban Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

The criteria certification emissions for the Urban test shall be the worst case emissions of NMOG, CO, NOx, and PM from either the charge depleting or charge sustaining tests. The sum of NMOG + NOx emissions shall constitute the worst case for the urban charge sustaining or charge depleting modes of operation.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

5.1 Vehicle Preconditioning.

To be conducted pursuant to the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” with the following supplemental requirements:

5.1.1 For vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

5.1.2 For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

5.1.3 After setting battery state-of-charge, the vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4 of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

5.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours.

5.1.5 After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned.

5.1.6 If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

5.1.7 For the charge depleting range test and the charge sustaining emission test, the preconditioning cycle shall be the UDDS. The vehicle must be in charge sustaining operation during the preconditioning drive. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start to the end of the two consecutive UDDSs. As an option, charge sustaining operation can be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. The vehicle must meet the SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Alternative procedures may be used to determine charge sustain operation for the precondition drive if the alternate procedure demonstrates charge sustaining operation based on section ~~F~~G.10 and is approved in advance by the Executive Officer of the Air Resources Board.

5.1.8 A fuel drain and fill shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.1.9 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 2001 and Subsequent Model Motor Vehicles."

5.1.10 For the urban charge depleting range test, the highway charge depleting range test, and the cold start US06 range test, charge the vehicle to full state-of-charge as specified by the vehicle manufacturer. The vehicle must be turned off during charging and charge time shall not exceed soak time.

5.2 Urban Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.2.1 Amend subparagraph (a).

Overview. The charge depleting range test dynamometer run shall consist of a series of charge depleting UDDSs, each followed by a 10 minute key-off hot soak period until charge sustaining operation is achieved for two consecutive UDDSs. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS. As an option, charge sustaining operation may be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. To determine charge sustaining operation, in this case, the vehicle shall meet SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Emissions are measured for all UDDSs when the auxiliary power unit is operating.

The vehicle shall be turned off and stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. At the end of this cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

The charge sustaining emission test dynamometer run shall consist of two consecutive UDDSs with a 10 minute key-off hot soak in between. Vehicle emissions shall be measured over two UDDSs during charge sustaining operation, and the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS.

Vehicle charging shall be initiated within three hours after either the charge depleting range test or the charge sustaining emission test pursuant to section G.5.4.2 or G.5.4.3, as applicable. During charging, all requirements in section G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

For all exhaust emission tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. For UDDSs, particulate samples are collected on filters for weighing during each UDDS. Each sample plus backup is collected during each UDDS (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each UDDS. For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For vehicles with alcohol-fueled auxiliary power units, alcohol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

5.2.2 Subparagraphs (b) through (c). [No change.]

5.2.3 Subparagraph (d). [No change.]

5.2.4 Subparagraphs (e) through (g). [No change.]

5.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for all charge depleting and exhaust emission tests. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

5.2.6 Subparagraph (i). [No change.]

5.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

5.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of a series of UDDSs, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles." The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The vehicle is allowed to stand on the dynamometer during the 10 minute time period between each UDDS.

5.3.2 Amend subparagraph (b) as follows.

5.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample, and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

5.3.2.2 Delete subparagraph (b)(13).

5.3.2.3 Subparagraph (b)(14). [No change.]

5.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off the gas flow measuring device and particulate sample pump. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the UDDS. Obtain alcohol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the alcohol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4°C to 10°C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

5.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start UDDS. The steps in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start UDDS.

5.3.2.6 Delete subparagraph (b)(19).

5.3.2.7 Delete subparagraph (b)(20).

5.3.2.8 Amend subparagraph (b)(21): As soon as possible, transfer the particulate filters to the weighing chamber for post-test conditioning, if applicable. For vehicles undergoing a cold start charge sustaining test, a valid test shall satisfy the SOC criterion in section ~~F~~G.10.

5.3.2.9 Amend subparagraph (b)(24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.4 Determination of Urban All-Electric Range and Urban Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

5.4.1 The **Urban All-Electric Range** shall be shall be defined as the distance that the vehicle is driven from the start of Urban Charge Depleting Range Test until the internal combustion engine first starts.

5.4.2 **Urban Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned according to G.5.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.

The Alternative Continuous Urban Test Schedule may be substituted for the Continuous Urban Test Schedule if the test facility is unable to perform the Continuous Urban Test Schedule. Refer to sections G.5.5, G.5.6, and G.11, for calculations of urban exhaust emissions, urban particulate emissions, and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after either the charge depleting range test or the charge sustaining emission test, and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

5.4.3 **Urban Charge Sustaining Emission Test.** The Urban Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

(i) **Vehicle preconditioning.** If the Urban Charge Sustaining Emission Test is performed within 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9. If the Urban Charge Sustaining Emission Test is performed more than 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1, except for vehicle charging. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and two UDDSs shall be performed during charge sustaining operation, each separated by a 10 minute key-off hot soak period. The vehicle must meet the SOC criterion in section G.10 from the start of the first UDDS until the end of the second UDDS. If the SOC criterion is not satisfied, the test shall be stopped, the vehicle cold soak shall be conducted again, and the dynamometer test run shall be conducted again.

(iii) **Vehicle charging after testing.** If the vehicle was not charged after the Urban Charge Depleting Range Test, then vehicle charging shall begin within three hours after the Urban Charge Sustaining Emission Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all requirements in G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

5.5 Calculations - Urban Exhaust Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

5.5.1 Amend subparagraph (a):

Gaseous Emissions – Urban Charge Depleting Range Test.

For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43*\left(\frac{Y_c}{D_c}\right) + 0.57*\left(\frac{\Sigma Y_n}{\Sigma D_n}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NOx, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Gaseous Emissions – Urban Charge Sustaining Emission Test.

For light-duty vehicles and light-duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

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_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

Y_h = Mass emissions as calculated from the hot start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

D_h = The measured driving distance from the hot start UDDS, in miles.

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

5.6 Calculations - Urban Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.6.1 Amend subparagraph (a):

Particulate Emissions – Urban Charge Depleting Range Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{\Sigma M_{pn}}{\Sigma D_n}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Particulate Emissions – Urban Charge Sustaining Emission Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

M_{ph} = Mass of particulate determined from the hot start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

D_c = The measured driving distance from the cold start UDDS, in miles.

D_h = The measured driving distance from the hot start UDDS, in miles.

5.6.2 Subparagraph (b). [No change.]

5.6.3 **Equivalent All-Electric Range** shall be calculated in accordance with section G.11 of these test procedures.

6. Highway Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

The third emission test HFEDS of the Highway Charge Sustaining Test shall be used to calculate highway NOx emissions and must be within the SOC criterion in section G.10. As an option, the manufacturer may perform the Highway Charge Sustaining Test with two emission test HFEDSs provided that the second HFEDS meets the SOC criterion in section G.10. In this case, the second HFEDS shall be used to calculate emissions.

Highway NOx emissions may be determined from the HFEDS in the Highway Charge Depleting Range Test that demonstrates charge sustaining operation.

6.1 Vehicle Preconditioning.

If the Highway Charge Depleting Range Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to sections G.5.1.9 through G.5.1.10, without canister preconditioning. If the Highway Charge Depleting Range Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to section G.5.1, without canister preconditioning. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

If the Highway Charge Sustaining Emission Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1.9 without canister preconditioning. If the Highway Charge Sustaining Emissions Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1 without canister precondition and vehicle charging. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

6.2 Highway Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions. This section G.6.2 shall apply during both charge sustaining and charge depleting operation.

6.2.1 Subparagraph (a). [n/a]

6.2.2 Amend subparagraph (b) as follows:

6.2.2.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO, CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

6.2.2.2 Replace subparagraph (b)(6) with: Cold soak: The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

6.2.2.3 Amend subparagraph (b)(7)(i): The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section G.10 for the third emission measurement HFEDS. As an option the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second emission measurement HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section G.6.2.2.2.

6.2.2.4 Amend subparagraph (b)(7)(iii): One exhaust sample and one background sample per each HFEDS shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

6.2.2.5 Add subparagraph (b)(7)(v): For vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

6.2.2.6 Amend subparagraph (b)(9)(v): Operate the vehicle over the continuous highway test schedule, consisting of repeated HFEDSs according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

6.2.2.7 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed between each HFEDS, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. During the idle period, one of the following conditions shall apply:

(a) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on during the idle period.

(b) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

6.2.2.8 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, the following conditions shall apply: For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC criterion in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). Up to three highway emission tests shall be allowed to satisfy the SOC criterion.

6.2.2.9 Delete subparagraph (b)(10).

6.2.3 Delete subparagraphs (c) through (e).

6.3 Determination of Highway All-Electric Range and Highway Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

6.3.1 The **Highway All-Electric Range** shall be defined as the distance that the vehicle is driven from the start of test until the internal combustion engine starts.

6.3.2 **Highway Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Highway Test Schedule until the State–of-Charge Net Change Tolerances (specified in section G.10 of these test procedures) that indicate charge sustaining operation is met for one HFEDS. The Alternative Continuous Highway Test Schedule may be substituted for the Continuous Highway Test Schedule if the test facility is unable to perform the Continuous Highway Test Schedule. Refer to section G.11, for calculations of highway exhaust emissions and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after the Highway Charge Depleting Range Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in section G.3 must be met, and energy consumption shall be calculated according to the requirements in section G.11.7. If the manufacturer provides supplemental data demonstrating that the energy required to charge the vehicle from highway charge sustaining operation to full charge is equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from urban charge sustaining operation to full charge, then the energy required to charge the vehicle from urban charge sustaining operation to full charge may be used to determine highway energy consumption pursuant to section G.11.7. Data shall be approved in advance by the Executive Officer of the Air Resources Board.

6.3.3 **Highway Charge Sustaining Emission Test.** The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed:

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section G.10 for the third emission measurement HFEDS. As an option, the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section G.6.3.3.

6.3.4 **Equivalent All-Electric Range** shall be calculated in accordance with section G.11 of these test procedures.

7. SFTP Emission Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

7.1 US06 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section G.1 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.1.1 Subparagraphs (a) through (m). [No change.]

7.1.2 Amend subparagraph (n) *Aggressive Driving Test (US06) Preconditioning*. as follows:

7.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

7.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

7.1.2.2 Subparagraph (2). [No change.]

7.1.3 Subparagraph (o). [No change.]

7.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions. This section 7.2 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.2.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The vehicle is preconditioned in accordance with §86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section G.10.

7.2.2 Amend subparagraph (b) as follows.

7.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.2.3 Subparagraph (c). [No change.]

7.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

7.2.5 Subparagraph (e). [No change.]

7.2.6 Amend subparagraph (f) as follows.

7.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.2.6.2 Amend subparagraph (f)(2)(ix): At the completion of the test US06 cycle, determine if the SOC criterion in section G.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (f)(2)(i), without the preconditioning cycle. Up to three US06 emission tests shall be allowed to satisfy the SOC criterion. The idle period between multiple test cycles shall not to be less than one minute and not greater than two minutes. For the final test cycle, turn off the vehicle two seconds after the end of the last deceleration. During the idle period between multiple test cycles, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section 7.3 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.3.1 Subparagraphs (a) through (n). [No change.]

7.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

7.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission urban, highway, or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

7.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

7.3.2.2 Subparagraphs (2) through (3). [No change.]

7.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions. This section 7.4 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed. References to §86.162-03 shall mean §86.162-03 as adopted October 22, 1996.

7.4.1 Amend subparagraph (a): *Overview*. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulate testing in an environmental test cell (see §86.162-03 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95^{o}F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of §86.136-90 (engine starting and restarting). For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section G.10.

7.4.2 Amend subparagraph (b) as follows.

7.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.4.3 Amend subparagraph (c) as follows.

7.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

7.4.4 Amend subparagraph (d) as follows.

7.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03 test, record the battery state-of-charge to determine if the SOC criterion in section G.10 is satisfied. If the SOC criterion is not satisfied , then turn off the engine and the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

7.4.5 Subparagraph (e). [No change.]

7.5 Optional Cold Start US06 Range Test.

7.5.1 **Cold soak and vehicle charging.** The vehicle shall be stored at an ambient temperature not less than 68^{o}F (20^{o}C) and not more than 86^{o}F (30^{o}C) for 12 to 36 hours. During this time, the vehicle battery shall be charged to a full state-of-charge. The vehicle must be turned off during charging. Charge time shall not exceed soak time.

7.5.2 At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and shall be driven on a continuous US06 test cycle until either:

(a) the auxiliary power unit starts, or
(b) the vehicle can no longer meet the speed trace limits of the US06 driving schedule as specified in CFR 86 Appendix I to within 2 mph higher than the highest point on the trace within 1 second for the upper limit or within 2 mph lower than the lowest point on the trace within 1 second for the lower limit.

When either of these conditions is met, the test shall be ended. The range for this test, in miles, shall be the distant driven from the start of the test to when condition (a) or (b) is met. Emission sampling is not required for this test.

8. 50^{o}F and 20^{o}F Test Provision for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

50 ^{o}F testing shall be conducted pursuant to section ~~F~~G.5 with the modifications in Part II, Section C of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles" and the additional following revisions.

20 ^{o}F testing shall be conducted pursuant to section G.5 and shall include the temperature provisions in 40 CFR Part 86 Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

For 50 ^{o}F and 20 ^{o}F charge depleting testing, vehicle charging, prior to emissions testing, shall be performed during the soak period at 50 ^{o}F and 20 ^{o}F, respectively.

8.1 To satisfy test requirements for the 50^{o}F emission test, the vehicle shall be tested in the worst case (NMOG + NOx) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. To satisfy test requirements for the 20^{o}F emission test, the vehicle shall be tested in the worst case (CO) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. For the 20^{o}F and 50^{o}F emission tests, the vehicle is not required to meet SOC net tolerances.

8.2 If the worst case for emissions is charge sustaining operation, the vehicle shall be preconditioned, and 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 UDDS, phase two as 506 seconds to the end of the UDDS, a 10 minute key-off soak period, and phase three the first 505 seconds of the UDDS. The first two phases test shall be counted as the first UDDS and the second and third phases will constitute the second UDDS. 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, a 10 minute key-off soak period, and phase two as a UDDS. Emission weighting for the four phase test will follow the procedure outlined in section G.5.5.1.

8.3 If measurement of worst case emissions requires the urban charge depleting range test to be performed, the vehicle shall be preconditioned and fully charged. The continuous urban test schedule shall then be performed. The UDDS, in which the auxiliary power unit first starts, shall be the cold UDDS. Emissions shall be sampled according to one of the options in section G.8.2. For the three phase test option, if the auxiliary power unit starts in phase two of the UDDS, phase one emissions are considered zero for emission calculation purposes. Emissions are weighted according to section G.8.2.

9. Additional Provisions.

9.1 Confirmatory testing may be performed on all tests to establish if higher emissions occur at different states-of-charge in charge depleting mode. This is to ensure that cold start and other emissions standards are not exceeded at other operating SOCs.

9.2 Confirmatory testing may be performed on the US06 test or the manufacturer may provide data to show that potential cold start off-cycle emissions are controlled to the extent that they are controlled for the UDDS.

9.3 Confirmatory testing may be performed on vehicles equipped with an optional charge sustaining operation mode selector with selector set to simulate charge sustaining operation or in actual charge sustaining operation in accordance with section F of these test procedures.

9.4 For an example of an off-vehicle charge capable hybrid electric vehicle with all-electric range and blended operation that has charge depleting actual range and charge depleting cycle range, please see section I, Figure 1.

9.5 For an example of charge depleting to charge sustaining range with and without transitional range and end of test conditions, please see section I, Figure 2.

9.6 When determining the SOC tolerance during testing, the current drive cycle may be aborted if the SOC tolerance is met for previous drive cycle.

9.7 If the manufacturer determines there is insufficient fuel to run the subsequent test, the manufacturer may perform a fuel drain and fill or add fuel pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

10. State-of-Charge Net Change Tolerances.

10.1 For vehicles that use a battery as an energy storage device, the following state-of-charge net 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 Air Resources Board.

An alternate state-of-charge net tolerance may be used if shown to be technically necessary and if approved in advance by the Executive Officer of the Air Resources Board.

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

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

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

Where:

$(V_{final})_{max}$ = The stored capacitor voltage allowed at the end of the test
$(V_{final})_{min}$ = The stored capacitor voltage allowed at the end of the test
$V^2_{initial}$ = 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

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

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

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

Where:
$(rpm_{final})_{max}$ = The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})_{min}$ = The minimum flywheel rotational speed allowed at the end of the test
$rpm^2_{initial}$ = 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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

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

11. Calculations – Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

11.1 Charge Depleting CO_2 Produced means the cumulative tailpipe CO_2 emissions produced, M_{cd}, in grams per mile during the charge depleting cycle range.

$$M_{cd} = \Sigma Y_i$$

where:

Y_i = The sum of the CO_2 grams per mile in the charge depleting mode from each test cycle (UDDS or HFEDS)

i = Number (UDDS or HFEDS) of the test over the charge depleting cycle range, R_{cdc}

11.2 Charge Sustaining CO_2 Produced - urban means the cumulative tailpipe CO_2 emissions produced, M_{cs}, in grams per mile, during the cold start charge sustaining urban test.

$$M_{cs} = Y_c + Y_h * \left[\frac{(R_{cdcu} - D_c)}{D_c} \right]$$

where:

R_{cdcu} = Urban Charge Depleting Cycle Range, in miles

D_c = The measured driving distance from the cold start UDDS, in miles

Y_c = Grams per mile CO_2 emissions as calculated from the cold start UDDS

Y_h = Grams per mile CO_2 emissions as calculated from the hot start UDDS

11.3 Charge Sustaining CO_2 Produced - highway means the grams per mile tailpipe CO_2 emissions produced, M_{cs}, during the cold start charge sustaining highway test.

$$M_{cs} = \left(\frac{R_{cdch}}{D_h} \right) * Y_h$$

where:

R_{cdch} = Highway Charge Depleting Cycle Range, in miles

D_h = The measured driving distance from the hot start HFEDS, in miles

Y_h = Grams per mile emissions as calculated from the hot start HFEDS

11.4 Urban Equivalent All-Electric Range ($EAER_u$) shall be calculated as follows:

$$EAER_u = \left(\frac{M_{cs} - M_{cd}}{M_{cs}}\right) * R_{cdcu}$$

where:

M_{cs} is as defined in G.11.2.
M_{cd} is as defined in G.11.1, using the UDDS test cycle.

11.5 Highway Equivalent All-Electric Range ($EAER_h$) shall be calculated as follows:

$$EAER_h = \left[\frac{M_{cs} - M_{cd}}{M_{cs}}\right] * R_{cdch}$$

where:

M_{cs} is as defined in G.11.3.
M_{cd} is as defined in G.11.1, using the HFEDS test cycle.
R_{cdch} is as defined in G.11.3

11.6 Electric Range Fraction (%).

The Electric Range Fraction means fraction of the total miles driven electrically (with the engine off) for blended operation hybrid electric vehicles.

The Urban Electric Range Fraction (ERF_u) is calculated as follows:

$$ERF_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

The Highway Electric Range Fraction (ERF_h) is calculated as follows:

$$ERF_h\ (\%) = \left(\frac{EAER_h}{R_{cdah}}\right) * 100$$

11.7 Equivalent All-Electric Range Energy Consumption.

The Urban Equivalent All-Electric Range Energy Consumption ($EAEREC_u$) shall be calculated as follows:

$$EAEREC_u \text{ (wh/mi)} = \frac{E_{cd}}{EAER_u}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

The Highway Equivalent All-Electric Range Energy Consumption ($EAEREC_h$) shall be calculated as follows:

$$EAEREC_h \text{ (wh/mi)} = \frac{E_{cd}}{EAER_h}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

11.8 The Urban Charge Depleting Cycle Range, R_{cdcu}, (see section H for an illustration of R_{cdcu}) shall be defined as the distance traveled on the Urban Charge Depleting Procedure up to the UDDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

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

Where:

$(\text{Amp-hr}_{final})_{min}$	=	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 Air Resources Board.

11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be reported to the nearest 0.1 miles. For an illustration of R_{cda} see section I.

11.10 The Charge Depleting to Charge Sustaining Urban Range shall be defined as the distance driven in miles from the start of the Urban Charge Depleting Test through the UDDS preceding the one or two UDDSs used to end the Urban Charge Depleting Test.

11.11 The Highway Charge Depleting Cycle Range, R_{cdch}, shall be defined as the sum of the distance traveled on the Highway Charge Depleting Test up to the HFEDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

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

Where:

$(\text{Amp-hr}_{\text{final}})_{\text{min}}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{initial}})$	=	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 Air Resources Board.

11.12 The Charge Depleting to Charge Sustaining Highway Range shall be defined as the distance driven in miles from the start of the Highway Charge Depleting Test through the HFEDS preceding the final HFEDS.

11.13 The Urban Equivalent All Electric Range for vehicles with an urban charge depleting actual range greater than 40 miles, $EAER_{u40}$, is determined through the following equation:

$$EAER_{u40}\ (\text{miles}) = \left(\frac{ERF_u \times 40\,mi}{100} \right)$$

12. The Calculations of the Combined Green House Gas Regulatory Rating of Off-vehicle Charge Capable Hybrid Electric Vehicles

12.1 The combined Greenhouse Gas (GHG) emissions value is determined by the following equation.

$$GHG_{PHEV,\ combined} = 0.55 * (GHG_{urban}) + 0.45 * (GHG_{highway}) \qquad \text{(Eq. 1)}$$

12.2 The urban GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equations.

12.2.1 The urban GHG emissions value is determined by the following equation.

$$GHG_{urban} = \sum_{i=1}^{N_{urban}} (UF_i) * \left(\frac{Y_{CD.i}}{D_i} + GHG_{cd.AC.i}\right) - \sum_{i=1}^{N_{urban}} (UF_i) * G_{upstream} + \left(1 - \sum_{i=1}^{N_{urban}} (UF_i)\right) * (Y_{cs.urban})$$

(Eq. 2)

Where,

GHG_{urban} = Rated urban GHG emissions for PHEV, in gCO_2e/mile
i = Number of charge-depleting urban test cycle
N_{urban} = Total number of urban test cycles in charge depleting to charge sustaining range (R_{cdtcs})
UF_i = Utility factor for urban test cycle i
$Y_{CD.i}$ = Mass emissions of CO_2 in grams per vehicle mile, for the "i"th test in the charge depleting test
$D_{.i}$ = Distance of the "i"th urban test cycle, in miles.
$GHG_{cd.AC.i}$ = Rated GHG emissions for test cycle i, in gCO_2e/mile
$Y_{cs.urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.
$G_{upstream}$ = Gasoline upstream factor = $0.25 * GHG_{target}$.

12.2.2 The Charge Depleting to Charge Sustaining Range (R_{cdtcs}) is the total number of cycles driven at least partially in charge depleting mode times the cycle distance. Cycles meets charge sustaining criterion are not included in the R_{cdtcs}. The R_{cdtcs} includes the transitional cycle, where the vehicle may have operated in both depleting and sustaining modes.

12.2.3 The utility factors for urban and highway cycles are provided in the following table.

Utility factors for each PHEV drive cycle test with charge-depletion operation

Test cycle number	Test cycle utility factor	
	Urban, UF_i	Highway, UF_j
1	0.176	0.233
2	0.141	0.172
3	0.112	0.127
4	0.091	0.095
5	0.074	0.071
6	0.059	0.054
7	0.049	0.041
8	0.039	0.032
9	0.033	0.025
10	0.027	0.020
11	0.023	0.017
12	0.019	0.013

12.2.4 This charge-depleting GHG rate from electricity use in each test cycle is defined by the following equation:

$$GHG_{cd.AC.i} = GHG_{grid} * E_{cd.AC.i} \qquad \text{(Eq. 3)}$$

Where,

$GHG_{cd.AC.i}$ = Rated GHG emissions for charge-depleting PHEV, in gCO_2e/mile
$E_{cd.AC.i}$ = Urban or highway charge depleting electricity use, in kWh/mile
GHG_{grid} = Lifecycle California electricity GHG intensity, 270 gCO_2e/kWh

12.2.5 The urban or highway charge depleting electricity use is defined by the following formula:

$$E_{cd.AC.i} = \frac{E_{cd.DC.i}}{\sum_{i=1}^{N} E_{cd.DC.i}} * E_{cd.AC.total} \qquad \text{(Eq. 4)}$$

Where,

N = Total number of test cycles in the charge depleting to charge sustaining range (R_{cdtcs}) of the urban or highway charge depleting test.
$E_{cd.AC.i}$ = AC kWh consumed in the "i"th cycle of the charge depleting test.
$E_{cd.DC.i}$ = Depleted DC energy for the "i"th cycle in the charge depleting test. It is defined in section F.3.4 of these test procedures.
$E_{cd.AC.total}$ = Charge-depleting net AC energy consumption is determined according to section F.3.4 of these test procedures.

12.2.6 The $Y_{cs.urban}$, which is the weighted CO_2 mass emissions of the charge-sustaining test, is determined by the following equation, which can be found in section F.5.5 of these test procedures.

$$Y_{CS.Urban} = 0.43 * \frac{Y_C}{D_C} + 0.57 * \frac{Y_H}{D_H} \qquad \text{(Eq. 5)}$$

Where,

$Y_{CS.Urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.
Y_C = Mass emissions as calculated from the cold start UDDS, in grams per cycle.
Y_H = Mass emissions as calculated from the hot start UDDS, in grams per cycle.
D_C = The measured driving distance from the cold start UDDS, in miles.
D_H = The measured driving distance from the hot start UDDS, in miles.

12.3 The highway GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equation.

$$GHG_{highway} = \sum_{j=1}^{N_{highwayn}} (UF_j\} * (\frac{Y_{CD.j}}{D_j} + GHG_{cd.AC.j}) - \sum_{j=1}^{N_{highway}} (UF_i) * G_{upstream} + (1 - \sum_{j=1}^{N_{highway}} (UF_j)) * (Y_{cs.highway})$$

(Eq. 7)

Where,

$GHG_{highway}$= Rated highway GHG emissions for PHEV, in gCO_2e/mile
j = Number of charge-depleting highway test cycle
$N_{highway}$ = Total number of highway test cycles in charge depleting to charge sustaining range (R_{cdtcs})
UF_j = Utility factor for highway test cycle j (see Table 1)
$Y_{CD.j}$ = Mass emissions of CO_2 in grams per vehicle mile, for the “j”th test in the charge depleting test
D_j = Distance of the HFEDS cycle, in miles.
$GHG_{cd.AC.j}$ = Rated GHG emissions for test cycle *j*, in gCO_2e/mile (see Eq. 3)
$Y_{cs.highway}$ = Mass emissions of CO_2 in grams/mi of the highway charge sustaining emission test, which can be found in section F.6.3.3 of these test procedures.
$G_{upstream}$ = Gasoline upstream factor $0.25 * GHG_{target}$

H. Off-Vehicle Charge Capable Hybrid Electric Vehicle Exhaust Emission Test Sequence.

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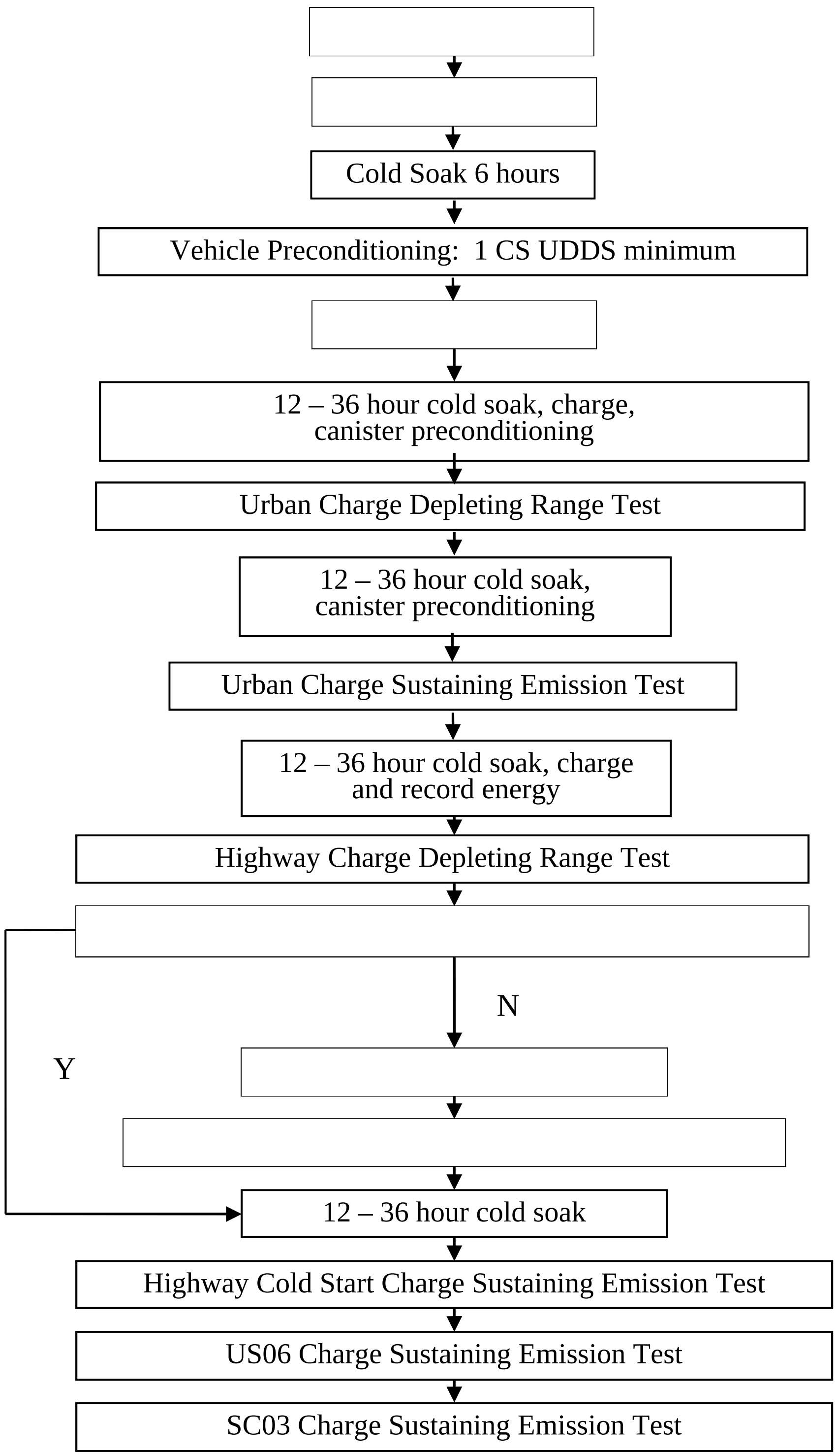
Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



I. Examples of Off-Vehicle Charge Capable Hybrid Electric Vehicle Terminology.

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Example of an Off-Vehicle Charge Capable HEV with AER and Blended Operation Undergoing the Urban Charge Depleting Range Test

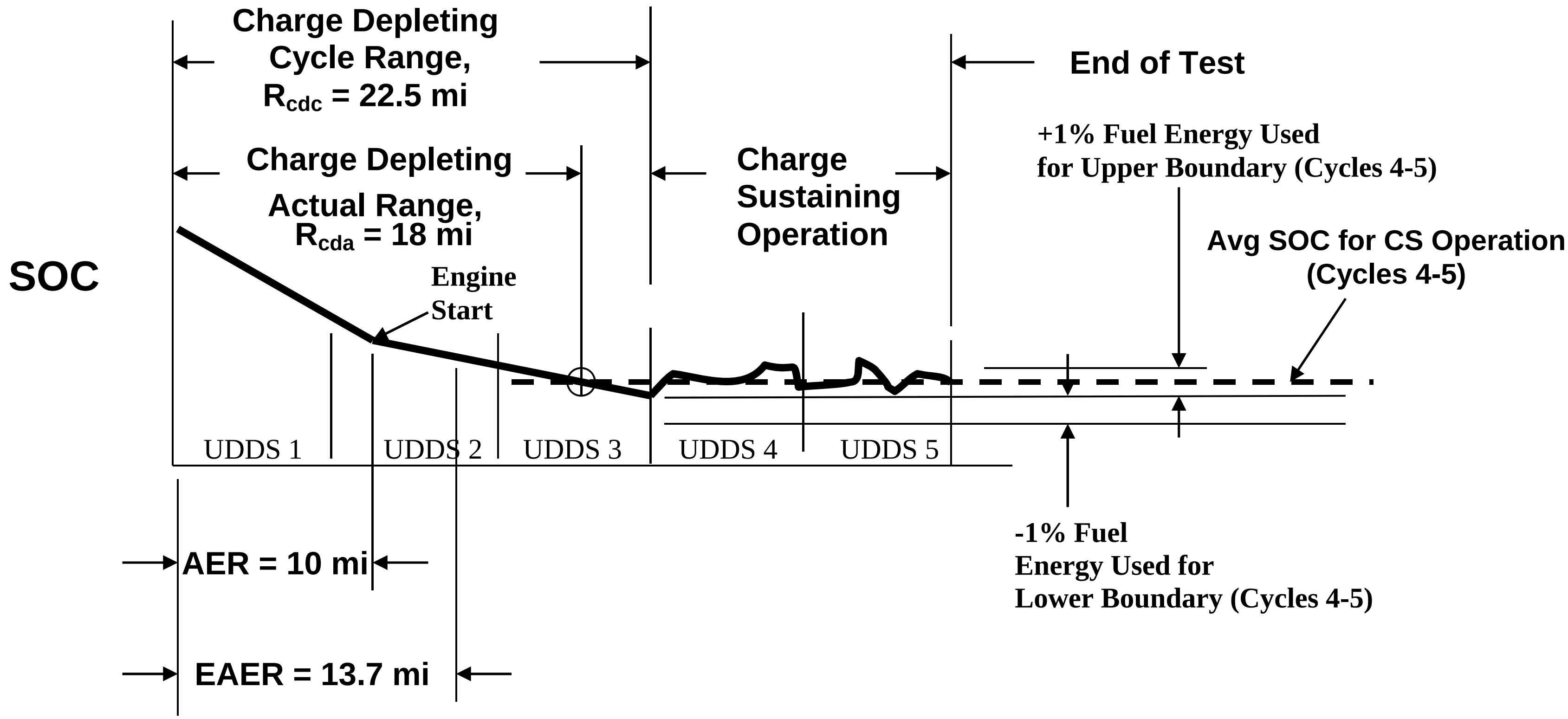
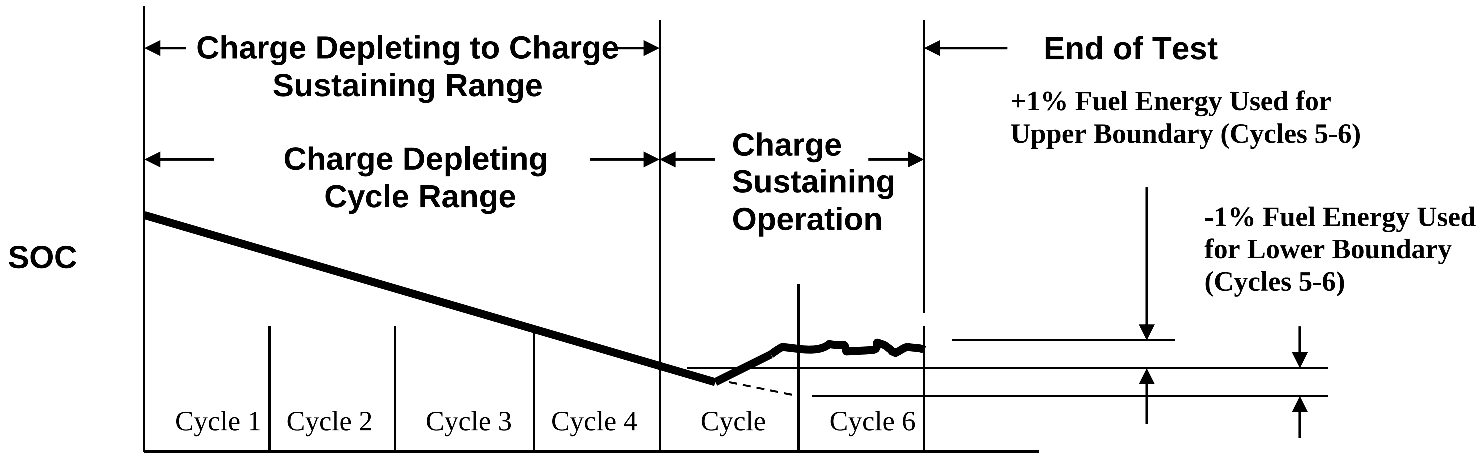
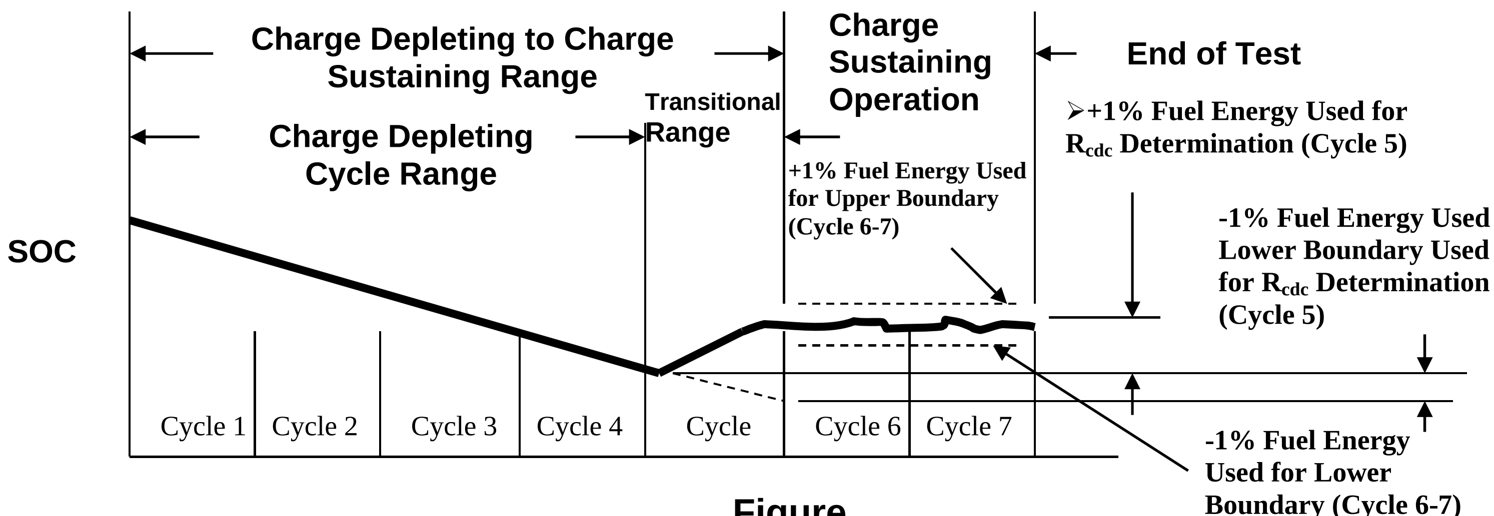


Figure 1

Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV



Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV with Transitional Range



Figure

J. Advanced Technology Demonstration Program data requirements.

A vehicle placed in a California advanced technology demonstration program may earn ZEV credits even if it is not "delivered for sale" in accordance with the ZEV regulation section C.7.4. Approval by the ARB's Executive Officer is required for Advanced Technology Demonstration Program credits. The following data shall be provided in order to evaluate applications for an Executive Order:

1. Project Description

(a) General description
(b) Goal
(c) Specific objectives (e.g. durability tests, customer marketability)
(d) Location (include state, city, and agency/organization)

2. Vehicle data

(a) Model
(b) Model year
(c) Date placed in program
(d) Vehicle Identification Number (VIN)

3. Vehicle specifications

(a) Passenger car (PC) or light duty truck (LDT)
(b) Curb weight – pounds (lbs)
(c) Payload (lbs)
(d) City/highway range – miles (mi)
(e) Estimated fuel economy or EPA fuel economy city/highway – miles per gallon (mpg)
(f) Fuel type
(g) Refueling time
(h) Electric motor output – kilowatts (kW)
(i) Hybrid energy storage; type, capacity and peak power
(j) For Battery Electric Vehicles and hybrids – fuel fired heater (yes/no)
(k) For Fuel Cell Vehicles (FCVs), fuel cell stack: type, peak output, manufacturer and estimated design life.

California Environmental Protection Agency
AIR RESOURCES BOARD

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

Adopted: March 22, 2012
Amended: December 6, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as adopted March 22, 2012. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

* * * *

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

* * * *

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

A. General Applicability

1. §86.1801 Applicability.

1.1 §86.1801-12. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]~~. Amend as follows:

* * * *

B. Definitions, Acronyms and Abbreviations

1. §86.1803 Definitions.

1.1 §86.1803-01. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]~~. [No change, except as otherwise noted below.]

2. California Definitions.

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

* * * *

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

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

1. A minimum cargo bed width between the wheelhouses of 48 inches, measured as the minimum lateral distance between the limiting interferences (pass-through) of the wheelhouses. The measurement shall exclude the transitional arc, local protrusions, and depressions or pockets, if present. An open cargo box means a vehicle where the cargo box does not have a permanent roof or cover. Vehicles ~~sold~~ produced with detachable covers are considered “open” for the purposes of these criteria.
2. A minimum open cargo box length of 60 inches, where the length is defined by the lesser of the pickup bed length at the top of the body and the pickup bed length at the floor, where the length at the top of the body is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the height of the top of the open pickup bed ~~cargo floor surface~~ along vehicle centerline, and the length at the floor is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo floor surface along vehicle centerline.
3. A minimum towing capability of 5,000 pounds, where minimum towing capability is determined by subtracting the gross vehicle weight rating from the gross combined weight rating, or a minimum payload capability of 1,700 pounds, where minimum payload capability is determined by subtracting the curb weight from the gross vehicle weight rating.

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“**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.

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

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

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

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"**Small volume manufacturer**" means any manufacturer that meets the "small volume manufacturer" definition as set forth in section 1900, title 13, CCR. ~~whose projected or combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. A manufacturer's California sales shall consist of all vehicles or engines produced by the manufacturer and delivered for sale in California, except that vehicles or engines produced by the manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as California sales of the marketing manufacturer.~~

~~Except as provided in the last paragraph of this definition, for the 2015 through 2017 model years, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, one of which is 10% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 10% or more in each of the firms; or (3) vehicles produced by two or more firms having a common corporate officer(s) who is (are) responsible for the overall direction of the companies; or (4) vehicles imported or distributed by any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.~~

~~Except as provided in the last paragraph of this definition, for the 2018 and subsequent model years, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, one of which is 33.4% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 33.4% or more in each of the firms; or (3) vehicles produced by two or more firms having a common corporate officer(s) who is (are) responsible for the overall direction of the companies; or (4) vehicles imported or distributed by any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.~~

~~For the purposes of this paragraph, all manufacturers whose annual sales are aggregated together under the provisions of this definition shall be defined as "related manufacturers." Notwithstanding such aggregation, the Executive Officer may make a determination of operational independence if all of the following criteria are met for at least 24 months preceding the application submittal: (1) for the three years preceding the year in which the initial application is submitted, the average California sales for the applicant does not exceed 4,500 vehicles per year; (2) no financial or other support of economic value is provided by related manufacturers for purposes of design, parts procurement, R&D and production facilities and operation, and any other transactions between related manufacturers are conducted under normal~~

~~commercial arrangements like those conducted with other parties, at competitive pricing rates to the manufacturer; (3) related manufacturers maintain separate and independent research and development, testing, and production facilities; (4) related manufacturers do not use any vehicle powertrains or platforms developed or produced by related manufacturers; (5) patents are not held jointly with related manufacturers; (6) related manufacturers maintain separate business administration, legal, purchasing, sales, and marketing departments, as well as autonomous decision-making on commercial matters; (7) the overlap of the Board of Directors between related manufacturers is limited to 25% with no sharing of top operational management, including president, chief executive officer, chief financial officer, and chief operating officer, and provided that no individual overlapping director or combination of overlapping directors exercises exclusive management control over either or both companies; and (8) parts or components supply between related companies must be established through open market process, and to the extent that the manufacturer sells parts/components to non-related manufacturers, it does so through the open market a competitive pricing. Any manufacturer applying for operational independence must submit to ARB an Attestation Engagement from an independent certified public accountant or firm of such accountants verifying the accuracy of the information contained in the application, as defined by and in accordance with the procedures established in 40 C.F.R. §80.125, as last amended January 19, 2007, which is incorporated by reference in section 1900, title 13, CCR. The applicant must submit information to update any of the above eight criteria as material changes to any of the criteria occur. If there are no material changes to any of the criteria, the applicant must certify that to the Executive Officer annually. With respect to any such changes, the Executive Officer may consider extraordinary conditions (e.g., changes to economic conditions, unanticipated market changes, etc.) and may continue to find the applicant to be operationally independent. In the event that a manufacturer loses eligibility as a "small volume manufacturer" after a material change occurs, the manufacturer must begin compliance with the primary emissions program in the third model year after the model year in which the manufacturer loses its eligibility. The Executive Officer may, in his or her discretion, re-establish lost "small volume manufacturer" status if the manufacturer shows that it has met the operational independence criteria for three consecutive years.~~

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"**Subconfiguration**" means <u>a unique combination within a vehicle configuration that meets the criteria in 40 CFR §600.002-08 (October 15, 2012).</u>

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

1. §86.1810-09. ~~July 6, 2011~~ <u>October 15, 2012</u> Amend §86.1810-09 as follows:

This section applies to model year 2015 and later light-duty vehicles, light-duty trucks, and medium-duty vehicles fueled by gasoline, diesel, methanol, ethanol, natural gas and liquefied petroleum gas fuels. Multi-fueled vehicles (including bi-fueled, dual-fueled and flexible-fueled vehicles) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible-fueled vehicles). This section also applies to hybrid electric vehicles. The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated.

* * * *

(p) Amend as follows: For gasoline and diesel-fueled LEV II and LEV III vehicles, manufacturers may measure non-methane hydrocarbons (NMHC) in lieu of NMOG. For LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.1, manufacturers must multiply NMHC measurements by an adjustment factor of 1.04 before comparing with the NMOG standard to determine compliance with the standard. For LEV III vehicles and LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.2, manufacturers must multiply NMHC measurements by an adjustment factor of 1.1<u>0</u> before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard. <u>For LEV III vehicles and LEV II vehicles that are certified using a gasoline fuel that contains an ethanol content greater than that allowed by the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.2 and less than or equal to 25 percent ethanol, the adjustment factor that must be used to demonstrate compliance with this paragraph is calculated using the following formula:</u>

<u>Adjustment factor = 1.0302 + 0.0071 x volume percent fuel ethanol</u>

<u>where the value for the "volume percent fuel ethanol" used in this formula is 15 if the gasoline contains 15 percent ethanol, the "volume percent fuel ethanol" used in this formula is 20 if the gasoline contains 20 percent ethanol, etc. Manufacturers must multiply NMHC measurements by this calculated adjustment factor before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard.</u> Manufacturers may use other factors to adjust NMHC results to more properly represent NMOG results. Such factors must be based upon comparative testing of NMOG and NMHC emissions and be approved in advance by the Administrator.

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E. California Exhaust Emission Standards.

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1. Exhaust Emission Standards.

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

The exhaust emission standards set forth in this section refer to the exhaust emitted over the driving schedule set forth in title 40, CFR <u>Part 86</u>, Subparts B and C, except as amended in these test procedures.

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

2015 – 2019 model-year LEV II LEV vehicles may be certified to the 150,000 mile NMOG+NOx emission standards ~~numerical values~~ for LEV160, LEV395, or LEV630, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG~~+NOx~~ numerical values in section E.1.4.1; and LEV II ULEV vehicles may be certified to the 150,000 mile NMOG+NOx emission standards ~~numerical values~~ for ULEV125, ULEV340, or ULEV570, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG~~+NOx~~ numerical values in section E.1.4.1.~~; and LEV II SULEV vehicles may be certified to the NMOG+NOx numerical values for SULEV30, SULEV170, or SULEV230, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1.~~ 2015 – 2019 model-year LEV II SULEV vehicles that receive a partial ZEV allowance in accordance with the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and 2015 – 2016 model year vehicles that are allowed to certify to LEV II SULEV standards using "carryover" of emission test data under the provisions in section E.2.2 may be certified to the 150,000 mile NMOG+NOx emission standards for SULEV30, SULEV170, or SULEV230, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG numerical values in section E.1.4.1. LEV II SULEV vehicles that do not either (1) receive a partial ZEV allowance or (2) certify to LEV II SULEV standards in the 2015 – 2016 model years using "carryover" of emission test data may not certify to combined NMOG+NOx standards. LEV II vehicles that certify to combined NMOG+NOx standards will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

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1.1.2 **LEV III Exhaust Standards.** The following standards are the maximum exhaust emissions for the full useful life from new 2015 and subsequent model year "LEV

III” passenger cars, light-duty trucks, and medium-duty vehicles, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on both of the fuels they are designed to use. Before the 2015 model year, a manufacturer that produces vehicles meeting these standards has the option of certifying the vehicles to the standards, in which case the vehicles will be treated as LEV III vehicles for purposes of the fleet-wide phase-in requirements. All medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete Otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the LEV III chassis standards and test procedures set forth in this section E.1.1.2 in 2020 and subsequent model years.

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

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	NMOG + Oxides of Nitrogen (g/mi)	Carbon Monoxide (g/mi)	Formaldehyde (mg/mi)	Particulates[1] (g/mi)
All PCs; LDTs 8500 lbs. GVWR or less; and MDPVs Vehicles in this category are tested at their loaded vehicle weight	150,000	LEV160	0.160	4.2	4	0.01
		ULEV125	0.125	2.1	4	0.01
		ULEV70	0.070	1.7	4	0.01
		ULEV50	0.050	1.7	4	0.01
		SULEV30	0.030	1.0	4	0.01
		SULEV20	0.020	1.0	4	0.01
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV395	0.395	6.4	6	0.12
		ULEV340	0.340	~~3.2~~6.4	6	0.06
		ULEV250	0.250	~~2.~~6.4	6	0.06
		ULEV200	0.200	~~2.6~~4.2	6	0.06
		SULEV170	0.170	~~1.5~~4.2	6	0.06
		SULEV150	0.150	~~1.5~~3.2	6	0.06
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV630	0.630	7.3	6	0.12
		ULEV570	0.570	~~3.~~7.3	6	0.06
		ULEV400	0.400	~~3.0~~7.3	6	0.06
		ULEV270	0.270	~~3.0~~4.2	6	0.06
		SULEV230	0.230	~~1.7~~4.2	6	0.06
		SULEV200	0.200	~~1.7~~3.7	6	0.06

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

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

*   *   *   *

1.1.2.1 **LEV III Particulate Standards.**

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

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

1.1.2.1.4.1 **Alternative Phase-in Schedules for the 3 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 3 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. In the 2021 model year, t~~T~~he cumulative total must be equal to or greater than 490, and 100 percent of the manufacturer’s passenger cars, light-duty trucks, and medium-duty passenger vehicles must be certified to the 3 mg/mi particulate standard, ~~in the 2021 model year~~ to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

1.1.2.1.4.2 **Alternative Phase-in Schedules for the 1 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 1 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2028 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 1 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2025 model year, 3 for the 2026 model year, 2 for the 2027 model year, and 1 for the 2028 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. In the 2028 model year, t~~T~~he cumulative total must be equal to or greater than 500 and 100 percent of the manufacturer's passenger cars, light-duty trucks, and medium-duty passenger vehicles must be certified to the 1 mg/mi particulate standard ~~in the 2028 model year~~ to be considered equivalent. A manufacturer may add vehicles introduced before the 2025 model year (e.g., the percent of vehicles introduced in 2024 would be multiplied by 4) to the cumulative total.

1.1.2.1.4.3 **Alternative Phase-in Schedules for the Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from medium-duty vehicles other than medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the total percent of MDVs certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for MDVs shall be summed together to determine a cumulative total for MDVs. In the 2021 model year, t~~T~~ he cumulative total must be equal to or greater than 490, and 100 percent of the manufacturer's MDVs must be certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, ~~in the 2021 model year~~ to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

* * * *

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

1.2.1 **4,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.** The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for 2015 through ~~2020~~ 2021 model year passenger cars, and light-duty truck and medium-duty vehicles (less than 8,501 pounds gross vehicle weight rating) certifying to the LEV II exhaust emission standards in section E.1.1.1:

SFTP Exhaust Emission Standards for LEV II Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles[1,2]						
Vehicle Type	*Gross Vehicle Weight Rating (lbs.)*	*Test Weight*[3] *(lbs.)*	*US06 Test (g/mi)*		*A/C Test (g/mi)*	
			NMHC + NOx	*CO*	*NMHC + NOx*	*CO*
PC	All	All	0.14	8.0	0.20	2.7
LDT	≤ 6000 lbs.	0-3750 lbs.	0.14	8.0	0.20	2.7
		3751-5750 lbs.	0.25	10.5	0.27	3.5
MDV	6,001-8,500 lbs.	3751-5750 lbs.	0.40	10.5	0.31	3.5
		5751-8500 lbs.	0.60	11.8	0.44	4.0

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

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

"LDT" (light-duty truck) is any motor vehicle rated at 6,000 pounds gross vehicle weight rating or less, which is designed primarily for purposes of transportation of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"MDV" (medium-duty vehicle) is any motor vehicle having a manufacturer's gross vehicle weight rating of greater than 6,000 pounds and less than 14,001 pounds, except passenger cars and light-duty trucks. Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this section E.1.2.1.

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

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

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

* * * *

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

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

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

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

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

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

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

SFTP NMOG+NOx and CO Composite Emission Standards for 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles (g/mi)[1]

Model Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025+
All PCs; LDTs 8,500 lbs. GVWR or less; and MDPVs[3]	***Sales-Weighted Fleet Average NMOG+NOx Composite Exhaust Emission Standards***[2,4,5,6]										
	0.140	0.110	0.103	0.097	0.090	0.083	0.077	0.070	0.063	0.057	0.050
Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 pounds) except LEV II vehicles, which are subject to the test weights specified in §1960.1(r), title 13, CCR.	***CO Composite Exhaust Emission Standard***[7]										
	4.2										

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

2 *Determining NMOG+NOx Composite Emission Values of LEV II Test Groups and Cleaner Federal Vehicles.* For test groups certified to LEV II FTP emission standards, SFTP emission values shall be converted to NMOG+NOx and projected out to 120,000 miles or 150,000 miles (depending on LEV II FTP certification) using deterioration factors or aged components. ~~NMHC emission values for the US06 and SC03 test cycles shall be converted to NMOG emission values by multiplying by a factor of 1.03.~~ In lieu of deriving a deterioration factor specific to SFTP test cycles, carry-over LEV II test groups may use the applicable deterioration factor from the FTP cycle in order to determine the carry-over composite emission values for the purpose of the NMOG+NOx sales-weighted fleet-average calculation. If an SFTP full-useful life emission value is used to comply with the LEV II SFTP 4k standards, that value may be used in the sales-weighted fleet-average without applying an additional deterioration factor. For federally-certified test groups certifying in California in accordance with Section H subparagraph 1.4, the full-useful life emission value used to comply with federal full-useful life SFTP requirements may be used in the sales-weighted fleet-average without applying an additional deterioration factor. In all cases, NMHC emission values for the US06 and SC03 test cycles shall be converted to NMOG emission values by multiplying by a factor of 1.03.

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

4 LEV III ~~T~~test groups shall certify to bins in increments of 0.010 g/mi. Beginning with the 2018 model year, vehicles may not certify to bin values above a maximum of 0.180 g/mi.

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

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

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

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

"Composite Value of Bin" = the numerical value selected by the manufacturer for the certification bin that serves as the emission standard for the vehicles in the test group with respect to all testing for test groups certifying to SFTP on a 150,000-mile durability basis, and the SFTP carry-over composite emission value, as described in footnote ~~7~~2 of this table, for carry-over LEV II test groups.

* * * *

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

A vehicle that is certified to the LEV III standards in section E.1.1.2, which does not generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," a manufacturer may subtract 5 mg/mi from the NMOG+NOx emission standard value set forth in section E.3.1.1 when calculating the manufacturer's fleet average, provided that the manufacturer extends the performance and defects warranty period to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device (such as battery, ultracapacitor, or other electric storage device).

* * * *

2. Emission Standards Phase-In Requirements for Manufacturers.

2.1 Fleet Average NMOG + NOx Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

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

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

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

* * * *

2.1.1.2 **PZEVs Anti-Backsliding Requirement**. In the 2018 and subsequent model years, a manufacturer must produce and deliver for sale in California a minimum percentage of its passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards. This minimum percentage must be equal to the average percentage of PZEVs produced and deliver for sale in California for that manufacturer for the 2015 through 2017 model year. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales. The percentage of a manufacturer's passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards averaged across the applicable model year and the two previous model years shall be used to determine compliance with this requirement, beginning with the 2020 model year.

* * * *

2.1.4 **Treatment of ZEVs.** ZEVs classified as LDTs (>3750 lbs. LVW) that have been counted toward the ZEV requirement for PCs and LDTs (0-3750 lbs. LVW) as specified in section C of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," shall be included ~~in this equation~~ as LDT1s in the calculation of a fleet average NMOG+NOx value.

* * * *

2.4 Implementation Schedules for SFTP Emission Standards.

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

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

* * * *

(b) Under Option 2, for 2015 and subsequent model years, a manufacturer shall certify its fleet of PCs, LDTs, and MDPVs such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value and each test group's CO composite emission value do~~es~~ not exceed the applicable composite emission standards in effect for that model year in accordance with section E.1.2.2.1.2. ~~During the 150,000-mile durability phase-in, the sales-weighted fleet-average NMOG+NOx composite emission value shall be calculated using a combination of carry-over values and new-certification values. Carry-over test groups shall convert values to NMOG+NOx and may use the applicable deterioration factor from the FTP cycle in lieu of deriving a deterioration factor specific to SFTP test cycles. Any vehicle certified to SFTP requirements on a 150,000-mile durability basis shall be subject to the applicable emission standards for the full useful life of that vehicle. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging.~~

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

* * * *

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

* * * *

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

* * * *

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

* * * *

<u>2.5.1.3.4 *Optional Compliance Via the 2017 through 2025 MY National Greenhouse Gas Program.*</u>

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

<u>2.5.1.3.4.1 A manufacturer that selects compliance with this option must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with section E.2.5;</u>

<u>2.5.1.3.4.2 The manufacturer must submit to ARB all data that it submits to EPA in accordance with the reporting requirements as required under 40 CFR §86.1865-12, for demonstrating compliance with the 2017 through 2025 MY National greenhouse gas program and the EPA determination of compliance. All such data must be submitted within 30 days of receipt of the EPA determination of</u>

compliance for each model year that a manufacturer selects compliance with this option;

2.5.1.3.4.3 The manufacturer must provide to the Executive Officer separate values for the number of vehicles produced and delivered for sale in California, the District of Columbia, and each individual state that has adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507), the applicable fleet average CO_2 standards for each of these model types and footprint values, the calculated fleet average CO_2 value for each of these model types and footprint values, and all values used in calculating the fleet average CO_2 values.

* * * *

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

* * * *

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

* * * *

2.5.3.3.4. A manufacturer may elect to petition for alternative standards under this section E. 2.5.3.3 by submitting to ARB a copy of the data and information submitted to EPA as required under 40 CFR §86.1818-12 (g) (October 15, 2012), as incorporated by reference herein, and the EPA approval of the manufacturer’s request for alternative fleet average standards for the 2017 through 2025 MY National Greenhouse Gas Program.

* * * *

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

* * * *

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

2.5.6.3.1 HFC-134a vapor compression systems

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

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

Where:

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

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

Avg LR = 16.6 grams/year for passenger cars;

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

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

Where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised February 2012 ~~August 2008~~) incorporated by reference in section 1961.2, title 13, CCR;

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

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

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

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

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of ~~the August 2008 version of~~ SAE J2727 or an alternate method if s/he determines that the updated SAE J2727 or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the February 2012 ~~August 2008~~ version of SAE J2727 does.

2.5.6.3.2 Low-GWP vapor compression systems

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

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

Where:

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

and

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

Where:

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

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

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

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

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

Avg LR = 13.1 g/yr for passenger cars;

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

and where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised February 2012 ~~August 2008~~);

Min LR = 8.3 g/yr for passenger cars;

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

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of SAE J2727 or an alternate applicable test method if s/he finds the update or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the February 2012 ~~August 2008~~version of SAE J2727 does.

* * * *

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

* * * *

2.5.7.5 For the purposes of this section E.2.5.7.5, the AC17 Test Procedure shall mean the AC17 Air Conditioning Efficiency Test Procedure set forth in 40 CFR §86.167-17, as amended by ~~Part II, Section A.100.5.6 of~~ these test procedures.

* * * *

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

* * * *

3. Calculation of Credits/Debits

3.1 Calculation of NMOG+NOx Credits/Debits

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

* * * *

3.1.3 **Procedure for Offsetting NMOG+NOx Debits.**

* * * *

3.1.3.2 For the 2015 and subsequent model years, t~~T~~he emission credits earned in any given model year shall retain full value through five subsequent model years. Credits will have no value if not used by the beginning of the sixth model year after being earned.

* * * *

3.2 Calculation of Greenhouse Gas Credits/Debits.

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

* * * *

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

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

* * * *

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

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

4.2.1 **LEV III Particulate Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2017 through 202~~1~~0 model years, the interim in-use compliance standard for vehicles certifying to the 3 mg/mi particulate standard is 6 mg/mi. For the 2025 through 2028 model years, the interim in-use compliance standard for vehicles certifying to the 1 mg/mi particulate standard is 2 mg/mi.

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F. Requirements and Procedures for Durability Demonstration

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4. §86.1823 Durability demonstration procedures for exhaust emissions.

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4.2 §86.1823-08. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]~~. [No change, except that subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

4.3 **SFTP**. These procedures are not applicable to vehicles certified to the SFTP standards set forth in section E.1.2.~~2~~1.

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.

*   *   *   *

G. Procedures for Demonstration of Compliance with Emission Standards

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

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3.1 §86.1829-01. ~~May 7, 2010~~ October 15, 2012. Amend as follows:

*   *   *   *

11. §86.1837 Rounding of emission measurements.

*   *   *   *

11.2 Fleet average NMOG+NOx value calculations shall be rounded, in accordance with ASTM E29-67, to four significant figures before comparing with fleet average NMOG+NOx requirements.

*   *   *   *

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.

* * * *

1.4 **Certification of a Federal Vehicle in California.**

* * * *

1.4.1 Except as noted in H.1.4.1.1 and H.1.4.1.2, i~~I~~f a federally-certified vehicle model is certified in California in accordance with subparagraph 1.4, the model shall be subject to the federal requirements for FTP exhaust emissions and cold CO emissions. The vehicle model shall be subject to all other California requirements including evaporative emissions, OBD II, SFTP emissions, 50^{o}F exhaust emissions, highway NMOG+NOx emissions, greenhouse gas emissions, and emissions warranty.

1.4.1.1 A vehicle certified to federal Tier II emission Bin 3 or Bin 4 is not required to meet California 50^{o}F exhaust emissions requirements.

1.4.1.2 If a federally-certified vehicle model is certified in California in accordance with subparagraph 1.4 based on a comparison of the sum of the 120,000 mile federal standards to the sum of the 120,000 mile LEV II NMOG and NOx standards, that federally-certified vehicle model shall be subject to the federal requirements for highway NOx and is not required to meet California highway NMOG+NOx emissions requirements.

1.4.2 Prior to certification of a 2015 or subsequent model-year vehicle, a manufacturer must submit information sufficient to enable the Executive Officer to determine whether there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model based on the criteria listed in subparagraph 1.~~5~~4.

* * * *

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

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3. §86.1843 General information requirements

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3.2 **Alternative Fuel Information.**

For passenger cars, light-duty trucks, and medium-duty vehicles ~~not certified exclusively on gasoline or diesel, except for vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the vehicles are certified. For vehicles~~ that use hydrogen fuel, the manufacturer shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, thirty-three months prior to January 1 of the model year for which the vehicles are certified.

* * * *

I. In-Use Compliance Requirements and Procedures

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

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

* * * *

1.1.3 **High Mileage Testing.** Amend subparagraph (c)(2) of 40 CFR §86.1845-04 to read as follows: All test vehicles certified to the emission standards in Part I, Section E.1.1.1 of these procedures must have a minimum odometer mileage of 50,000 miles. At least one vehicle of each test group certified to the emission standards in Part I, Section E.1.1.1 of these procedures must have a minimum age and odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. All test vehicles certified to the emission standards in Part I, Section E.1.1.2 of these test procedures must have a minimum age and odometer mileage of ~~112,500~~ <u>105,000</u> miles. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

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J. Procedural Requirements

1. §86.1848-10 Certification. ~~July 6, 2011~~ <u>October 15, 2012</u>. [No change.]

* * * *

13. §86.1865-12 How to comply with the fleet average CO_2 standards. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
14. §86.1866-12 CO_2 ~~fleet average~~ credits for advanced technology vehicles ~~programs~~. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75372 (December 1, 2011)]~~. [No change, except that for the 2012 through 2016 model years this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
15. §86.1867-12 Optional early CO_2 credit programs. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75387 (December 1, 2011)]~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

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

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

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

* * * *

100.2 Equipment and Facility Requirements.

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86.111-94 Exhaust gas analytical-system. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]~~. [No change.]

* * * *

100.5 Test Procedures and Data Requirements.

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86.135-12　Dynamometer procedure. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]~~. [No change.]

*　　*　　*　　*

86.159-08　Exhaust emission test procedures for US06 emissions. December 27, 2006.

100.5.5 California exhaust emission test procedures for US06 emissions.

*　　*　　*　　*

100.5.5.2　Delete subparagraph (b)(9) of §86.159-08 and replace with:
During dynamometer operation, a fixed speed cooling fan with a maximum discharge velocity of 15,000 cubic feet per minute or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

100.5.5.3　**Hot 1435 LA92 (Hot 1435 Unified Cycle) Test Procedure.**
Amend §86.159-08 as follows: Add the following sentences: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored. The NMOG, CO, NOx, and formaldehyde emissions shall be measured according to the US06 Test Procedure as set forth in Subpart B, 40 CFR 86.159-08 with the following modifications:

*　　*　　*　　*

2.　Amend 40 CFR 86.159-08 as follows:

*　　*　　*　　*

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

2.2.2 Delete subparagraph (9); replace with: **Dynamometer activities.** During dynamometer operation, a fixed speed cooling fan <u>with a maximum discharge velocity of 15,000 cubic feet per minute </u>or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

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

100.5.5.4 **US06 Bag 2 Test Procedure.**

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

* * * *

2. Amend 40 CFR 86.159-08 as follows:

* * * *

2.2 Paragraph (b)

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

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

During dynamometer operation, a fixed speed cooling fan <u>with a maximum discharge velocity of 15,000 cubic feet per minute </u>or a road speed modulated fan as specified in § 86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

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

* * * *

86.165-12 Air Conditioning idle test procedure. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]~~. [No change, except that for the 2016 model year~~s~~, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

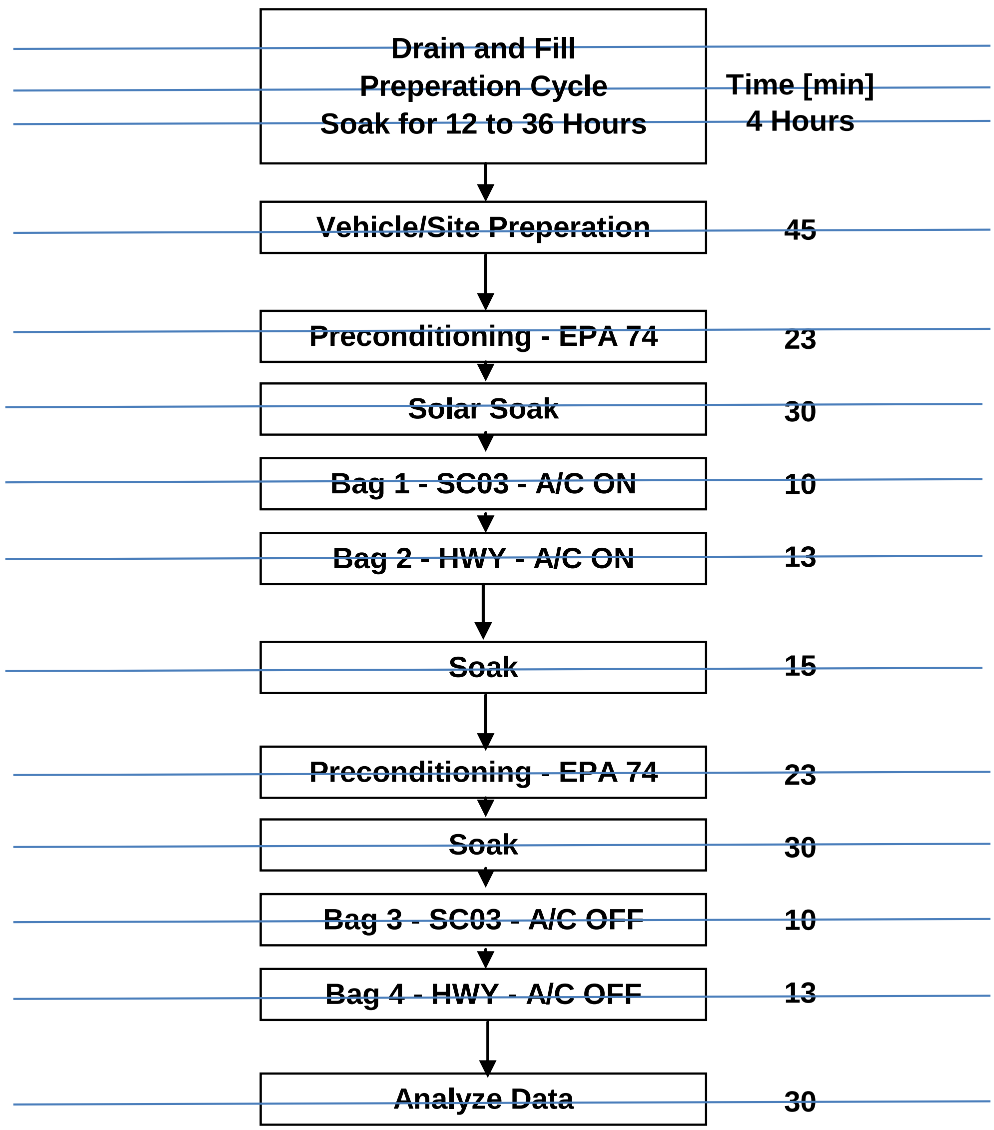
~~86.166-12 Method for calculating emissions due to air conditioning leakage. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying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

86.167-17 AC17 Air Conditioning ~~Efficiency~~ Emissions Test Procedure. October 15, 2012 ~~[Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75358 (December 1, 2011)]~~. [No change, except that for the 2012 through 2016 model years, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

~~**100.5.6 AC17 Air Conditioning Efficiency Test Procedure.**~~

~~1. Overview. The dynamometer operation consists of four elements: a pre-conditioning cycle, a 30-minute soak period under simulated solar heat, an SC03 drive cycle, and a Highway Fuel Economy Test (HWFET) drive cycle. The vehicle is preconditioned with the UDDS to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 30 minute vehicle soak (engine off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The SC03 driving schedule is followed immediately by the HWFET cycle, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the preconditioning driving, vehicle soak, and SC03 and HWFET official test cycles, is conducted in an environmental test facility. The environmental test facility must be capable of providing the following nominal ambient test conditions of: 77 °F air temperature, 50 percent relative humidity, a solar heat load intensity of 850 W/m2, and vehicle cooling air flow proportional to vehicle speed. Section §86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The entire test sequence is run twice; with and without the vehicle's air conditioner operating during the SC03 and HFET test cycles. For gasoline-~~

~~fueled Otto-cycle vehicles, the composite samples collected in bags are analyzed for THC, CO, CO_2, and CH_4. For petroleum-fueled diesel-cycle vehicles, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, and CH_4. The following figure shows the basic sequence of the test procedure.~~



~~2. **Dynamometer requirements**.~~

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

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

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

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

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

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

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

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

~~3. **Test cell ambient conditions**~~.

~~3.1 **Ambient air temperature**~~.

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

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

~~3.2 **Ambient humidity**~~.

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

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

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

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

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

~~4.1.1 The outlet of the center duct on the dash.~~

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

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

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

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

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

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

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

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

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

~~6.3 Open all vehicle windows.~~

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

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

~~6.6 Set the air conditioning system controls to off.~~

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

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

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

~~6.8 Following the preconditioning cycle, the test vehicle and cooling fan(s) are turned off, all windows are rolled up, and the vehicle is allowed to soak in the ambient conditions of paragraph (c)(1) of this section for 30 ±1 minutes. The solar heat system must be turned on and generating 850 W/m² within 1 minute of turning the engine off.~~

~~6.9 **Air conditioning on test**~~.

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

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

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

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

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

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

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

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

~~6.10 **Air conditioning off test**~~. ~~The air conditioning off test is identical to the steps identified in paragraphs 6.1 through 6.9 of this section, except that the air conditioning system and fan speeds are set to complete off or the lowest. It is preferred that the air conditioning off test be conducted sequentially after the air conditioning on test, following a 10-15 minute soak.~~

* * * *

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA 2001 THROUGH 2014 MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2009 THROUGH 2016 MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted:	August 5, 1999
Amended:	December 27, 2000
Amended:	July 30, 2002
Amended:	September 5, 2003 (corrected February 20, 2004)
Amended:	May 28, 2004
Amended:	August 4, 2005
Amended:	June 22, 2006
Amended:	October 17, 2007
Amended:	May 2, 2008
Amended:	December 2, 2009
Amended:	February 22, 2010
Amended:	March 29, 2010
Amended:	September 27, 2010
Amended:	March 22, 2012
Amended:	December 6, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as adopted March 22, 2012. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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CALIFORNIA 2001 THROUGH 2014 MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2009 THROUGH 2016 MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

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 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," with the following exceptions and additions.

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

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B. Definitions, Acronyms and Abbreviations

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2. California Definitions.

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"**Small volume manufacturer**" means any manufacturer <u>that meets the "small volume manufacturer" definition as set forth in section 1900, title 13, CCR.</u> ~~whose projected or combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. A manufacturer's California sales shall consist of all vehicles or engines produced by the manufacturer and delivered for sale in California, except that vehicles or engines produced by the manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as California sales of the marketing manufacturer. For the 2009 through 2016 model years, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, one of which is 10% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 10% or more in each of the firms; or (3) vehicles produced by two or more firms having a common corporate officer(s) who is (are) responsible for the overall direction of the companies; or (4) vehicles imported or distributed by all firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.~~

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E. California Exhaust Emission Standards.

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2. Emission Standards Phase-In Requirements for Manufacturers

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

2.1.1 The fleet average non-methane organic gas exhaust mass emission values from the passenger cars and light-duty trucks produced and delivered for sale in California each model year by a manufacturer other than a small volume manufacturer or an independent low volume manufacturer shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES (50,000 mile Durability Vehicle Basis)		
Model Year	Fleet Average NMOG (g/mi)	
	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 8500 lbs. GVW
2001	0.070	0.098
2002	0.068	0.095
2003	0.062	0.093
2004	0.053	0.085
2005	0.049	0.076
2006	0.046	0.062
2007	0.043	0.055
2008	0.040	0.050
2009	0.038	0.047
2010-2014[1]	0.035	0.043

[1] For the 2014 model year only, a manufacturer may comply with the fleet average NMOG+NOx values in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," in lieu of complying with the NMOG fleet average values in this table. A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its

PC/LDT1 fleet and its LDT2~~/MDPV~~ fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful life standards.

* * * *

F. Requirements and Procedures for Durability Demonstration

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4. §86.1823 Durability demonstration procedures for exhaust emissions.

* * * *

4.2 §86.1823-08. ~~September 15, 2011~~October 15, 2012. [No change, except that subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

* * * *

G. Procedures for Demonstration of Compliance with Emission Standards

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

* * * *

3.1 §86.1829-01. ~~May 7, 2010~~October 15, 2012. Amend as follows:

* * * *

H. Certification, Information and Reporting Requirements.

* * * *

3. §86.1843 General information requirements

3.1 §86.1843-01 [No change.]

3.2 **Alternative Fuel Information.**

For passenger cars, light-duty trucks, and medium-duty vehicles ~~not certified exclusively on gasoline or diesel, except for vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the vehicles are certified. For vehicles~~ that use hydrogen fuel, the manufacturer shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, thirty-three months prior to

January 1 of the model year for which the vehicles are certified. For calendar year 2012 only, the manufacturer of vehicles that use hydrogen fuel shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, twenty-nine months prior to January 1 of the model year for which the vehicles are certified.

* * * *

I. In-Use Compliance Requirements and Procedures

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

1.1 §86.1845-01. December 8, 2005. Amend as follows:

* * * *

1.1.3 **High Mileage Testing.** Amend subparagraph (c)(2) of 40 CFR §86.1845-01 to read: All test vehicles must have a minimum odometer mileage of 50,000 miles. At least one vehicle of each test group certified to the emission standards in Section E.1.1.1 must have a minimum age and odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. At least one vehicle of each test group certified to the 120,000-mile and 150,000-mile emission standards in Section E.1.1.2 must have a minimum age and odometer mileage of 90,000 miles and ~~112,500~~ <u>105,000</u> miles, respectively. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

* * * *

J. Procedural Requirements

* * * *

3. §86.1848-10 Certification. ~~July 6, 2011~~<u>October 15, 2012</u>. [No change, except that this version of §86.1848-10 shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

* * * *

15. §86.1865-12 How to comply with the fleet average CO_2 standards. ~~September 15, 2011~~ October 15, 2012. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
16. §86.1866-12 CO_2 ~~fleet average~~ credits for advanced technology vehicles ~~programs~~. ~~July 6, 2011~~October 15, 2012. [No change, except that for the 2012 through 2016 model years this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
17. §86.1867-12 Optional early CO_2 credit programs. ~~July 6, 2011~~October 15, 2012. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

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

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

* * * *

100.2 Equipment and Facility Requirements.

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86.111-94 Exhaust gas analytical-system. ~~May 7, 2010~~ October 15, 2012. [No change.]

* * * *

100.5 Test Procedures and Data Requirements.

* * * *

86.135-12 Dynamometer procedure. ~~May 7, 2010~~ October 15, 2012. [No change.]

* * * *

86.165-12 Air Conditioning idle test procedure. ~~July 6, 2011~~ October 15, 2012. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

~~86.166-12 Method for calculating emissions due to air conditioning leakage. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as~~

~~proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]~~

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<ins>86.167-17 AC17 Air Conditioning Emissions Test Procedure. October 15, 2012. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]</ins>

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California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA NON-METHANE ORGANIC GAS TEST PROCEDURES

Adopted:	July 12, 1991
Amended:	September 22, 1993
Amended:	June 24, 1996
Amended:	August 5, 1999
Amended:	July 30, 2002
Amended:	March 22, 2012
Amended:	December 6, 2012

Monitoring and Laboratory Division, Southern Laboratory Branch
Mobile Source Division
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NOTE: Mention of any trade name or commercial product does not constitute endorsement or recommendation of this product by the Air Resources Board. Note: The proposed amendments to this document are shown in underline to indicate additions and strikeout to indicate deletions compared to the test procedures as last amended March 22, 2012. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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PART B

DETERMINATION OF NON-METHANE HYDROCARBON MASS EMISSIONS BY FLAME IONIZATION DETECTION

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5. NMHC MASS EMISSION PER TEST PHASE

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5.2 All Vehicles

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5.2.5 The density of the NMHC is determined using the carbon:hydrogen ratio of the fuel, $C_xH_yO_z$, according to the following equation:

$$NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g / mole) * \left(\frac{28.316847 \text{ liter/ft3}}{24.055 \text{ liter/mole}} \right)$$

where: 12.01115 = atomic weight of carbon
1.00797 = atomic weight of hydrogen

<u>except when using any gasoline-based fuel, including Phase 2 gasoline and E85 fuel, for which the $NMHC_{dens}$ is defined as 16.33.</u>

*   *   *   *

7. SAMPLE CALCULATIONS

7.1 Given the following data for a gasoline vehicle operated on phase 2 certification fuel, $CH_{1.964}O_{0.0182}$, calculate the weighted NMHC mass emission.

Test Phase	FID THC_e (ppmC)	FID THC_d (ppmC)	CH_{4e} (ppmC)	CH_{4d} (ppmC)	CO_{em} (ppm)	CO_{2e} (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	21.928	3.557	3.667	2.545	94.758	0.9581	2745	3.610
2	3.826	3.533	2.694	2.490	16.516	0.5925	4700	3.876
3	4.242	3.386	2.769	2.414	11.524	0.8225	2738	3.611

For Phase 1:

$NMHC_e$ $= \text{FID } THC_e - (r_{CH_4} * CH_{4e})$
$= 21.928 \text{ ppmC} - (1.15 * 3.667 \text{ ppmC})$
$= 17.711 \text{ ppmC}$

$NMHC_d$ $= \text{FID } THC_d - (r_{CH_4} * CH_{4d})$
$= 3.557 \text{ ppmC} - (1.15 * 2.545 \text{ ppmC})$
$= 0.630 \text{ ppmC}$

The numerator of the DF
$= 100 * (x / (x + y/2 + 3.76 * (x + y/4 – z/2))$
$= 100 * (1 / 1 + 1.964 / 2 + 3.76 * (1 + 1.964 / 4 – 0.0182 / 2)$
$= 13.2381$

DF $= 13.2381 \div [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

$$DF = \frac{13.2381}{0.9581 + (17.711\,\text{ppmC} + 3.667\,\text{ppmC} + 94.758\,\text{ppmC}) * 10^{-4}}$$

$= 13.653$

$NMHC_{conc}$ $= NMHC_e - NMHC_d * [1 - (1 \div DF)]$
$= 17.711 \text{ ppmC} – 0.630 \text{ ppmC} * [1 - (1 \div 13.653)]$
$= 17.127 \text{ ppmC}$

$$\cancel{NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g/mole) * \left(\frac{28.316847\text{liter/ft3}}{24.0547\text{liter/mole}}\right)}$$

$NMHC_{dens}$ $= \underline{16.33\ g/ft^3}$ $\cancel{(1 * 12.01115 + 1.964 * 1.00797) * (28.316847/24.055)}$
$\cancel{= 16.470\ g/ft^3}$

$NMHC_{mass\ n} = NMHC_{conc} * NMHC_{dens} * VMIX * 10^{-6}$
$= 17.127 \text{ ppmC} * 16.\underline{33}\cancel{47}\ g/ft^3 * 2745\ ft^3 * 10^{-6}$

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$NMHC_{mass\ 1}$ = 0.77$\underline{0}$~~43~~ g

Similarly, for Phase 2: $NMHC_{mass\ 2}$ = 0.0068 g
and for Phase 3: $NMHC_{mass\ 3}$ = 0.021$\underline{7}$~~9~~ g

Therefore,

$$NMHC_{wm} = 0.43 * \left(\frac{NMHC_{mass1} + NMHC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{NMHC_{mass3} + NMHC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$\cancel{NMHC_{wm} = 0.43 * \left(\frac{0.768\,g + 0.0068\,g}{3.610\text{ miles} + 3.876\text{ miles}} \right) + 0.57 * \left(\frac{0.0217\,g + 0.0068\,g}{3.611\text{ miles} + 3.876\text{ miles}} \right)}$$

$$\underline{NMHC_{wm} = 0.43 * \left(\frac{0.770\,g + 0.0068\,g}{3.610\text{ miles} + 3.876\text{ miles}} \right) + 0.57 * \left(\frac{0.0217\,g + 0.0068\,g}{3.611\text{ miles} + 3.876\text{ miles}} \right)}$$

$NMHC_{wm}$ = 0.047 g/mile

7.2 Given the following data for a vehicle operating on 10% ethanol and 90% gasoline (E10) $CH_{\underline{1.8784}\cancel{2.7841}}O_{\underline{0.0338}\cancel{0.3835}}$, calculate the weighted NMHC mass emission.

Test Phase	FID THC_e (ppmC)	FID THC_d (ppmC)	CH_{4e} (ppmC)	CH_{4d} (ppmC)	CO_{em} (ppm)	CO_{2e} (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	14.398	2.971	3.639	2.125	97.83	0.9203	3508	3.590
2	2.882	2.830	2.176	2.010	12.25	0.5935	6010	3.858
3	3.976	2.642	2.621	2.058	19.86	0.7624	3502	3.581

For Phase 1:

$NMHC_e$ = FID THC_e - (r_{CH_4} * CH_{4e})
= 14.398 ppmC - (1.15 * 2.215 ppmC)
= 10.213 ppmC

$NMHC_d$ = FID THC_d - (r_{CH_4} * CH_{4d})
= 2.971 ppmC - (1.15 * 2.125 ppmC)
= 0.527 ppmC

The numerator of the DF
= 100 * (x / (x + y/2 + 3.76 * (x + y/4 – z/2)))
= 100 * (1 / (1 + 1.8784 / 2 + 3.76 * (1 + 1.8784 / 4 – 0.0338 / 2)))
= 13.511

$$DF = 13.511 \div [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$$

$$= \frac{13.511}{0.9203 + (10.213\,\text{ppmC} + 3.639\,\text{ppmC} + 97.83\,\text{ppmC}) * 10^{-4}}$$

$$= 14.505$$

$$\begin{aligned} NMHC_{conc} &= NMHC_e - NMHC_d * [1 - (1 / DF)] \\ &= 10.213\ \text{ppmC} - 0.527\ \text{ppmC} * [1 - (1 / 14.505)] \\ &= 9.722\ \text{ppmC} \end{aligned}$$

$$NMHC_{mass\ n} = NMHC_{conc} * NMHC_{dens} * VMIX * 10^{-6}$$

$NMHC_{mass\ 1}$ = 0.557~~8~~ g

Similarly, Phase 2: $NMHC_{mass\ 2}$ = 0.0 g
and for Phase 3: $NMHC_{mass\ 3}$ = 0.040 g

Therefore,

$$NMHC_{wm} = 0.43 * \left(\frac{NMHC_{mass1} + NMHC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{NMHC_{mass3} + NMHC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$\cancel{NMHC_{wm} = 0.43 * \left(\frac{0.558\,\text{g} + 0.00\,\text{g}}{3.590\ \text{miles} + 3.858\ \text{miles}} \right) + 0.57 * \left(\frac{0.040\,\text{g} + 0.00\,\text{g}}{3.581\ \text{miles} + 3.858\ \text{miles}} \right)}$$

$$\underline{NMHC_{wm} = 0.43 * \left(\frac{0.557\,\text{g} + 0.00\,\text{g}}{3.590\ \text{miles} + 3.858\ \text{miles}} \right) + 0.57 * \left(\frac{0.040\,\text{g} + 0.00\,\text{g}}{3.581\ \text{miles} + 3.858\ \text{miles}} \right)}$$

$NMHC_{wm}$ = 0.035 g/mile

*   *   *   *

Part D

DETERMINATION OF C_2 TO C_5 HYDROCARBONS IN AUTOMOTIVE SOURCE SAMPLES BY GAS CHROMATOGRAPHY

METHOD NO. 1002

*   *   *   *

2. METHOD SUMMARY

*   *   *   *

2.2 The samples are received by the laboratory in Tedlar®, Kynar®, or Solef® bags, which are sub-sampled into a GC for separation and analysis.

*   *   *   *

4. INSTRUMENTS AND APPARATUS

4.1 ~~Kynar® (polyvinylidene fluoride)~~ Sample collection bags, ~~4 mil in thickness,~~ nominally 5 to 10 liters in capacity and equipped with quick-connect fittings, are typically used to contain the samples. Sample collection bags may be made of Tedlar® (polyvinylfloride, or PVF), 2 mil in thickness, or of Kynar® or Solef® (polyvinylidenefloride, or PVDF), each 4 mil in thickness. Other sample bag material or sample collection containers, such as ~~bags made of Tedlar® (polyvinyl fluoride) film or~~ nickel-coated stainless steel canisters, may be used, provided they are made of non-reactive material and do not cause sample loss or contamination.

*   *   *   *

Part E

DETERMINATION OF C_6 TO C_{12} HYDROCARBONS IN AUTOMOTIVE SOURCE SAMPLES BY GAS CHROMATOGRAPHY

METHOD NO. 1003

*   *   *   *

2. **METHOD SUMMARY**

*   *   *   *

2.2 The samples are received by the laboratory in Tedlar®, Kynar®, or Solef® bags, which are sub-sampled into a GC for separation and analysis.

*   *   *   *

4. **INSTRUMENTATION AND APPARATUS**

4.1 ~~Kynar® (polyvinylidene fluoride)~~ Sample collection bags, ~~4 mil in thickness,~~ nominally 5 to 10 liters in capacity and equipped with quick-connect fittings, are typically used to contain the samples. Sample collection bags may be made of Tedlar® (polyvinylfloride, or PVF), 2 mil in thickness, or of Kynar® or Solef® (polyvinylidenefloride, or PVDF), each 4 mil in thickness. Other sample bag material or sample collection containers, such as ~~bags made of Tedlar® (polyvinyl fluoride) film or~~ nickel-coated stainless steel canisters, may be used, provided they are made of non-reactive material and do not cause sample loss or contamination.

*   *   *   *

Part F

DETERMINATION OF ALDEHYDE AND KETONE COMPOUNDS IN AUTOMOTIVE SOURCE SAMPLES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

METHOD NO. 1004

*   *   *   *

7. **CALCULATIONS**

*   *   *   *

7.3 ~~For tolualdehyde, the sum of all isomers present is reported as m-tolualdehyde. —~~

Under the conditions of the system described in Section 6.6, the isomers coelute. The m-tolualdehyde response factor is applied to the single tolualdehyde peak. This concentration is reported as m-tolualdehyde.

*   *   *   *

Part G
DETERMINATION OF NMOG MASS EMISSIONS

* * * *

3. DILUTION FACTOR AND NMHC MASS EMISSION CALCULATION

* * * *

3.2 The density of the NMHC is determined using the carbon:hydrogen ratio of the fuel, $C_xH_yO_z$, according to the following equation:

$$NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g/mole) * \left(\frac{28.316847 liter/ft3}{24.0547 liter/mole}\right)$$

where: 12.01115 = atomic weight of carbon
1.00797 = atomic weight of hydrogen

<u>except when using any gasoline-based fuel, including Phase 2 gasoline and E85 fuel, for which the $NMHC_{dens}$ is defined as 16.33.</u>

* * * *

b) For Phase 2 gasoline, $CH_{1.94}O_{0.017}$, where x = 1, y = 1.94 and z = 0.017,
DF = 13.295 / [CO_{2e} + ($NMHC_e$ + CH_{4e} + CO_e) * 10^{-4}]
$NMHC_{dens}$ = <u>16.33</u> ~~16.44~~

* * * *

e) For E85, $CH_{2.7841}O_{0.3835}$, ~~W~~<u>w</u>here x = 1, y = 2.7841, and z = 0.3835:
DF = 12.4253 / [CO_{2e} + ($NMHC_e$ + CH_{4e} + CO_e) * 10^{-4}]
$NMHC_{dens}$ = <u>16.33</u> ~~17.44~~

3.3 Sample Calculation

A flex-fuel vehicle using E85 fuel $CH_{2.7841}O_{0.3835}$, where x = 1, y = 2.7841, and z = 0.3835:

Test Phase	FID THC_e (ppmC)	CH_{4e} (ppmC)	CO_{2e} (%)	CO_e (ppm)	FID THC_d (ppmC)	CH_{4d} (ppmC)	CO_{2d} (%)	CO_d (ppm)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	27.230	6.918	0.8564	117.801	3.532	2.261	0.0438	0.5224	3495	3.591
2	3.5459	2.357	0.5595	10.8229	3.476	2.247	0.4446	0.3322	5799	3.846
3	3.8510	2.590	0.7163	5.1538	3.396	2.188	0.4507	0.6752	3484	3.591

FID response factor of methane is experimentally determined for each individual FID. The value of 1.15 used here is for example only.

For phase 1:

$$NMHC_e = FID\ THC_e - r_{CH_4} * CH_{4e}$$
$$= 27.230 - 1.15 * 6.918$$
$$= 19.274 \text{ ppmC}$$

$$DF = 12.4253\ /\ [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$$
$$= 12.4253\ /\ [0.8564 + (19.274 + 6.918 + 117.801) * 10^{-4}]$$
$$= 14.2688 \text{ ppmC}$$

$$NMHC_d = FID\ THC_d - r_{CH_4} * CH_{4d}$$
$$= 3.532 - 1.15 * 2.261$$
$$= 0.9319 \text{ ppmC}$$

$$NMHC_{conc} = NMHC_e - NMHC_{d*} (1 - 1/DF)$$
$$= 19.274 - 0.9319 * (1 - 1\ /\ 14.2688)$$
$$= 18.407 \text{ ppmC}$$

$$NMHC_{mass1} = NMHC_{conc} * NMHC_{dens} * VMIX_1 * 10^{-6}$$

$$= 18.407 * \underline{16.33}\ \cancel{17.44} * 3495 * 10^{-6}$$
$$= \underline{1.0506}\ \cancel{1.1220} \text{ g}$$

Similarly, for Phase 2, DF $= 22.152$ and $NMHC_{mass2} = 0$

Similarly, for Phase 3, DF $= 17.3\underline{26}\cancel{32}$ and $NMHC_{mass2} = 0.002\underline{5}\cancel{6}$ g

4. SPECIATED HYDROCARBON MASS EMISSIONS CALCULATION

* * * *

4.4. SAMPLE CALCULATION

4.4.1 Exhaust emissions from a gasoline vehicle are collected in three dilute exhaust sample bags and one dilution air (background) sample bag during the FTP. Gas chromatography is used to determine the benzene concentration of each bag sample. Calculate the weighted benzene mass emissions based on the following data:

Test Phase	HC_e (ppbC)	HC_d (ppbC)	FID THC_e (ppmC)	CH_{4e} (ppmC)	CO_{2e} (%)	CO_{em} (ppm)	R_a (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	500	25	98	6	1.20	280	28	2846	3.584
2	100	25	22	4	0.95	87	25	4854	3.842
3	120	25	29	5	1.07	101	24	2840	3.586

For Phase 1:

$DF = 13.47 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
(see section 3, DF Calc.)

$NMHC_e = \text{FID } THC_e - (r_{CH_4} * CH_{4e})$
$= 98 \text{ ppmC} - (1.04 * 6 \text{ ppmC})$
$= 92 \text{ ppmC}$

$CO = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$
NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e .
$= (1 - (0.01925) * 1.2\% - 0.000323 * 28\%) * 280 \text{ ppm}$
$= 271 \text{ ppm}$

$DF = 13.47 / [1.2\% + (92 \text{ ppmC} + 6 \text{ ppmC} + 271 \text{ ppm}) * 10^{-4}]$
$= 10.89$

$HC_{conc} = HC_e - (HC_d * (1 - (1 / DF)))$
$= 500 \text{ ppbC} - (25 \text{ ppbC} * (1 - (1 / 10.89)))$
$= 477 \text{ ppbC}$

Mol. Wt. of $C_6H_6 = (6 * 12.01115) + (6 * 1.00797)$
$= 78.11472$ g/mole

$HC_{dens} = (\text{Mol. Wt.} * \text{conversion of liter to } ft^3) / (\text{Mol. Vol.})$
$= (78.11472 \text{ g/mole} * 28.316 \text{ liter}/ft^3) / 24.055 \text{ liter/mole}$
$= 91.952 \text{ g}/ft^3$

$HC_{mass\ n} = (HC_{conc} * HC_{dens} * VMIX * 10^{-6}) / (\text{Carbon No.})$

$HC_{mass\ 1} = (477 \text{ ppbC} * 91.952 \text{ g}/ft^3 * 2846\ ft^3 * 10^{-6}) / 6$
$= 20.8$ mg

Similarly, for Phase 2: $H\underline{C}\cancel{e}_{mass\ \underline{2}} = 5.7$ mg and for Phase 3: $\text{H}\underline{\text{C}}\cancel{\text{c}}_{\text{mass }\underline{3}}$ = 4.2 mg

Therefore,

$$HC_{wm} = 0.43 * \left(\frac{HC_{mass1} + HC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{HC_{mass3} + HC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$HC_{wm} = 0.43 * \left(\frac{20.8\,\text{mg} + 5.7\,\text{mg}}{3.584\text{ miles} + 3.842\text{ miles}} \right) + 0.57 * \left(\frac{4.2\,\text{mg} + 5.7\,\text{mg}}{3.586\text{ miles} + 3.842\text{ miles}} \right)$$

HC_{wm} = 2.3 mg/mile (benzene weighted mass emissions)

5. ALCOHOL MASS EMISSIONS CALCULATION

* * * *

5.4 SAMPLE CALCULATION

5.4.1 Alcohol emissions from an E85 fueled vehicle are collected in three sets of dilute exhaust impingers and one set of dilution air impingers during the FTP. Gas chromatography is used to determine the alcohol concentration in each impinger. This is the same vehicle test as the example in section 3.3. Calculate the weighted ethanol mass emissions based on the following data, along with the data presented in section 3.3:

Test Phase	$Ivol_r$ (mL)	$Iconc_{e1}$ (µg/mL)	$Iconc_{e2}$ (µg/mL)	$Ivol_{em}$ (liter)	$Iconc_{d1}$ (µg/mL)	$Iconc_{d2}$ (µg/mL)	$Ivol_{dm}$ (liter)	$Itemp_e$ (°K)	$Itemp_d$ (°K)
1	15	4.984	0.106	8.18	0	0	31.16	294.26	294.26
2	15	0	0	14.65	0	0	31.16	294.26	294.26
3	15	0	0	8.67	0	0	31.16	294.26	294.26

Test Phase	$D_{phase\ n}$ (mile)	DF	P_B (mm HG)	VMIX (ft^3~~3~~)
1	3.591	14.27	760	3495
2	3.846	22.15	760	5799
3	3.591	17.33	760	3484

* * * *

6. CARBONYL MASS EMISSIONS CALCULATIONS

* * * *

6.4. SAMPLE CALCULATION

6.4.1 Carbonyl emissions from an E85 vehicle are collected in three sets of dilute exhaust impingers and one set of dilution air impingers during the FTP. HPLC is used to determine the carbonyl mass in each impinger. This is the same vehicle test as the example in section 3.3. Calculate the weighted formaldehyde and acetaldehyde mass emissions based on the following data, along with the data presented in section 3.3:

Test Phase	$Ivol_c$ (mL~~l~~)	Formaldehyde		$Ivol_{em}$ (liter)	Acetaldehyde		$Ivol_{dm}$ (liter)	$Itemp_e$ (°K)	$Itemp_d$ (°K)
		$Iconc_{ce}$ (µg/mL)	$Iconc_{cd}$ (µg/mL)		$Iconc_{ce}$ (µg/mL)	$Iconc_{cd}$ (µg/mL)			
1	4.4	0.387	0.006	8.47	4.114	0.006	8.23	294.26	294.26
2	4.4	0.048	0.016	15.35	0.013	0.009	13.88	294.26	294.26
3	4.4	0.016	0.006	9.01	0.012	0.005	8.16	294.26	294.26

Test Phase	$D_{phase\ n}$ (mile)	DF	P_B (mm HG)	VMIX (ft^3 ~~3~~)
1	3.591	14.27	760	3495
2	3.846	22.15	760	5799
3	3.591	17.33	760	3484

* * * *

7 NONMHC MASS EMISIONS CALCULATION

* * * *

7.3 Sample Calculation

Continuing from the same E85 test used in the alcohol and carbonyl calculations:

Test Phase	$NMHC_{mass\ n}$ (g)	$Ethanol_{mass\ n}$ (g)	$Formaldehyde_{massn}$ (g)	$Acetaldehyde_{mass\ n}$ (g)
1	1.0506 ~~1.1220~~	0.09271	0.0197	0.212
2	0	0	0.001457	0.000165
3	0.0025~~6~~	0	0.000472	0.000329

and

$NMHC_{dens}$ = 16.33 ~~17.44~~ g/ft^3

As Amended: December 6, 2012
Date of Hearing: November 15, 2012

$$NONMHC_{mass1} = NMHC_{mass1} - NMHC_{dens} * \sum\left(\frac{ROH_{mass1}}{ROH_{dens}}\right) * r_{ROH} - NMHC_{dens} * \sum\left(\frac{RHO_{mass1}}{RHO_{dens}}\right) * r_{RHO}$$

$$\begin{aligned}
NONMHC_{mass1} &= \underline{1.0506}\ \cancel{1.1220} - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.9271\ g / 27.116\ (g/ft^3)) * 0.756 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.0197\ g / 35.350\ (g/ft^3)) * 0 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.212\ g / 25.929\ (g/ft^3)) * 0.5 \\
&= \underline{1.0506}\ \cancel{1.1220} - \underline{0.4221}\ \cancel{0.4508} - 0 - \underline{0.0668}\ \cancel{0.0713} \\
&= \underline{0.5617}\ \cancel{0.5999}\ g
\end{aligned}$$

$$\begin{aligned}
NONMHC_{mass2} &= 0\ - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0\ g / 27.116\ (g/ft^3)) * 0.756 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.001457\ g / 35.350\ (g/ft^3)) * 0 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.000165\ g / 25.929\ (g/ft^3)) * 0.5 \\
&= 0\ - 0 - 0 - 0.00005\underline{2}\cancel{5} \\
&= 0\ g
\end{aligned}$$

Note: Results that are less than zero are reported as zero.

$$\begin{aligned}
NONMHC_{mass3} &= 0.002\underline{5}\cancel{6} - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0\ g / 27.116\ (g/ft^3)) * 0.756 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.000472\ g / 35.350\ (g/ft^3)) * 0 \\
&\quad - \underline{16.33}\ \cancel{17.44}\ g/ft^3 * (\ 0.000329\ g / 25.929\ (g/ft^3)) * 0.5 \\
&= 0.002\underline{5}\cancel{6} - 0 - 0 - 0.0001\cancel{11} \\
&= 0.0024\cancel{9}\ g
\end{aligned}$$

8 WEIGHTED HYDROCARBON MASS EMISSIONS CALCULATION

* * * *

8.2 Sample calculation

Continuing from the previous example:

Test Phase	$NONMHC_{mass\ n}$ (g)	$Ethanol_{mass\ n}$ (g)	$Formaldehyde_{mass\ n}$ (g)	$Acetaldehyde_{mass\ n}$ (g)	Distance (mile)
1	~~0.5999~~ $\underline{0.5617}$	0.9271	0.019718	0.212	3.591
2	0	0	0.001457	0.000165	3.846
3	0.0024~~9~~	0	0.000472	0.000329	3.591

$$\cancel{NONMHC_{wm} = 0.43 * \left(\frac{0.5999\,g + 0\,g}{3.591\,miles + 3.846\,miles}\right) + 0.57 * \left(\frac{0.00249\,g + 0\,g}{3.591\,miles + 3.846\,miles}\right)}$$

$$\underline{NONMHC_{wm} = 0.43 * \left(\frac{0.5617\,g + 0\,g}{3.591\,miles + 3.846\,miles}\right) + 0.57 * \left(\frac{0.0024\,g + 0\,g}{3.591\,miles + 3.846\,miles}\right)}$$

$NONMHC_{wm}$ = <u>0.03266</u> ~~0.03488~~ g/mile
Similarly, $Ethanol_{wm}$ = 0.05360 g/mile
Similarly, $Formaldehyde_{wm}$ = 0.00137 g/mile
Similarly, $Acetaldehyde_{wm}$ = 0.01231 g/mile

With all the above information, the weighted mass emissions of non-methane organic gas can be calculated:

$$NMOG_{wm} = \sum NONMHC_{wm} + \sum ROH_{wm} + \sum RHO_{wm}$$

$NMOG_{wm}$ = <u>0.03266</u> ~~0.03488~~ g/mile + 0.05360 g/mile + 0.00137 g/mile + 0.01231 g/mile

= <u>0.09994</u> ~~0.102~~ g/mile

APPENDIX 1

LIST OF COMPOUNDS

CAS #	COMPOUND	MIR

*   *   *   *

Light End and Mid-Range Hydrocarbons
(Listed in approximate elution order)

*   *   *   *

03404-61-3	3-methyl-1-hexene	~~4.56~~<u>4.41</u>

*   *   *   *

As Amended: December 6, 2012
Date of Hearing: November 15, 2012

State of California
AIR RESOURCES BOARD

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

Adopted: August 5, 1999
Amended: June 22, 2006
Amended: October 17, 2007
Amended: December 2, 2009
Amended: September 27, 2010
Amended: March 22, 2012
Amended: December 6, 2012

Note: Proposed amendments to this document are shown in underline to indicate additions and in ~~strikeout~~ to indicate deletions compared to the test procedures as last amended March 22, 2012. Existing intervening text that is not amended is indicated by a row of asterisks (* * * *).

*   *   *   *

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

The provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts A and B (as adopted or amended as of July 1, 1989); Subpart S (as adopted or amended on May 4, 1999); and, such sections of these Subparts as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, insofar as those subparts pertain to evaporative emission standards and test procedures, are hereby adopted as the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Years," with the following exceptions and additions:

PART I. GENERAL CERTIFICATION REQUIREMENTS FOR EVAPORATIVE EMISSIONS

*   *   *   *

E. Emission Standards

1. Evaporative Emission Standards for 2001 and Subsequent Model Year Vehicles Other Than Motorcycles.

*   *   *   *

(e) For 2015 and subsequent model motor vehicles, the following evaporative emission requirements apply:

*   *   *   *

(iii) Carry-Over of 2014 Model-Year Evaporative Families Certified to the Zero-Fuel Evaporative Emission Standards. A manufacturer may carry over 2014 model motor vehicles certified to the zero-fuel (0.0 grams per test) evaporative emission standards set forth in section I.E.1.(c) through the 2018 model year and be considered compliant with the requirements of section I.E.1.(e). <u>For all motor vehicles that are certified via this carry-over provision, the emission standards set forth in section I.E.1.(c) shall apply when determining in-use compliance throughout the vehicle's useful life.</u> If the manufacturer chooses to participate in the fleet-average option for the highest whole vehicle diurnal plus hot soak emission standard, the following family emission limits are assigned to these evaporative families for the calculation of the manufacturer's fleet-average hydrocarbon emission value.

Vehicle Type	Highest Whole Vehicle Diurnal + Hot Soak (grams per test)
Passenger Cars	0.300
Light-Duty Trucks 6,000 lbs. GVWR and under, and 0 - 3,750 lbs. LVW	0.300
Light-Duty Trucks 6,000 lbs. GVWR and under, and 3,751 – 5,750 lbs. LVW	0.400
Light-Duty Trucks 6,001 - 8,500 lbs. GVWR	0.500

* * * *

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

Adopted:	December 27, 2000
Amended:	December 12, 2002
Amended:	July 26, 2007
Amended:	October 17, 2007
Amended:	September 27, 2010
Amended:	March 22, 2012
<u>Amended:</u>	<u>December 6, 2012</u>

Note: The proposed amendments to this document are shown in <u>underline</u> to indicate additions and strikeout to indicate deletions compared to the test procedures as adopted March 22, 2012. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

*   *   *   *

Part I. GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy Duty Vehicles

*   *   *   *

10. **Emission standards for Otto-cycle heavy-duty engines and vehicles.** [§86.xxx-10]

*   *   *   *

B. California provisions.

1. Exhaust emissions from new 2004 and later model year Otto-cycle medium- and heavy-duty engines, except for Otto-cycle medium- and heavy-duty engines subject to the alternative standards in 40 CFR §86.005-10(f), shall not exceed:

California Emission Standards for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines[A]
(in g/bhp-hr)

Model Year	Emission Category	NMHC + NOx	NMHC	NOx	CO[H]	HCHO	PM
Standards for Heavy-Duty Otto-Cycle Engines Used In 2004 through ~~2019~~ 2021 Model Medium-Duty Vehicles 8,501 to 10,000 pounds GVW[B] and 2004 and Subsequent Model Medium-Duty Vehicles 10,001 to 14,000 pounds GVW[C]							
2004	ULEV	2.4 **or** 2.5 with 0.5 NMHC cap[D]	n/a	n/a	14.4	0.05	n/a
	SULEV	2.0	n/a	n/a	7.2	0.025	n/a
2005 through 2007[F]	ULEV	1.0[D,F]	n/a	n/a	14.4	0.05	n/a
	SULEV	0.5[D,F]	n/a	n/a	7.2	0.025	n/a
2008 and subsequent[G]	ULEV	n/a	0.14[F]	0.20[F]	14.4	0.01	0.01
	SULEV	n/a	0.07[F]	0.10[F]	7.2	0.005	0.005
Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW							
2004	n/a	2.4 **or** 2.5 with 0.5 NMHC cap[D]	n/a	n/a	37.1	0.05[E]	n/a
2005 through 2007[F]	n/a	1.0[C,E]	n/a	n/a	37.1	0.05[E]	n/a
2008 and subsequent[G]	n/a	n/a	0.14[F]	0.20 [E]	14.4	0.01	0.01

* * * *

[B] For the 202~~0~~2 and subsequent model years, medium-duty vehicles 8,501 to 10,000 pounds GVW must certify to the LEV III primary emission standards and test procedures for complete vehicles specified in section 1961.2, title 13, CCR.

* * * *

2. **Optional Standards for Complete <u>and Incomplete</u> Heavy-Duty Vehicles.**

Manufacturers may request to group complete <u>and incomplete</u> heavy-duty vehicles into the same test group as vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete <u>and incomplete</u> heavy-duty Otto-cycle vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

*   *   *   *

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL-ENGINES AND VEHICLES

Adopted:	December 12, 2002
Amended:	July 24, 2003
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Amended:	March 22, 2012
<u>Amended:</u>	<u>December 6, 2012</u>

Note: The proposed amendments to this document are shown in <u>underline</u> to indicate additions and strikeout to indicate deletions compared to the test procedures as adopted March 22, 2012. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by “ * * * * ”.

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

*   *   *   *

PART 86 – CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

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

*   *   *   *

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

*   *   *   *

11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

*   *   *   *

A. California provisions.

*   *   *   *

5. **Standards for Medium-Duty Engines.**

5.1 **Requirements Specific to Heavy-Duty Engines Used in Medium-Duty Vehicles 8,501 to 10,000 pounds GVW.** For the 2004 through ~~2019~~ 2021 model years, a manufacturer of heavy-duty engines used in medium-duty vehicles 8,501 to 10,000 pounds GVW may choose to comply with the following standards as an alternative to the primary emission standards and test procedures specified in title 13, CCR, §1961 or §1961.2, as applicable. A manufacturer that chooses to comply with these optional heavy-duty standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in title 13, CCR, §2139(c). For the 202~~0~~2 and subsequent model years, a manufacturer of heavy-duty engines used in medium-duty vehicles 8,501 to 10,000 pounds

GVW must comply with the primary emission standards and test procedures specified in title 13, CCR, §1961.2.

*   *   *   *

5.3 **Exhaust Emission Standards for Medium-Duty Engines.** The exhaust emissions from new 2004 through ~~2019~~ 2021 model heavy-duty diesel engines used in ultra-low emission and super-ultra-low emission medium-duty diesel vehicles 8,501 to 10,000 pounds GVW and 2004 and subsequent model heavy-duty diesel engines used in ultra-low emission and super-ultra-low emission medium-duty diesel vehicles 10,001 to 14,000 pounds GVW shall not exceed:

Exhaust Emission Standards for 2004 through 2006 Model Medium-Duty ULEVs and SULEVs					
Vehicle Emission Category	NOx + NMHC		CO	PM	HCHO
ULEV[1] Option A	2.5 (with a 0.5 cap on NMHC)		14.4	0.10	0.050
ULEV[1]; Option B	2.4		14.4	0.10	0.050
Exhaust Emission Standards for 2007 through ~~2019~~ 2021 Model Medium-Duty ULEVs and SULEVs 8,501-10,000 lbs. GVW and 2007 and Subsequent Model Medium-Duty ULEVs and SULEVs 10,001-14,000 lbs. GVW					
Vehicle Emission Category	NOx	NMHC or NMHCE	CO	PM	HCHO
ULEV[1]	0.20	0.14	15.5	0.01	0.050
SULEV[1]	0.10	0.07	7.7	0.005	0.025

[1] Emissions averaging may be used to meet these standards using the requirements for participation averaging, banking and trading programs, as set forth in Section I.15 of these test procedures.

5.4 **Optional Standards for Complete and Incomplete Heavy-Duty Vehicles.** Manufacturers may request to group complete and incomplete heavy-duty vehicles into the same test group as vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete and incomplete heavy-duty diesel vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

*   *   *   *

II. TEST PROCEDURES

*   *   *   *

Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

1065.701 General requirements for test fuels. April 30, 2010.

*   *   *   *

B. California provisions.

*   *   *   *

3. **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 the new clean fuel are not specifically set forth in paragraph §86.1313-98 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

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

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMHC, NOx, and CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014~~,~~" ~~as amended March 22, 2012~~ or the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," ~~as adopted March 22, 2012~~ <u>which are incorporated by reference in title 13, CCR, §2317</u>, as applicable. In the case of fuel-flexible vehicles or dual-fuel vehicles that were not certified on the new clean fuel but are capable of being operated on it, exhaust and evaporative emissions from the use of the new clean fuel shall not increase compared to exhaust and evaporative emissions from the use of gasoline that complies with Title 13, Division 3, Chapter 5, Article 1, California Code of Regulations.

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California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017 MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: December 17, 2008
Amended: December 2, 2009
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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017 MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

* * * * *

C. Zero-Emission Vehicle Standards.

* * * * *

2. Percentage ZEV Requirements

* * * * *

2.2 Requirements for Large Volume Manufacturers.

* * * * *

(d) *Requirements for Large Volume Manufacturers in Model Years 2012 through 2017.*

(1) *2012 through 2014 Requirements.* On an annual basis, a manufacturer must meet the total ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEVs and Type 0 ZEVs, equal to at least 0.79% of its annual sales, using either production volume determination method described in subdivision C.2.1(b) No more than 50% of the total obligation may be met with credits generated from PZEVs~~,~~. No more than 75% of the total obligation may be met with credits generated from AT PZEVs. No more than 93.4% may be met with Enhanced AT PZEVs, Type 0 ZEVs, and NEVs, other than limits described in subdivision C.7.6. The entire obligation may be met solely with credits generated from ZEVs.

(2) *2015 through 2017 Requirements.* On an annual basis, a manufacturer must meet its ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEVs and Type 0 ZEVs, equal to at least 3% of its annual sales, using either production volume determination method described in subdivision C.2.1(b). No more than 42.8% of the total obligation may be met with credits generated from PZEVs. No more than 57.1% of the total obligation may be met with credits generated from AT PZEVs. No more than 78.5% may be met with credits generated from TZEVs, Type 0 ZEVs, and NEVs, other than limits described in subdivision C.7.6. The entire obligation may be met solely with credits generated from ZEVs.

* * * * *

3.3 Zero-Emission VMT PZEV Allowance.

(a) *Calculation of Zero-Emission VMT Allowance.* A vehicle that meets the requirements of subdivision C.3.2 and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero-emission VMT PZEV allowance, calculated as follows:

Range	*Zero-emission VMT Allowance*
$EAER_u$ < 10 miles	0.0
$EAER_u$ ≥10 to 40 miles	$EAER_u$ x (1 – UF_{Rcda})/11.028
$EAER_u$ > 40 miles	~~($EAER_{u40}$) x [1 – (UF_{40}*R_{cda}/$EAER_u$)]/ 11.028~~ 3.627 x (1 – UF_n) Where, ~~UF_{40}= utility factor at 40 miles~~ ~~$EAER_{u40}$= 40 miles~~ n = 40 x (R_{cda}/$EAER_u$)

A vehicle cannot generate more than 1.39 zero-emission VMT PZEV allowance.

The urban equivalent all-electric range ($EAER_u$) and urban charge depletion range actual (R_{cda}) shall be determined in accordance with section G.~~5.4~~11.4 and G.11.9, respectively, of these test procedures. The utility Factor (UF) shall be determined according to SAE International's Surface Vehicle Information Report J2841 SEP2010 (Revised September 2010), incorporated by reference herein, from the Fleet Utility Factors (FUF) Table in Appendix B or using a polynomial curve fit with "FUF Fit" coefficients from Table 2 Utility Factor Equation Coefficients ~~based on the charge depleting actual range (urban cycle) (R_{cda}) shall be determined according to Section 4.5.2 Equation 6 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3 of SAE J2841 March 2009~~.

* * * * *

F. Test Procedures for 2012 through 2017 Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2012 through 2017 Model Hybrid-Electric Vehicles, Except Off-Vehicle Charge Capable Hybrid Electric Vehicles.

* * * * *

8. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

* * * * *

8.2 US06 Emission Test.

* * * * *

8.2.6 Amend subparagraph (f) as follows.

* * * * *

8.2.6.2 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the US06, record the battery state-of-charge to determine if the SOC criterion in section ~~F~~G.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i) without the preconditioning cycle. A total of three US06 emission tests shall be allowed to satisfy the SOC criterion.

* * * * *

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

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NOTE: This document is incorporated by reference in section 1962.2, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of zero-emission vehicles and hybrid electric vehicles are contained in other documents that are designed to be used in conjunction with this document.

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

* * * * *

C. Zero-Emission Vehicle Standards.

* * * * *

3. Transitional Zero-Emission Vehicles (TZEV).

* * * * *

3.2 TZEV Requirements*.* In order for a vehicle to be eligible to receive a ZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements:

* * * * *

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G)~~.~~ or 1976(b)(1)(E)~~ Manufacturers may certify 2018 and 2019 TZEVs to the evaporative standards for PCs and LDTs in subdivision 1976(b)(1)(E)~~;

* * * * *

3.3 Allowances for TZEVs.

(a) *Zero-Emission Vehicle Miles Traveled TZEV Allowance Calculation.* A vehicle that meets the requirements of subdivision C.3.2 and has zero-emission vehicle miles traveled (VMT), as defined by and calculated by this test procedure and measured as equivalent all electric range (EAER) capability will generate allowance according to the following equation:

UDDS Test Cycle Range (~~E~~AER)	*Allowance*
<10 all electric miles	0.00
≥10 miles range	TZEV Credit = [(0.01) * EAER + 0.30]
>80 miles (credit cap)	1.10

(1) Allowance for US06 Capability. TZEVs with US06 all electric range capability (AER) of at least 10 miles shall earn an additional 0.2 allowance. US06 test cycle range capability shall be determined in accordance with section ~~E.8~~G.7.5 of these test procedures.

* * * *

7. Generation and Use of ZEV Credits; Calculation of Penalties

* * * * *

7.6 Use of ZEV Credits.

* * * * *

(c) *GHG-ZEV Over Compliance Credits.*

(1) *Application***.** Manufacturers may apply to the Executive Officer, no later than December 31, 2016, to be eligible for this subdivision C.7.6(c), based on the following qualifications:

(A) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with sections 1961.1 and 1961.3, or compliance with the National greenhouse gas program as allowed by subdivisions 1961.1(a)(1)(A)(ii) and 1961.3(c), and

(B) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with section 1962.1, and

(C) A manufacturer must submit documentation of its projected product plans to show over compliance with the manufacturer's section 1961.3 requirements, or over compliance with the National greenhouse gas program requirements as allowed by subdivision 1961.3(c) by at least 2.0 gCO_2/mile in each model year through the entire 2018 through 2021 model year period.

(2) *Credit Generation and Calculation.* Manufacturers must calculate their over compliance with section 1961.3 requirements, or over compliance with the National greenhouse gas program requirements as allowed by subdivision 1961.3(c) for model years 2018 through 2021 based on compliance with the previous model year standard. For example, to generate credits for this subdivision C.7.6(c) for model year 2018, manufacturers would calculate credits based on model year 2017 compliance with section 1961.3, or compliance with the National greenhouse gas program requirements as allowed by subdivision 1961.3(c).

(A) At least 2.0 gCO_2/mile over compliance with section 1961.3, or over compliance with the National greenhouse gas program as allowed by subdivision 1961.3(c) is required in each year and the following equation must be used to calculate the amount of ZEV credits earned for purposes of this subdivision C.7.6(c):

[(Manufacturer US PC and LDT Sales) x (gCO_2/mile below manufacturer GHG standard for a given model year)] / (Manufacturer GHG standard for a given model year)

(B) Credits earned under ~~section~~subdivision 1961.3(a)(9), or credits earned under 40 CFR, part 86, Subpart S, 86.1866-12(a), 86.1866-12(b), or 86.1870-12 may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A). All ZEVs included in the calculation above must include associated upstream emission values found in section 1961.3.

(C) Banked gCO_2/mile credits earned under 1961.1 and 1961.3, or under the National greenhouse gas program requirements as allowed by subdivision 1961.3(c) from previous model years or from other manufacturers may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A).

(3) *Use of GHG-ZEV Over Compliance Credits*. A manufacturer may use no more than the percentage enumerated in the table below to meet either the total ZEV requirement nor the portion of their ZEV requirement that must be met with ZEV credits, with credits earned under this subdivision C.7.6(c).

2018	**2019**	**2020**	**2021**
50%	50%	40%	30%

Credits earned in any given model year under this subdivision C.7.6(c) may only be used in the applicable model year and may not be used in any other model year.

Credits calculated under this provision must also be removed from the GHG compliance bank, and cannot be banked for future compliance toward section 1961.3, towards compliance with the National greenhouse gas program requirements as allowed by subdivision 1961.3(c).

(4) *Reporting Requirements.* Annually, manufacturers are required to submit calculations of credits for this subdivision C.7.6(c) for the model year, any remaining credits/debits from previous model years under section 1961.3, or under the National greenhouse gas program requirements as allowed by subdivision 1961.3(c), and projected credits/debits for future years through 2021 under section 1961.3, or under the National greenhouse gas program requirements as allowed by subdivision 1961.3(c) and this subdivision C.7.6(c).

If a manufacturer, who has been granted the ability to generate credits under this subdivision C.7.6(c), fails to over comply by at least 2.0 gCO_2/mile in any one year, the manufacturer will be subject to the full ZEV requirements for the model year and future model years, and will not be able to earn credits for any other model year under this subdivision C.7.6(c).

~~(5) If the Executive Officer does not make a determination that a Federal greenhouse gas fleet standard is functionally equivalent to subdivision 1961.3, than this subdivision C.7.6(c)(1) through (4) is unavailable for use by any manufacturer.~~

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State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

Adopted: December 27, 2000
As Amended: December 12, 2002

Note: Proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as adopted December 27, 2000.

NOTE: This document is incorporated by reference in section 1956.8(d), title 13, California Code of Regulations ("CCR") and also incorporates by reference various sections of Title 40, Part 86 of the Code of Federal Regulations, with some modifications. It contains the majority of the requirements necessary for certification of heavy-duty Otto-cycle engines for sale in California, in addition to containing the exhaust emissions standards and test procedures for these Otto-cycle engines.[1] The section numbering conventions for this document are set forth in subparagraph 4 on page 4. Reference is also made in this document to other California-specific requirements that are necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

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

~~2. "California Motor Vehicle Emission Control and Smog Index Label Specifications" (incorporated by reference in section 1965, title 13, CCR).~~

~~3. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978(b), title 13, CCR).~~

2 4. Warranty requirements (sections 2035, et seq., title 13, CCR).

3 ~~5~~. OBDII (section 1968, et seq. ~~.1~~, title 13, CCR, as applicable).

[1] The requirements for Otto-cycle engines used in complete vehicles up to 14,000 pounds GVW are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in §1961(d), title 13, CCR.

TABLE OF CONTENTS

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

The following provisions of Subparts A, N, and P, Part 86, Title 40, Code of Federal Regulations ("CFR"), as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the 40 CFR Part 86 section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty Otto-cycle engines, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," with the following exceptions and additions.

Part I. GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy Duty Vehicles

1. **General Applicability.** [§86.xxx-1]

A. Federal provisions.

1. §86.001-1. October 6, 2000.

1.1 Subparagraph (a). [No change.]

1.2 Delete subparagraph (b) and replace with the following: A manufacturer must certify any complete heavy-duty vehicle of 14,000 pounds gross vehicle weight rating or less in accordance with the medium-duty vehicle provisions contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated herein by reference. Heavy-duty engine or vehicle provisions of subpart A do not apply to such a vehicle.

1.3 Subparagraph (c). [n/a (ADP for LDVs)]

1.4 Subparagraph (d). [n/a (NLEVs)]

1.5 Amend subparagraph (e) 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 a manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. The small volume manufacturer's heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

1.6 Subparagraph (f). [n/a; exhaust opacity refers to diesel engines.]

2. §86.005-1 October 6, 2000.

2.1 Subparagraph (a). [No change.]

2.2 Delete subparagraph (b) and replace with the following: A manufacturer must certify any complete heavy-duty vehicle of 14,000 pounds gross vehicle weight rating or less in accordance with the medium-duty vehicle provisions contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in §1961(d), title 13, CCR. Heavy-duty engine or vehicle provisions of subpart A do not apply to such a vehicle.

2.3 Subparagraph (c). [No change.]

2.4 Subparagraph (d). [Reserved.]

2.5 Amend subparagraph (e) 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 a manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. The small volume manufacturer's heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

2.6 Subparagraph (f). [n/a; exhaust opacity refers to diesel engines.]

B. California provisions.

1. These regulations are applicable to all heavy-duty Otto-cycle methanol-fueled, ethanol-fueled, natural-gas-fueled and liquefied-petroleum-gas-fueled dedicated, dual-fuel and multi-fuel engines (and vehicles) except those engines derived from existing diesel engines. For any engine which is not a distinctly Otto-cycle engine nor derived from such, the Executive Officer shall determine whether the engine shall be subject to these regulations or alternatively to the heavy-duty diesel engine regulations, in consideration of the relative similarity of the engine's torque-speed characteristics and vehicle applications with those of Otto-cycle and diesel engines. Reference to dual-fuel vehicles or engines shall also mean bi-fuel vehicles or engines.

2. References in the federal regulations to light-duty vehicles and light-duty trucks do not apply.

3. Any reference to vehicle sales throughout the United States shall mean vehicles and engines sales in California. Any reference to small volume manufacturer shall mean a California small-volume manufacturer as defined in section I.1.A.~~1.5~~, above.

4. 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, and Certification Short Test shall not be applicable to these procedures, except where specifically noted. The regulations pertaining to evaporative emissions are contained in "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," as incorporated in §1976, title 13, CCR.

~~5. Non-methane hydrocarbon emissions shall be measured in accordance with the "California Non-methane Hydrocarbon Test Procedures" as last amended July 12, 1991, which is incorporated herein by reference.~~

2. **Definitions.** [§86.xxx-2]

A. Federal provisions.

All of the definitions in previous CFR sections continue to apply, except as otherwise noted below. Definitions specific to other requirements such as evaporative emissions are contained in those separate documents.

1. §86.004-2. <u>January 18, 2001</u> ~~October 6, 2000~~.

B. California provisions.

"Administrator" means the Executive Officer of the Air Resources Board.

"**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.

<u>**"EPA"** means "Air Resources Board" or the Executive Officer of the Air Resources Board</u>.

"**EPA Enforcement Officer**" means the Executive Officer <u>of the Air Resources Board</u> or his delegate.

<u>**"Medium-Duty Engine"** means a heavy-duty engine that is used in a medium-duty vehicle</u>.

"Medium-Duty Vehicle" means any 1992 though 2006 model-year heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1960.1(h)(2) having a manufacturer's gross vehicle weight rating of 14,000 pounds or less~~; any 1995 through 2003 model-year heavy-duty vehicle certified to the standards in section 1960.1(h)(1) having a manufacturer's gross vehicle weight rating of 14,000 pounds or less;~~ and any 2000 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1961(a)(1) or 1962 having a manufacturer's gross vehicle weight rating between 8,500 and 14,000 pounds.

Warranty means the warranty provisions set forth in title 13, California Code of Regulations §2036.

3. **Abbreviations.** [§86.xxx-3]

A. Federal provisions.

1. §86.000-3. October 22, 1996. All federal abbreviations apply, except as otherwise noted below. Abbreviations specific to other requirements are contained in those separate documents.

B. California provisions.

CCR means California Code of Regulations
LEV means low-emission vehicle
ULEV means ultra-low-emission vehicle
SULEV means super-ultra-low-emission vehicle
MDV means medium-duty vehicle

4. **Section numbering; construction.**
§86.084-4. September 21, 1994. [No change.]

The section numbering convention employed in these test procedures, in order of priority, is I.1.A.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. California-only requirements are set forth in a separate subsection. In the beginning of each section the generic notation §86.xxx-1 is used when there is more than one applicable section (or when no versions of the section are being incorporated) to indicate the section being discussed without regard to model year. The years of applicability (denoted generically by "xxx") are added as applicable in the pertinent subsections.

In cases where the entire CFR section is incorporated by reference with no modifications, the notation "[No change.]" is used. In cases where the federal requirements are modified by California requirements, the notation "Amend (or delete) subparagraph (__) as follows:" is used. If the federal requirement is not applicable, the notation "[n/a]" is used. In cases where there are California only requirements, the additional California requirements are noted in a separate subsection with the numbering convention set forth above.

If a CFR section for a specific model year is set forth in this document, and that CFR section references previous CFR sections, then all previously referenced CFR sections are deemed incorporated into this document unless otherwise noted.

5. **General Standards; increase in emissions; unsafe conditions.**
[§86.090-5] November 12, 1996. [No change.]
6. **Hearings on certification.** [§86.078-6] [n/a]
7. **Maintenance of records; submittal of information; right of entry.**
[§86.000-7] October 22, 1996. [No change.]

8. **Emission standards for light-duty vehicles.** [§86.xxx-8] [n/a]

9. **Emission standards for light-duty trucks.** [§86.xxx-9] [n/a]

10. **Emission standards for Otto-cycle heavy-duty engines and vehicles.** [§86.xxx-10]

A. **Federal provisions.**

1. **§86.098-10.** October 6, 2000 ~~October 21, 1997~~. Amend as follows:

1.1 Amend subparagraph (a) as follows:

1.1.1 Delete subparagraph (a)(1) and replace with emission standards set forth in Section I.10.B below.]

1.1.2 Subparagraph (a)(2). [No change.]

1.1.3 Subparagraph (a)(3). [No change.]

1.2 Subparagraph (b) [n/a] [See evap TPs]

1.3 Subparagraph (c) [No change.]

1.4 Subparagraph (d) [No change.]

2. **§86.099-10**. ~~August 23, 1995~~. [n/a; See evap TPs.]

3. **§86.005-10**. January 18, 2001 ~~October 6, 2000~~. Amend as follows:

3.1 ~~Amend s~~Subparagraph (a) ~~as follows~~: [No change.]

~~3.1.1 Delete subparagraph (a)(1).~~ [See, also emission standards in I.10.B below]

~~3.1.2 Subparagraph (a)(2). [No change.]~~

~~3.1.3 Subparagraph (a)(3). [No change.]~~

~~3.1.4 Subparagraph (a)(4). [No change.]~~

3.2 Subparagraph (b) [n/a] [See evap TPs]

3.3 Subparagraph (c) [No change.]

3.4 Subparagraph (d) [No change.]

3.5 Subparagraph (e) [No change.]

3.6 Subparagraph (f) [No change.]

4. **§86.008-10**. January 18, 2001 ~~October 6, 2000~~. Amend as follows:

4.1 ~~Amend s~~Subparagraph (a) ~~as follows~~: [No change.]

~~4.1.1 Delete subparagraph (a)(1).~~ [See, also emission standards in I.10.B below]

~~4.1.2 Subparagraph (a)(2). [No change.]~~

~~4.1.3 Subparagraph (a)(3). [No change.]~~

~~4.1.4 Subparagraph (a)(4). [No change.]~~

4.2 Subparagraph (b) [n/a] [See evap TPs]

4.3 Subparagraph (c) [No change.]

4.4 Subparagraph (d) [No change.]

4.5 Subparagraph (e) [No change.]

4.6 Subparagraph (f) [No change.]

4.7 Subparagraph (g) [No change.]

B. California provisions.

1. Exhaust emissions from new 2004 and later model year Otto-cycle medium- and heavy-duty engines, except for Otto-cycle medium- and heavy-duty engines subject to the alternative standards in 40 CFR §86.005-10(f), shall not exceed:

California Emission Standards for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines[A]
(in g/bhp-hr)

Model Year	Emission Category	NMHC + NOx	NMHC	NOx	CO[F]	HCHO	PM
Standards for Heavy-Duty Otto-Cycle Engines Used In Medium-Duty Vehicles 8,501 to 14,000 pounds GVW[B]							
2004	ULEV	2.4 **or** 2.5 with 0.5 NMHC cap[C]	n/a	n/a	14.4	0.05	n/a
	SULEV	2.0	n/a	n/a	7.2	0.025	n/a
2005 through 2007 [E]	ULEV	1.0[C,E]	n/a	n/a	14.4	0.05	n/a
	SULEV	0.5 [C,E]	n/a	n/a	7.2	0.025	n/a
2008 and subsequent [F]	ULEV	n/a	0.14[E]	0.20 [E]	14.4	0.01	0.01
	SULEV	n/a	0.07[E]	0.10 [E]	7.2	0.005	0.005
Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW							
2004	n/a	2.4 **or** 2.5 with 0.5 NMHC cap[C]	n/a	n/a	37.1	0.05[D]	n/a
2005 through 2007 [E]	n/a	1.0[C,E]	n/a	n/a	37.1	0.05[D]	n/a
2008 and subsequent [F]	n/a	n/a	0.14 [E]	0.20 [E]	14.4	0.01	0.01

[A] These standards apply to petroleum-fueled, alcohol-fueled, liquefied petroleum gas-fueled and natural gas-fueled Otto-cycle engines. Alcohol-fueled engines have the option of certifying to the organic material hydrocarbon equivalent ("OMHCE") or organic material non-methane hydrocarbon equivalent ("OMNMHCE") standard.

[B] A manufacturer of engines used in incomplete medium-duty vehicles may choose to comply with these standards as an alternative to the primary emission standards and test procedures for complete vehicles specified in section 1961, title

13, CCR. A manufacturer that chooses to comply with these optional heavy-duty engine standards and test procedures shall specify, in the Part I application for certification, an in-use compliance test procedure, as provided in section 2139(c), title 13 CCR.

[C] A manufacturer may request to certify to the Option 1 or Option 2 federal NMHC + NOx standards as set forth in 40 CFR §86.005-10(f), ~~as adopted October 6, 2000~~. However, for engines used in medium-duty vehicles ~~8,500 - 14,000 lbs. GVW,~~ the formaldehyde ~~and carbon monoxide~~ level ~~standards~~ must meet the standard ~~levels~~ specified above.

[D] This standard only applies to methanol-fueled Otto-cycle engines.

[E] A manufacturer may elect to include any or all of its medium- and heavy-duty Otto-cycle engine families in any or all of the emissions ABT programs for HDEs, within the restrictions described in section I.15 of these test procedures. For engine families certified to the Option 1 or 2 federal standards the FEL must not exceed 1.5 g/bhp-hr. If a manufacturer elects to include engine families certified to the 2005 and subsequent model year standards, the NOx plus NMHC FEL must not exceed 1.0 g/bhp-hr. For engine families certified to the 2008 and subsequent model year standards, the FEL is the same as set forth in 40 CFR 86.008-10(a)(1).

[F] A manufacturer may elect to include any or all of its medium- and heavy-duty Otto-cycle engine families in any or all of the emissions ABT programs for HDEs, within the restrictions described in section I.15 o f these test procedures.

[G] Idle carbon monoxide: For all Otto-cycle heavy-duty engines utilizing aftertreatment technology, and not certified to the on-board diagnostics requirements of title 13, CCR, §1968, et seq, as applicable, the CO emissions shall not exceed 0.50 percent of exhaust gas flow at curb idle.

~~Model Year~~	~~Emission Category~~	~~NMHC + NOx~~	~~CO~~	~~HCHO~~
~~**Standards for Heavy-Duty Otto-Cycle Engines Used In Medium-Duty Vehicles 8,501 to 14,000 pounds GVW**~~[B]				
~~2004~~	~~ULEV~~	~~2.4 **or** 2.5 with 0.5 NMHC cap~~[C]	~~14.4~~	~~0.05~~
~~2004~~	~~SULEV~~	~~2.0~~	~~7.2~~	~~0.025~~
~~**Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW**~~				
~~2004~~	~~n/a~~	~~2.4 **or** 2.5 with 0.5 NMHC cap~~[C]	~~37.1~~	~~0.05~~[D]
~~2005 and subsequent~~	~~ULEV~~	~~1.0~~[C]	~~14.4~~	~~0.05~~
	~~SULEV~~	~~0.5~~	~~7.2~~	~~0.025~~
~~**Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW**~~				
~~2005 and subsequent~~	~~n/a~~	~~1.0~~[C]	~~37.1~~	~~0.05~~[D]

11. **Emission standards for heavy-duty diesel engines and vehicles.** [§86.xxx-11] [n/a]

12. **Alternative certification procedures.** [§86.080-12] April 17, 1980. [No change.]

13. **Alternative durability program.** [§86.xxx-13] [n/a]

14. **Small-volume manufacturers certification procedures.** [§86.xxx-14]

~~A. Federal provisions~~.

[Note: A small volume manufacturer shall mean a California small volume manufacturer as defined in Section I.1.A., above. Any reference to 10,000 units shall mean 4,500 units in California based on a three year running average as defined in I.1.A., above.]

1. §86.094-14. January 3, 1996. Amend as follows:

1.1 Subparagraphs (a) through (c)(3) [No change.]

1.2 Amend subparagraph (c)(4) as follows: Small volume manufacturers shall include in their records all of the information that EPA requires in §86.094-21. This information will be considered part of the manufacturer's application for certification. [The last sentence is deleted.]

1.3 Subparagraphs (c)(5) through (c)(7)(i)(B) [No change.]

1.4 Amend subparagraph (c)(7)(i)(C)(*1*) as follows: Manufacturers with aggregated sales of less than 301 motor vehicles and motor vehicle engines per year may used assigned deterioration factors that the Administrator determines and prescribes based on design specifications or sufficient control over design specifications, development data, in-house testing procedures, and in-use experience. [The remainder of the paragraph is the same.]

1.5 Subparagraph (c)(7)(i)(C)(*2*) through (c)(13)(i) [No change.]

1.6 Add the following <u>sentence</u> ~~test~~ to subparagraph (c)(13)(ii): All running changes that do not adversely affect emissions or the emission control system durability shall be deemed approved unless disapproved by the Executive Officer within 30 days of the implementation of the running change.

2. §86.096-14. March 24, 1993. [n/a; pertains to evaporative requirements.]

3. §86.098-14. April 6, 1994. [No change.]

15. **NOx and particulate averaging, trading, and banking for heavy-duty engines.** [§86.xxx-15.] ~~[n/a]~~

<u>1. §86.004-15. October 6, 2000. [No change.]</u>

<u>2. §86.007-15. January 18, 2001. Amend as follows:</u>

<u>2.1 Subparagraphs (a) through (m)(2): [No change.]</u>

<u>2.2 Subparagraph (m)(3): Delete.</u>

<u>2.3 Subparagraphs (m)(4) through m(10). [No change.]</u>

16. **Prohibition of defeat devices.** §86.004-16. October 6, 2000. [No change.]

17. **Emission control diagnostic system for light-duty vehicles and trucks.** [§86.099-17; §86.005-17] Delete; replace with: All heavy-duty Otto-cycle engines up to 14,000 pounds GVW must have an on-board diagnostic system as required in section 1968<u>, et seq</u>. ~~.1~~, title 13, CCR<u>, as applicable</u>.

18. **[Reserved.]**

19. **[Reserved.]**

20. **Incomplete vehicles, classification**. §86.085-20. . January 12, 1983. [No change.]

21. **Application for certification** [§86.xxx-21]

A. Federal provisions.

1. **§**86.004-21. October 6, 2000. [No change.]
2. **§**86.007-21. October 6, 2000. [No change - diesel only.]

B. California provisions.

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

22. **Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certifications and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges**. [§86.001-22] ~~A. Federal provisions 1.~~ April 6, 1994. [No change.]

23. **Required data.** [§86.xxx-23]

A. Federal provisions.

1. §86.001-23. October 21, 1997. [No change.]
2. <u>§86.007-23. January 18, 2001. [No change.]</u>

B. California provisions.

1. The data derived from testing to determine the exhaust emission deterioration factors shall be submitted to the Executive Officer for review. If the durability test method is accepted by EPA, it shall also be accepted by ARB, subject to the following condition. If, after certification for the first model year in which the method is used, the Executive Officer determines that a manufacturer's durability test procedures do not conform with good engineering practices, the Executive Officer may require changes to that manufacturer's durability test procedures for subsequent model years. The manufacturer's revised durability test procedures shall be submitted to the Executive Officer for review and approval.

<u>2. In lieu of testing for formaldehyde emissions for certification, a manufacturer may provide a statement in its application for certification that such vehicles comply with the applicable standards. Such a statement must be based on previous emission tests, development tests, or other appropriate information.</u>

24. **Test vehicles and engines.** [§86.001-24]]October 22, 1996. [No change.]

25. **Maintenance. [**δ86.xxx-25**]**]

1. §86.004-25. October 17, 1997. [No change.]
2. §86.007-25. January 18, 2001. [No change.]

26. **Mileage and service accumulation; emission measurements.** [§86.004-26] October 6, 2000. [No change.]
27. **Special test procedures.** §86.090-27. April 11, 1989. [No change.]
28. **Compliance with emission standards.** [§86.xxx-28]
   A. Federal provisions.
      1. §86.004-28. January 18, 2001 ~~October 6, 2000~~. [No change.]
   B. California provisions.
      1. All dedicated methanol-fueled and fuel-flexible vehicles and engines shall comply with the requirements which are applicable to heavy-duty gasoline-fueled Otto-cycle vehicles and engines, except where otherwise noted. In particular, for fuel-flexible vehicles and engines, a manufacturer's proposed durability demonstration program, as required in sections 86.094-21(b)(5)(i)(A) ~~86.091-21(b)(4)(iii)(A)~~ and 86.098-23(b)(1)(ii) ~~86.091-23(b)(1)(ii)~~, shall provide for the assessment of the durability of the engine in operation with methanol and gasoline, as well as intermediate mixtures of both fuels. A manufacturer's proposed mileage and service accumulation, as required in section 86.096-24(c) ~~86.090-24(c)~~, shall be conducted on methanol.
      2. For fuel-flexible vehicles and engines, the noted deterioration factors shall be determined from testing conducted with gasoline fuel. However, as an assurance that fuel-flexible vehicles and engines will comply with applicable exhaust emission standards throughout their useful lives when operated on methanol fuel, the manufacturer shall demonstrate that exhaust emissions tests conducted with methanol fuel at the beginning, middle, and end of the durability service accumulation schedule do not exceed the applicable exhaust emission standards. For certification to be granted, the vehicle or engine may not exceed applicable certification exhaust emission standards.
      3. For dual-fuel or multi-fuel gaseous engines and vehicles, the noted deterioration factors shall be determined separately for operation on each type of fuel or combination of fuels that the engine is designed to use. For certification to be granted, the provisions of 86.004-28(c) ~~86.091-28(c)~~ must be met separately for emissions using each type and combination of fuels.
29. **Testing by the Administrator.** §86.091-29. March 24, 1993. [No change.]
30. **Certification.** §86.004-30. October 6, 2000. [No change.]
31. **Separate certification.** §86.079-31. September 8, 1977. [No change.]
32. **Addition of a vehicle or engine after certification.** §86.079-32. September 8, 1977. [No change.]
33. **Changes to a vehicle or engine covered by certification.** §86.079-33. September 8, 1977. [No change.]
34. **Alternative procedure for notification of additions and changes.** §86.082-34. November 2, 1982. [No change.]
35. **Labeling.** [§86.xxx-35]
   ~~Delete.~~
   A. Federal provisions.
      1. §86.001-35. April 6, 1994.

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

2. §86.007-35. January 18, 2001. [No change, except as noted above for §86.001-35.]

B. California Provisions

1. ~~Labels shall comply with the requirements set forth in the "California Motor Vehicle Emission Control and Smog Index Label Specifications," incorporated by reference in §1965, title 13, CCR.~~ For 2003 through 2007 model year engines certified to the optional standards in §86.005-10(f) the following statement shall also be printed on the label, "This engine conforms to the California ULEV standards applicable to 20XX model year Heavy-Duty Otto-Cycle Engines.

36. **Submission of vehicle identification numbers.** [§86.079-36] [n/a]

37. **Production vehicles and engines.** §86.085-37. June 6, 1997. [No change.]

38. **Maintenance instructions.** [§86.xxx-38]

1. §86.004-38. October 21, 1997.

1.1 Subparagraphs (a) through (f). [No change.]

1.2 Amend subparagraph (g)(1) as follows:

(g) Emission control diagnostic service information:

(1) Manufacturers shall furnish or cause to be furnished to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, or the Administrator upon request, any and all information needed to make use of the on-board diagnostic system and such other information, including instructions for making emission-related diagnosis and repairs, including, but not limited to, service manuals, technical service bulletins, recall service information, data stream information, bi-directional control information, and training information, unless such information is protected by section 208(c) of the Act or California Government Code Section 6250, as a trade secret. No such information may be withheld under section 208(c) of the Act or California Government Code Section 6250, if that information is provided (directly or indirectly) by the manufacturer to franchised dealers or other persons engaged in the repair, diagnosing, or servicing of motor vehicles or motor vehicle engines.

1.3 Subparagraph (h). [No change.]

2. §86.007-38. January 18, 2001. [No change, except as noted above for §86.004-38 subparagraph (g)(1).]

39. **Submission of maintenance instructions.** [§86.079-39] September 8, 1977. [No change.]

40. **Heavy-duty engine rebuilding practices.** [§86.xxx-40]

1. §86.004-40. January 18, 2001 ~~October 21, 1997~~.

1.1 Add the following sentence to ~~Amend~~ the introductory paragraph ~~as follows~~: ~~The provisions of this section are applicable to heavy-duty engines subject to model year 2004 or later standards and are applicable to the process of engine rebuilding (or rebuilding a portion of an engine or engine system). The process of~~

~~engine rebuilding generally includes disassembly, replacement of multiple parts due to wear, and reassembly, and also may include the removal of the engine from the vehicle and other acts associated with rebuilding an engine.~~ Any deviation from the provisions contained in this section is <u>also</u> a prohibited act under ~~section 203(a)(3) of the Clean Air Act (42 U.S.C. 7522(a)(3)) or of~~ the California Vehicle Code § 27156, et seq.

1.2 Subparagraphs (a) through (e). [No change.]

Part II OTHER REQUIREMENTS; TEST PROCEDURES

Subpart N, Emission Regulations for New Otto-Cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

86.1301-90 Scope; applicability. April 11, 1989.
86.1302-84 Definitions. November 16, 1983.
86.1303-84 Abbreviations. November 16, 1983.
86.1304-90 Section numbering; construction. October 6, 2000.
86.1305-2004 Introduction; structure of subpart. October 6, 2000.
86.1306-96 Equipment required and specification; overview. September 21, 1994.
86.1306-07 Equipment required and specification; overview. January 18, 2001.
86.1308-84 Dynamometer and engine equipment specifications. December 16, 1987.
86.1309-90 Exhaust gas sampling system; Otto-cycle and non-petroleum-fueled engines. January 18, 2001 ~~June 30, 1995~~.

Amend subparagraph (a)(3) as follows: For methanol-fueled engines, the sample lines for the methanol and formaldehyde samples are heated to 235º ± 15ºF (113º ± 8ºC).

86.1311-94 Exhaust gas analytical system; CVS bag sample. October 21, 1997.
86.1313-94 Fuel specifications. September 5, 1997.
86.1313-98 Fuel specifications. February 18, 2000 ~~September 5, 1997~~. [n/a diesel fuel specifications.]
86.1313-2004 Fuel specifications. January 18, 2001.
86.1313-2007 Fuel specifications. January 18, 2001 [n/a diesel fuel specifications.]

A. Federal Provisions.

Amend the federal fuel specifications as follows:

1. California Certification Gasoline Specification. Add the following subparagraph which reads: Gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in 86.1313-94(a)(1) and in 86.1313-2004(a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

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

[(a)] The gasoline must be blended from typical refinery feedstocks.

[(b)] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[(c)] Although §2263~~,~~ title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[(d)] The range for interlaboratory testing is 195-215^{o} F.

[(e)] The range for interlaboratory testing is 285-305^{o} F.

[(f)] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[(g)] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[(h)] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

2. Alcohol Fuel Specifications.

Amend §86.1313-94(c) as follows:

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

(c)(1) **Emission test fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust and evaporative emission testing shall meet the specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

Specification	Limit
M-100 Fuel Methanol	
Methanol	98.0 ± 0.5 vol. percent
Ethanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of Part II subparagraph 1 ~~section 100.3.1~~.	1.0 ± 0.1 vol. percent
E-100 Fuel Ethanol	
Ethanol	98.0 ± 0.5 vol. percent
Methanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of Part II subparagraph 1 ~~section 100.3.1~~.	1.0 ± 0.1 vol. percent

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

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

2.3 Add the following subparagraph.

2.3.1 ~~(c)(3)~~ Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

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

Amend §86.1313-94(d) as follows:

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

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

Specification	Limit
M-85 Fuel Methanol	
Petroleum fuel meeting the specifications of Part II subparagraph 1 ~~section 100.3.1~~.	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.
E-85 Fuel Ethanol	
Petroleum fuel meeting the specifications of Part II subparagraph 1 ~~section 100.3.1~~.	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

(d)(2) **Mileage accumulation fuel.** For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel shall meet the applicable specifications in Part II, subparagraph 1 and methanol or ethanol fuel shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specification for E-85 Fuel Ethanol). Mileage accumulation procedures shall be subject to the requirements set forth in 40 CFR §86.001-26 and §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.

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

3.3 Add the following subparagraphs.

(a) ~~(d)(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, a blend of methanol or ethanol fuel used for evaporative emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) and gasoline meeting the specifications of Part II subparagraph 1 of these test procedures such that the final blend is composed of either 35 volume percent methanol (± 1.0 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (± 1.0 volume percent of total blend) for ethanol-fueled vehicles. Alternative alcohol-gasoline blends may be used in place of M35 or E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to prior approval of the Executive Officer.

(b) ~~(d)(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. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

4. Natural Gas Fuel Specifications.

4.1 Delete subparagraph (e).

4.2 Add the following subparagraphs:

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

Specification	Limit
Compressed Natural Gas Certification Test Fuel	
Methane	90.0 ± 1.0 mole percent
Ethane	4.0 ± 0.5 mole percent
C_3 and higher hydrocarbon	2.0 ± 0.3 mole percent

content	
Oxygen	0.5 mole percent maximum
Inert gases ($CO_2 + N_2$)	3.5 ± 0.5 vol. percent

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

5. Liquefied Petroleum Gas Fuel Specifications.

5.1 Delete subparagraph (f).

5.2 Add the following subparagraphs:

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

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

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

6. Subparagraph (g). [No Change]

B. California Provisions.

1~~6~~. Identification of New Clean Fuels to be Used in Certification Testing.

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraph 86.1313-94 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

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

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), 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," as adopted September 17, 1993. In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

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

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

86.1314-94 Analytical gases. June 30, 1995.
86.1316-94 Calibration; frequency and overview. September 5, 1997.
86.1318-84 Engine dynamometer system calibrations. November 16, 1983.
86.1319-90 CVS calibration. January 18, 2001 ~~May 4, 1998~~.
86.1320-90 Gas meter or flow instrumentation calibration; particulate, methanol, and formaldehyde measurement. April 11, 1989.
86.1321-94 Hydrocarbon analyzer calibration. September 5, 1997.
86.1322-84 Carbon monoxide analyzer calibration. September 5, 1997.
86.1323-84 Oxides of nitrogen analyzer calibration. September 5, 1997.
86.1323-2007 Oxides of nitrogen analyzer calibration. January 18, 2001.
86.1324-84 Carbon dioxide analyzer calibration. September 5, 1997.
86.1325-94 Methane analyzer calibration. September 5, 1997.
86.1326-90 Calibration of other equipment. April 11, 1989.
86.1327-98 Engine dynamometer test procedures; overview. September 5, 1997.
86.1330-90 Test sequence, general requirements. January 18, 2001 ~~September 5, 1997~~.
86.1332-90 Engine mapping procedures. September 21, 1994.
86.1333-90 Transient test cycle generation. February 18, 2000 ~~May 4, 1998~~.
86.1334-84 Pre-test engine and dynamometer preparation. January 18, 2001 ~~September 5, 1997~~.
86.1335-90 Optional forced cool-down procedure. September 5, 1997.
86.1336-84 Engine starting and restarting. September 21, 1994.
86.1337-96 Engine dynamometer test run. September 5, 1997.

86.1337-2007 Engine dynamometer test run. January 18, 2001.
86.1338-84 Emission measurement accuracy. September 5, 1997.
86.1338-2007 Emission measurement accuracy. January 18, 2001.
86.1340-94 Exhaust sample analysis. June 30, 1995.
86.1341-98 Test cycle validation criteria. September 5, 1997.
86.1342-94 Calculations; exhaust emissions. September 5, 1997.

A. Federal Provisions.

Add the following calculation:

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

$$OMNMHCE_{mass} = NMHC_{mass} + \left(\frac{13.8756}{32.042}\right) * (CH_3OH)_{mass} + \left(\frac{13.8756}{23.035}\right) * (CH_3CH_2OH)_{mass} + \left(\frac{13.8756}{30.0262}\right) * (HCHO)_{mass} + \left(\frac{13.8756}{22.027}\right) * (CH_3CHO)_{mass}$$

B. California Provisions.

1. Non-methane hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Organic Gas Test Procedures" as last amended July 30, 2002, which is incorporated by reference in section 1956.8(d), title 13, CCR.

~~Amend subparagraph (d) Meaning of symbols as follows:~~
~~(1)(ii) If gaseous fuels are being used, 18.64 g/ft^3 for natural gas and 17.28 g/ft^3 for liquefied petroleum gas, assuming an average carbon to hydrogen ratio of 1:3.803 for natural gas and 1:2.656 for liquefied petroleum gas, at 68º F and 760 mm Hg pressure. The Executive Officer may approve other density values deemed appropriate by a manufacturer when gaseous fuels are being used.~~

* * * * *

~~(3)(v)(B) CO_e = [1-(0.01 + 0.005HCR)CO_{2e} - 0.00323R]CO_{em} for methanol fuel, where HCR is hydrogen to carbon ratio as measured for the fuel used. For natural gas and liquefied petroleum gas, HCR is assumed to be 2.656 and 3.802 respectively.~~

* * * * *

86.1344-94 Required information. October 21, 1997.

Subpart P - Emission Regulations for New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Heavy-Duty Engines and New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Light-Duty Trucks; Idle Test Procedures

86.1501-94 Scope, applicability. October 6, 2000.
86.1502-84 Definitions. May 4, 1999.
86.1503-84 Abbreviations. May 4, 1999.
86.1504-94 Section numbering; construction. June 30, 1995.
86.1505-94 Introduction; structure of subpart. June 30, 1995.
86.1506-94 Equipment required and specifications; overview. September 21, 1994.
86.1509-84 Exhaust gas sampling system. June 30, 1995.
86.1511-84 Exhaust gas analysis system. June 30, 1995.
86.1513-94 Fuel specifications. September 21, 1994.
86.1514-84 Analytical gases. June 30, 1995.
86.1516-84 Calibration; frequency and overview. November 16, 1983.
86.1519-84 CVS calibration. November 16, 1983.
86.1522-84 Carbon monoxide analyzer calibration. November 16, 1983.
86.1524-84 Carbon dioxide analyzer calibration. November 16, 1983.
86.1526-84 Calibration of other equipment. November 16, 1983.
86.1527-84 Idle test procedure; overview. November 16, 1983.
86.1530-84 Test sequence; general requirements. November 16, 1983.
86.1537-84 Idle test run. June 30, 1995.
86.1540-84 Idle exhaust sample analysis. November 16, 1983.
86.1542-84 Information required. December 10, 1984.
86.1544-84 Calculation; idle exhaust emissions. July 7, 1986.

Appendix I to Part 86 - Urban Dynamometer Schedules.

(f)(1) EPA Engine Dynamometer Schedule for Heavy-Duty Gasoline-Fueled Engines. April 29, 1998.

Appendix XII to Part 86 - Tables for Production Compliance Auditing of Heavy-Duty Engines and Heavy-Duty Vehicles, Including Light-Duty Trucks.
August 30, 1985. [n/a as applies to light-duty trucks]

AMENDMENTS TO THE CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL-ENGINES AND VEHICLES

Adopted: April 8, 1985
Amended: July 29, 1986
Amended: January 22, 1990
Amended: May 15, 1990
Amended: December 26, 1990
Amended: July 12, 1991
Amended: October 23, 1992
Amended: October 22, 1993
Amended: March 24, 1994
Amended: September 22, 1994
Amended: June 29, 1995
Amended: June 4, 1997
Amended: February 26, 1999
Amended: November 22, 2000
Amended: December 8, 2000
Amended: October 25, 2001

NOTES: This document incorporates by reference various sections of the Code of Federal Regulations (CFR), some with modifications. Proposed modifications to portions of paragraphs in the Federal language are indicated by underline for additions and ~~strikeout~~ for deletions. Larger portions of Federal language for a specific section that are not to be included in these procedures are denoted by "DELETE" and larger portions of new California language are indicated by "REPLACE WITH" or "INSERT". The symbols "******" and "....." mean that the remainder of the federal text for a specific section, which is not shown in these procedures, is proposed for inclusion by reference, with only the printed text changed. The symbol "#####" means that the remainder of the text of these procedures, which is not shown in this amendment document, has no proposed changes, including but not limited to text that the Board amended and approved December 8, 2000. A complete version of these test procedures will be available at http://www.arb.ca.gov/msprog/onroadhd/onroadhd.htm upon the effective date of these amendments.

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

The following provisions of Subparts A, I, and N, Title 40, Code of Federal Regulations, as adopted or amended by the U. S. Environmental Protection Agency on the date listed, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty diesel-engines and vehicles, are adopted and incorporated herein by this reference as the California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel-Engines and Vehicles, except as altered or replaced by the provisions set forth below.

The federal regulations contained in the Subparts identified above ~~which~~ that pertain to oxides of nitrogen emission averaging shall not be applicable to these procedures except for diesel engines and vehicles produced in the 1998 and subsequent model years. The federal regulations contained in the Subparts identified above which pertain to particulate emission averaging ~~shall not be applicable to~~ are not incorporated in these procedures for 1996 and subsequent model years. The smoke exhaust test procedures shall be applicable to California petroleum-fueled, liquefied-petroleum gas-fueled, and compressed-natural gas fueled heavy-duty diesel engines and vehicles for 1988 and later model years.

The federal regulations contained in the subparts identified above which pertain to nonconformance penalties~~y~~ shall not be applicable.

The federal regulations contained in the subparts identified above which pertain to evaporative emission shall not be applicable to these procedures. Applicable regulations pertaining to evaporative emissions are contained in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles," as incorporated in Title 13, California Code of Regulations, Section 1976.

Starting with the 1990 model year, these regulations shall be applicable to all heavy-duty ~~diesel~~ natural-gas-fueled and liquefied-petroleum gas-fueled engines (and vehicles) including those engines derived from existing diesel engines. For any engine ~~which~~ that is not a distinctly diesel engine nor derived from such, the Executive Officer shall determine whether the engine shall be subject to these regulations or alternatively to the heavy-duty Otto-cycle engine regulations, in consideration of the relative similarity of the engine's torque-speed characteristics and vehicle applications with those of diesel and Otto-cycle engines.

The regulations concerning the certification of methanol-fueled urban bus engines are not applicable in California until 1991 and subsequent model years. The regulations concerning the certification of all other methanol-fueled diesel engines and vehicles are not applicable in California until 1993 and subsequent model years. Regulations concerning the certification of incomplete medium-duty diesel low-emission vehicles and engines and ultra-low-emission vehicles and engines operating on any fuel are applicable for the 1992 and subsequent model years.

All references to the "Administrator" in the federal regulations contained in the subparts identified above shall be replaced with the "Executive Officer".

Subpart A, General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and later Model Year New Gasoline-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

Amend § 86.004-2, Title 40, Code of Federal Regulations, to read:

§ 86.004-2 Definitions. ~~October 21, 1997~~ January 18, 2001

* * * * *

Amend § 86.004-28, Title 40, Code of Federal Regulations, to read:

§ 86.004-28 Compliance with emission standards. ~~October 21, 1997~~ January 18, 2001

* * * * *

Adopt and amend § 86.007-11, Title 40, Code of Federal Regulations, to read:

§ 86.007-11 Emission standards and supplemental requirements for 2007 and subsequent ~~later~~ model year heavy-duty diesel ~~heavy-duty~~ engines and vehicles. January 18, 2001

This section applies to new 2007 and later model year heavy-duty diesel engines ~~HDEs~~. Section 86.007-11 includes text that specifies requirements that differ from Sec. 86.004-11. Where a paragraph in Sec. 86.004-11 is identical and applicable to Sec. 86.007-11, this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see Sec. 86.004-11.".

(a)(1) Exhaust emissions from new 2007 and later model year heavy-duty diesel engines ~~HDEs~~ shall not exceed the following:

(i) Oxides of Nitrogen (NOx). (A) 0.20 grams per brake horsepower-hour (0.075 grams per megajoule).

(B) A manufacturer may elect to include any or all of its heavy-duty diesel engine ~~HDE~~ families in any or all of the NOx and NOx plus NMHC emissions ABT programs for heavy-duty diesel engines ~~HDEs~~, within the restrictions described in Sec. 86.007-15 or Sec. 86.004-15. If the manufacturer elects to include engine families in any of these programs, the NOx FELs may not exceed the following FEL caps: 2.00 grams per brake horsepower-hour (0.75 grams per megajoule) for model years before 2010; 0.50 grams per brake horsepower-hour (0.19 grams per megajoule) for model years 2010 and later. This ceiling value applies whether credits for the family are derived from averaging, banking, or trading programs.

(ii)(A) Non-Methane Hydrocarbons (NMHC) for engines fueled with either diesel fuel, natural gas, or liquefied petroleum gas. 0.14 grams per brake horsepower-hour (0.052 grams per megajoule).

(B) Non-Methane Hydrocarbon Equivalent (NMHCE) for engines fueled with methanol. 0.14 grams per brake horsepower-hour (0.052 grams per megajoule).

(iii) Carbon monoxide. (A) 15.5 grams per brake horsepower-hour (5.77 grams per megajoule).

(B) 0.50 percent of exhaust gas flow at curb idle (methanol-, natural gas-, and liquefied petroleum gas-fueled heavy-duty diesel engines ~~HDEs~~ only). This does not apply for vehicles certified to the requirements of Sec. 86.005-17

(iv) Particulate. (A) 0.01 grams per brake horsepower-hour (0.0037 grams per megajoule).

(B) A manufacturer may elect to include any or all of its heavy-duty diesel engine ~~HDE~~ families in any or all of the particulate ABT programs for heavy-duty diesel engines ~~HDEs~~, within the restrictions described in Sec. 86.007-15 or other applicable sections. If the manufacturer elects to include engine families in any of these programs, the particulate FEL may not exceed 0.02 grams per brake horsepower-hour (0.0075 grams per megajoule).

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(2) of appendix I to this part, and measured and calculated in accordance with the procedures set forth in subpart N ~~or P~~ of this part, except as noted in Sec. 86.007-23(c)(2).

(3) **DELETE** ~~SET (i) The weighted average exhaust emissions, as determined under Sec. 86.1360-2007(e)(5) pertaining to the supplemental emission test cycle, for each regulated pollutant shall not exceed 1.0 times the applicable emission standards or FELs specified in paragraph (a)(1) of this section.~~

~~(ii) For engines not having a NOx FEL less than1.5 g/bhp-hr, gaseous exhaust emissions shall not exceed the steady-state interpolated values determined by the Maximum Allowable Emission Limits (for the corresponding speed and load), as determined under Sec. 86.1360-2007(f), when the engine is operated in the steady-state control area defined under Sec. 86.1360-2007(d).~~

(4) **DELETE** ~~NTE (i)(A) The brake-specific exhaust NMHC or NOx emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.5 times the applicable NMHC or NOx emission standards or FELs specified in paragraph (a)(1) of this section, during engine and vehicle operation specified in paragraph (a)(4)(ii) of this section except as noted in paragraph (a)(4)(iii) of this section.~~

~~(B) For engines not having a NOx FEL less than1.50 g/bhp-hr, the brake-specific NOx and NMHC exhaust emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.25 times the applicable emission standards or FELs specified in paragraph (a)(1) of this section (or of Sec. 86.004-11, as allowed by paragraph (g) of this section), during engine and vehicle operation specified in paragraph (a)(4)(ii) of this section except as noted in paragraph (a)(4)(iii) of this section.~~

~~(C) The brake-specific exhaust PM emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.5 times the applicable PM emission standards or FEL (for FELs above the standard only) specified in paragraph (a)(1) of this section, during engine and vehicle operation specified in paragraph (a)(4)(ii) of this section except as noted in paragraph (a)(4)(iii) of this section.~~

~~(D) The brake-specific exhaust CO emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.25 times the applicable CO emission standards or FEL specified in paragraph (a)(1) of this section, during engine and vehicle operation specified in paragraph (a)(4)(ii) of this section except as noted in paragraph (a)(4)(iii) of this section.~~

* * * * *

(iv) * * *

(C) **DELETE** ~~For model years 2010 through 2013, the Administrator may allow up to three deficiencies per engine family. The provisions of paragraphs (a)(4)(iv)(A) and (B) of this section apply for deficiencies allowed by this paragraph (a)(4)(iv)(C). In determining whether to allow the additional deficiencies, the Administrator may consider any relevant factors, including the factors identified in paragraph (a)(4)(iv)(A) of this section. If additional deficiencies are approved, the Administrator may set any additional conditions that he/she determines to be appropriate.~~

(v) **DELETE** ~~The emission limits specified in paragraphs (a)(3) and (a)(4) of this section shall be rounded to the same number of significant figures as the applicable standards in paragraph (a)(1) of this section using ASTM E29-93a (Incorporated by reference at Sec. 86.1).~~

* * * * *

(b)(3) and (b)(4) [Reserved]. For guidance see Sec. 86.004-11.

(c) No crankcase emissions shall be discharged directly into the ambient atmosphere from any new 2007 or later model year ~~diesel HDE~~ <u>heavy-duty diesel engines</u>, with the following exception: ~~HDEs~~ <u>heavy-duty diesel engines</u> equipped with turbochargers, pumps, blowers, or superchargers for air induction may discharge crankcase emissions to the ambient atmosphere if the emissions are added to the exhaust emissions (either physically or mathematically) during all emission testing. Manufacturers taking advantage of this exception must manufacture the engines so that all crankcase emission can be routed into a dilution tunnel (or other sampling system approved in advance by the ~~Administrator~~ <u>Executive Officer</u>), and must account for deterioration in crankcase emissions when determining exhaust deterioration factors. For the purpose of this paragraph (c), crankcase emissions that are routed to the exhaust upstream of exhaust aftertreatment during all operation are not considered to be "discharged directly into the ambient atmosphere."

(d) Every manufacturer of new motor vehicle engines subject to the standards prescribed in the California Code of Regulations, title 13, §1956.8 (a), §1956.8 (h), and this section shall, prior to taking any of the actions prohibited by California Health & Safety Code section 43211 ~~specified in section 203(a)(1) of the Act~~, test or cause to be tested motor vehicle engines in accordance with applicable procedures in subpart I or N of ~~this part~~ the "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" to ascertain that such test engines meet the requirements of paragraphs (a), (b), (c), and (d) of this section.

(e) [Reserved]. For guidance see Sec. 86.004-11.

(f) **DELETE** ~~(1) Model year 2007 and later diesel-fueled heavy-duty engines and vehicles for sale in Guam, American Samoa, or the Commonwealth of the Northern Mariana Islands shall be subject to the same standards and requirements as apply to 2006 model year diesel heavy-duty engines and vehicles, but only if the vehicle or engine bears a permanently affixed label stating:~~

> ~~THIS ENGINE (or VEHICLE, as applicable) CONFORMS TO US EPA EMISSION STANDARDS APPLICABLE TO MODEL YEAR 2006. THIS ENGINE (or VEHICLE, as applicable) DOES NOT CONFORM TO US EPA EMISSION REQUIREMENTS IN EFFECT AT TIME OF PRODUCTION AND MAY NOT BE IMPORTED INTO THE UNITED STATES OR ANY TERRITORY OF THE UNITED STATES EXCEPT GUAM, AMERICAN SAMOA, OR THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS.~~

~~(2) The importation or sale of such a vehicle or engine for use at any location U.S. other than Guam, American Samoa, or the Commonwealth of the Northern Mariana Islands shall be considered a violation of section 203(a)(1) of the Clean Air Act. In addition, vehicles or vehicle engines subject to this exemption may not subsequently be imported or sold into any state or territory of the United States other than Guam, American Samoa, or Commonwealth of the Northern Mariana Islands.~~

* * * * *

Adopt and amend § 86.007-15, Title 40, Code of Federal Regulations, to read:

§ 86.007-15 NOx and particulate averaging, trading, and banking for heavy-duty engines. January 18, 2001

Section 86.007-15 includes text that specifies requirements that differ from Sec. 86.004-15. Where a paragraph in Sec. 86.004-15 is identical and applicable to Sec. 86.007-15, this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see Sec. 86.004-15."

(a) through (l) [Reserved]. For guidance see Sec. 86.004-15.

(m) The following provisions apply for model year 2007 and later engines (including engines certified during years 2007-2009 under the phase-in provisions of Sec. 86.007-11(g)(1)~~, Sec. 86.005-10(a), or Sec. 86.008-10(f)(1))~~. These provisions apply instead of the provisions of paragraphs Sec. 86.004-15 (a) through (k) to the extent that they are in conflict.

(1) ~~Manufacturers of Otto-cycle engines may participate in an NMHC averaging, banking and trading program to show compliance with the standards specified in Sec. 86.008-10. The generation and use of NMHC credits are subject to the same provisions in paragraphs Sec. 86.004-15 (a) through (k) that apply for NOx plus NMHC credits, except as otherwise specified in this section.~~ [Reserved]

(2) Credits are calculated as NOx or NMHC credits for engines certified to separate NOx and NMHC standards. NOx plus NMHC credits (including banked credits and credits that are generated during years 2007-2009 under the phase-in provisions of Sec. 86.007-11(g)(1)~~, Sec. 86.005-10(a), or Sec. 86.008-10(f)(1))~~ may be used to show compliance with 2007 or later NOx standards ~~(NOx or NMHC standards for Otto-cycle engines)~~, subject to an 0.8 discount factor (e.g., 100 grams of NOx plus NMHC credits is equivalent to 80 grams of NOx credits).

(3) ~~NOx or NMHC (or NOx plus NMHC) credits may be exchanged between heavy-duty Otto-cycle engine families certified to the engine standards of this subpart and heavy-duty Otto-cycle engine families certified to the chassis standards of subpart S of this part, subject to an 0.8 discount factor (e.g., 100 grams of NOx (or NOx plus NMHC) credits generated from engines would be equivalent to 80 grams of NOx credits if they are used in the vehicle program of subpart S, and vice versa).~~ [Reserved]

(4) Credits that were previously discounted when they were banked according to paragraph (c) of Sec. 86.004-15, are subject to an additional discount factor of 0.888 instead of the 0.8 discount factor otherwise required by paragraph (m)(2) ~~or (m)(3)~~ of this section. This results in a total discount factor of 0.8 (0.9 x 0.888 = 0.8).

(5) For diesel engine families, the combined number of engines certified to FELs higher than 0.50 g/bhp-hr using banked NOx (and/or NOx plus NMHC) credits in any given model year may not exceed 10 percent of the manufacturer's U.S.-directed production of engines in all heavy-duty diesel engine families for that model year.

(6) The FEL must be expressed to the same number of decimal places as the standard (generally, one-hundredth of a gram per brake horsepower-hour). For engines certified to standards expressed only one-tenth of a gram per brake horsepower-hour, if the FEL is below 1.0, then add a zero to the standard in the second decimal place and express the FEL to nearest one-hundredth of a gram per brake horsepower-hour.

(7) Credits are to be rounded to the nearest one-hundredth of a Megagram using ASTM E29-93a ~~(Incorporated by reference at Sec. 86.1)~~.

(8) Credits generated for 2007 and later model year diesel engine families, ~~or generated for 2008 and later model year Otto-cycle engine families~~ are not discounted (except as specified in paragraph (m)(2) ~~or (m)(3)~~ of this section), and do not expire.

(9) For the purpose of using or generating credits during a phase-in of new standards, a manufacturer may elect to split an engine family into two subfamilies (e.g., one which uses credits and one which generates credits). The manufacturer must indicate in the application for certification that the engine family is to be split, and may assign the numbers and configurations of engines within the respective subfamilies at any time prior to the submission of the end-of-year report required by Sec. 86.001-23.

(i) Manufacturers certifying a split diesel engine family to both the ~~Phase 1~~ <u>pre-2007 (phased-out)</u> and ~~Phase 2~~ <u>post-2007 (phased-in) emission</u> standards with equally sized subfamilies may exclude the engines within that split family from end-of-year NOx (or NOx+NMHC) ABT calculations, provided that neither subfamily generates credits for use by other engine families, or uses banked credits, or uses averaging credits from other engine families. All of the engines in that split family must be excluded from the phase-in calculations of Sec. 86.007-11(g)(1) (both from the number of engines complying with the standards being phased-in and from the total number of U.S.-directed production engines.)

(ii) ~~Manufacturers certifying a split Otto-cycle engine family to both the Phase 1 and Phase 2 standards with equally sized subfamilies may exclude the engines within that split family from end-of-year NOx (or NOx+NMHC) ABT calculations, provided that neither subfamily generates credits for use by other engine families, or uses banked credits, or uses averaging credits from other engine families. All of the engines in that split family must be excluded from the phase-in calculations of Sec. 86.008-10(f)(1) (both from the number of engines complying~~

~~with the standards being phased-in and from the total number of U.S.-directed production engines.)~~ [Reserved]

(iii) Manufacturers certifying a split engine family may label all of the engines within that family with a single NOx or NOx+NMHC FEL. The FEL on the label will apply for all SEA or other compliance testing.

(iv) Notwithstanding the provisions of paragraph (m)(9)(iii) of this section, for split families, the NOx FEL shall be used to determine applicability of the provisions of Sec. 86.1360-2007(j)(2) and (j)(3) and Sec.1370-2007(d)(1)(iii) and (d)(1)(iv), as modified by these procedures ~~Sec. 86.007-11(a)(3)(ii), (a)(4)(i)(B), and (h)(1), and Sec. 86.008-10(g)~~.

(10) For model years 2007 through 2009, to be consistent with the phase-in provisions of Sec. 86.007-11(g)(1), credits generated from engines in one diesel engine service class (e.g., light-heavy duty diesel engines) may be used for averaging by engines in a different diesel engine service class, provided the credits are calculated for both engine families using the conversion factor and useful life of the engine family using the credits, and the engine family using the credits is certified to the standards listed in Sec. 86.007-11(a)(1). Banked or traded credits may not be used by any engine family in a different service class than the service class of the engine family generating the credits.

Adopt and amend § 86.007-23, Title 40, Code of Federal Regulations, to read:

§ 86.007-23 Required data. January 18, 2001

* * * * *

(c) Emission data.--(1) Certification vehicles. The manufacturer shall submit emission data (including, methane, methanol, formaldehyde, and hydrocarbon equivalent, as applicable) on such vehicles tested in accordance with applicable test procedures and in such numbers as specified. These data shall include zero-mile data, if generated, and emission data generated for certification as required under Sec. 86.000-26(a)(3). In lieu of providing emission data the Administrator may, on request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other information) that the engine will conform with certain applicable emission standards of this part. Standards eligible for such manufacturer requests are those for idle CO emissions, smoke emissions, or particulate emissions from methanol-fueled or gaseous-fueled diesel-cycle certification vehicles, ~~those for particulate emissions from Otto-cycle certification vehicles or gaseous-fueled vehicles,~~ and those for formaldehyde emissions from petroleum-fueled vehicles. Also eligible for such requests are standards for total hydrocarbon emissions from model year 1994 and later certification vehicles. ~~By separate request, including appropriate supporting test data, the manufacturer may request that the Administrator also waive the requirement to measure particulate or formaldehyde emissions when conducting Selective Enforcement Audit testing of Otto-cycle vehicles.~~

(2) Certification engines. The manufacturer shall submit emission data on such engines tested in accordance with applicable emission test procedures of this subpart and in such numbers as specified. These data shall include zero-hour data, if generated, and emission data generated for certification as required under Sec. 86.000-26(c)(4). In lieu of providing emission data on idle CO emissions or particulate emissions from methanol-fueled or gaseous-fueled diesel-cycle certification engines~~, on particulate emissions from Otto-cycle engines,~~ or on CO emissions from diesel-cycle certification engines, the Administrator may, on request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other information) that the engine will conform with the applicable emission standards of this part. In lieu of providing emission data on smoke emissions from methanol-fueled or petroleum-fueled diesel certification engines, the ~~Administrator~~ Executive Officer may, on the request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other information) that the engine will conform with the applicable emissions standards of this part. In lieu of providing emissions data on smoke emissions from diesel-cycle engines when conducting Selective Enforcement Audit testing under subpart K of this part, the ~~Administrator~~ Executive Officer may, on separate request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other

information) that the engine will conform with the applicable smoke emissions standards of this part.

* * * * *

Adopt § 86.007-25, Title 40, Code of Federal Regulations, to read:

§ 86.007-25 Maintenance. January 18, 2001

* * * * *

Adopt and amend § 86.007-35, Title 40, Code of Federal Regulations, to read:

§ 86.007-35 Labeling. January 18, 2001

* * * * *

(a)(2) (ii) The name of the ~~Administrator~~ Executive Officer-approved alternative test procedure to be performed.

(2) **DELETE** ~~Light-duty truck and heavy-duty vehicles optionally certified in accordance with the light-duty truck provisions.~~

(i) ~~A legible, permanent label shall be affixed in a readily visible position in the engine compartment.~~

(ii) ~~The label shall be affixed by the vehicle manufacturer who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label. The label shall not be affixed to any equipment which is easily detached from such vehicle.~~

(iii) ~~The label shall 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) ~~The label heading: Important Vehicle Information;~~

(B) ~~Full corporate name and trademark of the manufacturer;~~

(C) ~~Engine displacement (in cubic inches or liters), engine family identification, and evaporative/refueling family;~~

* * * * *

Adopt and amend § 86.007-38, Title 40, Code of Federal Regulations, to read:

§ 86.007-38 Maintenance instructions. January 18, 2001

* * * * *

(i) For each new diesel-fueled engine subject to the standards prescribed in the California Code of Regulations, title 13, §1956.8 (a), §1956.8 (h), and Sec. 86.007-11, as applicable, the manufacturer shall furnish or cause to be furnished to the ultimate purchaser a statement that "This engine must be operated only with low sulfur diesel fuel (that is, diesel fuel meeting ~~EPA~~ ARB specifications for highway diesel fuel, including a 15 ppm sulfur cap)."

Subpart N, Emission Regulations for New Otto-Cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

Adopt § 86.1306-07, Title 40, Code of Federal Regulations, to read:

§ 86.1306-07 Equipment required and specifications; overview. January 18, 2001

* * * * *

Amend § 86.1309-90, Title 40, Code of Federal Regulations, to read:

§ 86.1309-90 Exhaust gas sampling system; Otto-cycle and non-petroleum-fueled engines. ~~June 30, 1995~~ January 18, 2001

* * * * *

Adopt and amend § 86.1310-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1310-2007 Exhaust gas sampling and analytical system for gaseous emissions from heavy-duty diesel-fueled engines and particulate emissions from all engines. January 18, 2001

* * * * *

(2) The THC analytical system for diesel engines requires a heated flame ionization detector (HFID) and heated sample system (191 ± plus or minus (+/-) 11 deg.C) using either:

(i) Continuously integrated measurement of diluted THC meeting the minimum requirements and technical specifications contained in paragraph (b)(3) of this section. Unless compensation for varying mass flow is made, a constant mass flow system must be used to ensure a proportional sample; or

(ii) Heated (191 ± plus or minus (+/-) 11 deg.C) proportional bag sampling systems for hydrocarbon measurement will be allowed if the bag sampling system meets the performance specifications for outgassing and permeability as defined in paragraph (b)(2) of this section.

* * * * *

(8) The mass of particulate in the exhaust is determined via filtration. The particulate sampling system requires dilution of the exhaust to a temperature of 47 deg.C ± plus or minus (+/-) 5 deg.C, measured upstream of a single high-efficiency sample filter (as close to the filter as practical).

(9) Since various configurations can produce equivalent results, exact conformance with these drawings is not required. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the components of the system. Other components, such as snubbers, which are not needed to maintain accuracy on some systems, may be excluded if their exclusion is based upon good engineering judgment.

(10) Other sampling and/or analytical systems may be used if shown to yield equivalent results and if approved in advance by the ~~Administrator~~ Executive Officer (see Sec. 86.1306-07).

(b) Component description. The components necessary for exhaust sampling shall meet the following requirements:

(1) Exhaust dilution system. The CVS shall conform to all of the requirements listed for the exhaust gas CVS systems in Sec. 86.1309-90(b), (c), and (d). With respect to

PM measurement, the intent of this measurement procedure is to perform the sample cooling primarily via dilution and mixing with air rather than via heat transfer to the surfaces of the sampling system. In addition the CVS must conform to the following requirements:

(i) The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream at the temperatures required for the measurement of particulate and hydrocarbon emission noted below and at, or above, the temperatures where aqueous condensation in the exhaust gases could occur. This is achieved by the following method. The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream in the primary dilution tunnel at a temperature of 191 deg.C or less at the sampling zone and as required to prevent condensation at any point in the dilution tunnel. Gaseous emission samples may be taken directly from this sampling point. An exhaust sample must then be taken at this point to be diluted a second time for use in determining particulate emissions. The secondary dilution system must provide sufficient secondary dilution air to maintain the double-diluted exhaust stream at a temperature of 47 C ± plus or minus (+/-) 5 C, measured at a point located between the filter face and 16 cm upstream of the filter face.

* * * * *

(B) Primary dilution air shall be filtered at the dilution air inlet. The manufacturer of the primary dilution air filter shall state that the filter design has successfully achieved a minimum particle removal efficiency of 98% (less than 0.02 penetration) as determined using ASTM test method F 1471-93 ~~(incorporated by reference at section 86.1)~~. Secondary dilution air shall be filtered at the dilution air inlet using a high-efficiency particulate air filter (HEPA). The HEPA filter manufacturer shall state the HEPA filter design has successfully achieved a minimum particle removal efficiency of 99.97% (less than 0.0003 penetration) as determined using ASTM test method F 1471-93. It is recommended that the primary dilution air be filtered using a HEPA filter. EPA intends to utilize HEPA filters to condition primary dilution air in its test facilities. It is acceptable to use of a booster blower upstream or downstream of a HEPA filter in the primary dilution tunnel (and upstream of the introduction of engine exhaust into the CVS) to compensate for the additional pressure loss associated with the filter. The design of any booster blower located downstream of the filter should minimize the introduction of additional particulate matter into the CVS.

(C) Primary dilution air may be sampled to determine background particulate levels, which can then be subtracted from the values measured in the diluted exhaust stream. In the case of primary dilution air, the background particulate filter sample shall be taken immediately downstream of the dilution air filter and upstream of the engine exhaust flow (Figure N07-1). The provisions of paragraphs (b)(7) of this section, and of Sec. 86.1312-2007 also apply to the measurement of background particulate matter, except that the filter temperature must be maintained below 52 deg.C.

(2) Heated proportional bag sampling systems. If a heated (191 ± plus or minus (+/-) 11 deg.C) proportional bag sampling system is used for THC measurement, sample bags must demonstrate minimal outgassing and permeability by passing the following performance test:

* * * * *

(A) Maintain a wall temperature of 191 deg.C ± plus or minus (+/-) 11 deg.C as measured at every separately controlled heated component (i.e., filters, heated line sections), using permanent thermocouples located at each of the separate components.

(B) Have a wall temperature of 191 deg.C ± plus or minus (+/-) 11 deg.C over its entire length. The temperature of the system shall be demonstrated by profiling the thermal characteristics of the system at initial installation and after any major maintenance performed on the system. The temperature profile of the HC sampling system shall be demonstrated by inserting thermocouple wires (typically Teflon™ coated for ease of insertion) into the sampling system assembled in-situ where possible, using good engineering judgment. The wire should be inserted up to the HFID inlet. Stabilize the sampling system heaters at normal operating temperatures. Withdraw the wires in increments of 5 cm to 10 cm (2 inches to 4 inches) including all fittings. Record the stabilized temperature at each position. The system temperature will be monitored during testing at the locations and temperature described in Sec. 86.1310-90(b)(3)(v)(A).

Note: It is understood that profiling of the sample line can be done under flowing conditions also as required with the probe. This test may be cumbersome if test facilities utilize long transfer lines and many fittings; therefore it is recommended that transfer lines be kept as short as possible and the use of fittings should be kept minimal.

(C) Maintain a gas temperature of 191 deg.C ± plus or minus (+/-) 11 deg.C immediately before the heated filter and HFID. These gas temperatures will be determined by a temperature sensor located immediately upstream of each component.

(vi) The continuous hydrocarbon sampling probe shall:

(A) Be defined as the first 25.4 cm (10 in) to 76.2 cm (30 in) of the continuous hydrocarbon sampling system;

(B) Have a 0.483 cm (0.19 in) minimum inside diameter;

(C) Be installed in the primary dilution tunnel at a point where the dilution air and exhaust are well mixed (i.e., approximately 10 tunnel diameters downstream of the point where the exhaust enters the dilution tunnel);

(D) Be sufficiently distant (radially) from other probes and the tunnel wall so as to be free from the influence of any wakes or eddies; and

(E) Increase the gas stream temperature to 191 deg.C ~~±~~ plus or minus (+/-) 11 deg.C by the exit of the probe. The ability of the probe to accomplish this shall be demonstrated at typical sample flow rates using the insertion thermocouple technique at initial installation and after any major maintenance. Compliance with the temperature specification shall be demonstrated by monitoring during each test the temperature of either the gas stream or the wall of the sample probe at its terminus.

(vii) The response time of the continuous measurement system shall be no greater than:

(A) 1.5 seconds from an instantaneous step change at the port entrance to the analyzer to within 90 percent of the step change;

(B) 10 seconds from an instantaneous step change at the entrance to the sample probe or overflow span gas port to within 90 percent of the step change. Analysis system response time shall be coordinated with CVS flow fluctuations and sampling time/test cycle offsets if necessary; and

(C) For the purpose of verification of response times, the step change shall be at least 60 percent of full-scale chart deflection.

(4) Primary-dilution tunnel. (i) The primary dilution tunnel shall be:

(A) Small enough in diameter to cause turbulent flow (Reynolds Number greater than 4000) and of sufficient length to cause complete mixing of the exhaust and dilution air. Good engineering judgment shall dictate the use of mixing plates and mixing orifices to ensure a well-mixed sample. To verify mixing, ~~EPA~~ ARB recommends flowing a tracer gas (i.e. propane or CO2) from the raw exhaust inlet of the dilution tunnel and measuring its concentration at several points along the axial plane at the sample probe. Tracer gas concentrations should remain nearly constant (i.e. within 2%) between all of these points.

* * * * *

(v) Additional dilution air must be provided so as to maintain a sample temperature of 47 deg. C ~~±~~ plus or minus (+/-) 5 deg. C upstream of the sample filter. Temperature shall be measured with a thermocouple with a 3/16" shank, having thermocouple wires with a gage diameter 24 AWG or smaller, a bare-wire butt-welded junction; or other suitable temperature measurement with an equivalent or faster time constant and an accuracy and precision of ~~±~~ plus or minus (+/-) 1.9 deg. C.

(vi) The filter holder assembly shall be located within 12.0 in (30.5 cm) of the exit of the secondary dilution tunnel.

(vii) The face velocity through the sample filter shall not exceed 100 cm/s (face velocity is defined as the standard volumetric sample flow rate (i.e., scm3/sec) divided by the sample filter stain area (i.e., cm2)).

(7) Particulate sampling. (i) Filter specifications. (A) Polytetrafluoroethylene (PTFE or Teflon™) coated borosilicate glass fiber high-efficiency filters or polytetrafluoroethylene (PTFE or Teflon™) high-efficiency membrane filters with an integral support ring of polymethylpentene (PMP) or equivalent inert material are required. Filters shall have a minimum clean filter efficiency of 99% as measured by the ASTM D2986-95a DOP test ~~(incorporated by reference at Sec. 86.1)~~.

* * * * *

Adopt and amend § 86.1312-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1312-2007 Filter stabilization and microbalance workstation environmental conditions, microbalance specifications, and particulate matter filter handling and weighing procedures. January 18, 2001

(a) Ambient conditions for filter stabilization and weighing.--(1) Temperature and humidity. (i) The filter stabilization environment shall be maintained at 22 deg.C ± <u>plus or minus (+/-)</u> 3 deg.C and a dewpoint of 9.5 deg.C ± <u>plus or minus (+/-)</u> 1 deg.C. Dewpoint shall be measured with an instrument that exhibits an accuracy of at least 0.25 deg.C NIST traceable as stated by the instrument manufacturer. Temperature shall be measured with an instrument that exhibits an accuracy of at least 0.2 deg.C or better.

(ii) The immediate microbalance workstation environment shall be maintained at 22 deg.C ± <u>plus or minus (+/-)</u> 1 deg.C and a dewpoint of 9.5 deg.C ± <u>plus or minus (+/-)</u> 1 deg.C. If the microbalance workstation environment freely circulates with the filter stabilization environment, and this entire environment meets 22 deg.C ± <u>plus or minus (+/-)</u> 1 deg.C and a dewpoint of 9.5 deg.C ± <u>plus or minus (+/-)</u> 1 deg.C , then there is no requirement to measure temperature and dewpoint at the microbalance separate from the filter stabilization location. Otherwise, temperature at the microbalance workstation shall be measured with an instrument that exhibits an accuracy of at least 0.2 deg.C or better, and dewpoint shall be measured with an instrument that exhibits an accuracy of at least 0.25 deg.C NIST traceable as stated by the instrument manufacturer.

* * * * *

Adopt and amend § 86.1313-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1313-2007 Fuel specifications. January 18, 2001

* * * * *

Section 86.1313-2007 includes text that specifies requirements that differ from Sec. 86.1313-90~~4~~ ~~and Sec. 86.1313-2004~~. Where a paragraph in Sec. 86.1313-90~~4~~ ~~or Sec. 86.1313-2004~~ is identical and applicable to Sec. 86.1313-2007, this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see Sec. 86.1313-90~~4~~." or "[Reserved]. ~~For guidance see Sec. 86.1313-04.~~".

(a) [Reserved]. ~~For guidance see Sec. 86.1313-2004.~~

(b) heading and (b)(1) [Reserved]. For guidance see Sec. 86.1313-90~~4~~.

(b)(2) Petroleum fuel for diesel engines meeting the specifications in Table N07-2, or substantially equivalent specifications approved by the ~~Administrator~~ Executive Officer, shall be used in exhaust emissions testing. The grade of petroleum fuel used shall be commercially designated as "Type 2-D" grade diesel fuel except that fuel commercially designated as "Type 1-D" grade diesel fuel may be substituted provided that the manufacturer has submitted evidence to the Administrator demonstrating to the ~~Administrator's~~ Executive Officer's satisfaction that this fuel will be the predominant in-use fuel. Such evidence could include such things as copies of signed contracts from customers indicating the intent to purchase and use "Type 1-D" grade diesel fuel as the primary fuel for use in the engines or other evidence acceptable to the ~~Administrator~~ Executive Officer. ~~(Note: Vehicles certified under Sec. 86.007-11(f) must be tested using the test fuel specified in Sec. 86.1313-2004, unless otherwise allowed by the Administrator.)~~ Table N07-2 follows:

Table N07-2

Item		ASTM test method No.	Type 1-D	Type 2-D
(i) Cetane Number		D613	40-54	40-50
(ii) Cetane Index		D976	40-54	40-50
(iii) Distillation range:				
(A) IBP	deg.F	D86	330-390	340-400
	(deg.C)		(165.6-198.9)	(171.1-204.4)
(B) 10 pct. point	deg.F	D86	370-430	400-460
	(deg.C)		(187.8-221.1)	(204.4-237.8)
(C) 50 pct. point	deg.F	D86	410-480	470-540
	(deg.C)		(210.0-248.9)	(243.3-282.2)
(D) 90 pct. point	deg.F	D86	460-520	560-630
	(deg.C)		(237.8-271-1)	(293.3-332.2)
(E) EP	deg.F	D86	500-560	610-690
	(deg.C)		(260.0-293.3)	(321.1-365.6)
(iv) Gravity	deg.API	D287	40-44	32-37

(v) Total sulfur	ppm	D2622	7-15	7-15
(vi) Hydrocarbon composition:.				
(A) Aromatics, minimum	pct	D5186	8	27
(Remainder shall be paraffins, naphthenes, and olefins).				
(vii) Flashpoint, min	deg.F	D93	120	130
	(deg.C)		(48.9)	(54.4)
(viii) Viscosity	centistokes	D445	1.6-2.0	2.0-3.2

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Amend § 86.1319-90, Title 40, Code of Federal Regulations, to read:

§ 86.1319-90 CVS calibration. ~~April 11, 1989~~ January 18, 2001

* * * * *

Adopt and amend § 86.1323-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1323-2007 Oxides of nitrogen analyzer calibration. January 18, 2001

This section describes the initial and periodic calibration of the chemiluminescent oxides of nitrogen analyzer.

(a) Prior to introduction into service and at least monthly thereafter, the chemiluminescent oxides of nitrogen analyzer must be checked for NO2 to NO converter efficiency. The ~~Administrator~~ Executive Officer may approve less frequent checks of the converter efficiency. Figure N84-9 is a reference for paragraphs (a) (1) through (11) of this section.

* * * * *

(A) Calculate the volume fraction of water vapor in the wetted span gas, as $H2O_{vol} = (\exp(3.69-(81.28/T_{sat})) + 1.61)/P_{sat}$. This calculation approximates some of the thermodynamic properties of water based on the "1995 Formulation for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use", issued by The International Association for the Properties of Water and Steam (IAPWS). However, this approximation should only be used as prescribed in this section because it is an exponential fit that is accurate for data at 25 deg.C ~~±~~ plus or minus (+/-) 10 deg.C. Then, assuming a diesel fuel atomic hydrogen to carbon ratio of 1.8, and an intake and dilution air humidity of 75 grains (10.71 $g_{water}/kg_{dry\ air}$ or 54.13 percent RH at 25 deg.C and 101.3 kPa),

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Amend § 86.1330-90, Title 40, Code of Federal Regulations, to read:

§ 86.1330-90 Test sequence; general requirements. ~~April 11, 1989~~ January 18, 2001

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Amend § 86.1334-84, Title 40, Code of Federal Regulations, to read:

§ 86.1334-84 Pre-test engine and dynamometer preparation. ~~December 10, 1984~~ January 18, 2001

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Adopt § 86.1337-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1337-2007 Engine dynamometer test run. January 18, 2001

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Adopt § 86.1338-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1338-2007 Emission measurement accuracy. January 18, 2001

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Amend § 86.1339-90, Title 40, Code of Federal Regulations, to read:

§ 86.1339-90 Particulate filter handling and weighing. ~~April 11, 1989~~ January 18, 2001

* * * * *

Amend § 86.1360-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1360-2007 Supplemental steady-state test; test cycle and procedures.
October 6, 2000.

(a) Applicability. This section applies to 2005 and subsequent model year heavy duty diesel engines.

(b) Test cycle.

(1)(i) The following 13-mode cycle must be followed in dynamometer operation on the test engine:

Mode Number	Engine Speed	Percent Load	Weighting Factor	Mode Length (minutes)
1	Idle	--	0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

(ii) For 2007 and subsequent model years, upon Executive Officer approval, the manufacturer may use mode lengths other than those listed in subparagraph (b)(1)(i) of this section.

(2) In addition to the 13 test points identified in paragraph (b)(1) of this section, for engines not certified to a NOx emission standard or FEL less than 1.5 g/bhp-hr, ARB may select, and require the manufacturer to conduct the test using, up to 3 additional test points within the control area (as defined in paragraph (d) of this section). ARB will notify the manufacturer of these supplemental test points in writing in a timely manner before the test. Emissions sampling for the additional test

modes must include all regulated gaseous pollutants. Particulate matter does not need to be measured.

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(e) Test requirements. (1) Engine warm-up. Prior to beginning the test sequence, the engine must be warmed-up according to the procedures in § 86.1332-90(d)(3)(i) through (iv).

(2) Test sequence. The test must be performed in the order of the mode numbers in paragraph (b)(1) of this section. Where applicable, ~~T~~the ARB-selected test points identified under paragraph (b)(2) of this section must be performed immediately upon completion of mode 13. The engine must be operated for the prescribed time in each mode, completing engine speed and load changes in the first 20 seconds of each mode. The specified speed must be held to within plus or minus (+/-) 50 rpm and the specified torque must be held to within plus or minus two percent of the maximum torque at the test speed.

(3) Particulate sampling. One ~~pair of~~ filter~~s (primary and back-up)~~ shall be used for sampling PM over the 13-mode test procedure. The modal weighting factors specified in paragraph (b)(1) of this section shall be taken into account by taking a sample proportional to the exhaust mass flow during each individual mode of the cycle. This can be achieved by adjusting sample flow rate, sampling time, and/or dilution ratio, accordingly, so that the criterion for the effective weighting factors is met. The sampling time per mode must be at least 4 seconds per 0.01 weighting factor. Sampling must be conducted as late as possible within each mode. Particulate sampling shall be completed no earlier than 5 seconds before the end of each mode.

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(ii) For PM measurements, a single ~~pair of~~ filter~~s~~ must be used to measure PM over the 13 modes. The brake-specific PM emission level for the test must be calculated as described for a transient hot start test in § 86.1343-88. Only the power measured during the sampling period shall be used in the calculation.

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(j) Emission testing caps. (1) The weighted average exhaust emissions, as determined under paragraph (e)(5) and (6) of this section pertaining to the supplemental steady-state test cycle, for each regulated pollutant shall not exceed 1.0 times the applicable emission standards specified in California Code of Regulations, title 13, §1956.8 (a)(~~1~~2) or §1956.8 (h)(2), or FELs specified in §86.007-11 (a)(1).

(2) For engines not having a NOx FEL less than1.5 g/bhp-hr, ~~G~~gaseous exhaust emissions shall not exceed the steady-state interpolated values determined by the

Maximum Allowable Emission Limits (for the corresponding speed and load), as determined under ~~paragraph~~ subdivision (g) of this section, when the engine is operated in the steady-state control area defined under ~~paragraph~~ subdivision (d) of this section, during steady-state engine operation.

(3) For engines with a NOx FEL less than1.5 g/bhp-hr, the Maximum Allowable Emission Limit requirements, as determined under Sec. 86.1360-2007(f), do not apply.

(4) The emission caps specified in this section shall be rounded to the same number of significant figures as the applicable standards in California Code of Regulations, Title 13, §1956.8 (a)(2) or §1956.8 (h)(2), using ASTM E29-93a.

* * * * *

Amend § 86.1370-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1370-2007 Not-To-Exceed (NTE) test procedures. October 6, 2000.

(a) General. The purpose of this test procedure is to measure in-use emissions of 2005 and subsequent model year heavy-duty diesel engines while operating within a broad range of speed and load points (the Not-To-Exceed Control Area) and under conditions which can reasonably be expected to be encountered in normal vehicle operation and use. Emission results from this test procedure are to be compared to the Not-To-Exceed Limits specified in paragraph (d)(1) of this section. <u>The Not-To-Exceed Limits specified in paragraph (d)(1) of this section do not apply for engine starting conditions specified in subdivision (k) of this section.</u>

(b) Not-to-exceed control area for heavy-duty diesel engines. The Not-To-Exceed Control Area for heavy-duty diesel engines consists of the following engine speed and load points:

# # # # #

(5) For particulate matter only <u>from 2005 and 2006 model year engines</u>, speed and load points determined by one of the following methods, whichever is applicable, shall be excluded from the Not-To-Exceed Control Area. B and C engine speeds shall be determined according to the provisions of § 86.1360-2007(c):

(i) If the C speed is below 2400 rpm, the speed and load points to the right of or below the line formed by connecting the following two points:

(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;

(B) 70% of maximum power at 100% speed (n_{hi});

(ii) If the C speed is above 2400 rpm, the speed and load points to the right of the line formed by connecting the two points in ~~paragraphs~~ <u>item</u> (b)(5)(ii)(A) and (B) of this section and below the line formed by connecting the two points in ~~paragraphs~~ <u>item</u> (b)(5)(ii)(B) and (C) of this section:

(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;

(B) 50% of maximum power at 2400 rpm;

(C) 70% of maximum power at 100% speed (n_{hi}).

INSERT

(6)(i) For 2007 and subsequent model year petroleum-fueled diesel cycle engines, a manufacturer may identify particular engine-vehicle combinations and may petition the Executive Officer at certification to exclude operating points from the Not-to-Exceed Control Area defined in Sec. 86.1370-2007(b)(1) through (4) if the manufacturer can demonstrate that the engine is not capable of operating at such points when used in the specified engine-vehicle combination(s).

(ii) For 2007 and subsequent model year diesel cycle engines that are not petroleum-fueled, a manufacturer may petition the Executive Officer at certification to exclude operating points from the Not-to-Exceed Control Area defined in Sec. 86.1370-2007(b)(1) through (4) if the manufacturer can demonstrate that the engine is not expected to operate at such points in normal vehicle operation and use.

(7) For 2007 and subsequent model year petroleum-fueled diesel cycle engines, a manufacturer may petition the Executive Officer to limit NTE testing in a single defined region of speeds and loads. Such a defined region must generally be of elliptical or rectangular shape, and must share some portion of its boundary with the outside limits of the NTE zone. Under this provision testing would not be allowed with sampling periods in which operation within that region constitutes more than 5.0 percent of the time-weighted operation within the sampling period. Approval of this limit by the Executive Officer is contingent on the manufacturer satisfactorily demonstrating that operation at the speeds and loads within that region accounts for less than 5.0 percent of all in-use operation (weighted by vehicle-miles-traveled or other ARB-approved weightings) for the in-use engines of that configuration (or sufficiently similar engines). At a minimum, this demonstration must include operational data from representative in-use vehicles.

(c) [Reserved]

(d) Not-to-exceed control area caps. (1) (i)The emission caps specified in this section shall be rounded to the same number of significant figures as the applicable standards in California Code of Regulations, Title 13, §1956.8 (a) using ASTM E29-93a.

(~~1~~ ii) For 2005 and 2006 model year engines, ~~W~~when operated within the Not-To-Exceed Control Area defined in ~~paragraph~~ subdivision (b) of this section, diesel engine brake-specific exhaust emissions in grams/bhp-hr (as determined under ~~paragraphs~~ subdivisions (b) and (c) of this section), for each regulated pollutant, shall not exceed 1.25 times the applicable emission standards specified in California Code of Regulations, Title 13, §1956.8 (a)(~~1~~2) and (h)(2) during engine and vehicle operation specified in paragraph (e)(1) of this section, except as noted in paragraph (e)(2) of this section, when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

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(iii) For 2007 and subsequent model year engines having a NOx FEL less than 1.50 g/bhp-hr, the brake-specific exhaust NMHC or NOx emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the NTE test procedures, shall not exceed 1.5 times the applicable NMHC or NOx emission standards or FELs specified in California Code of Regulations, title 13, §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in subdivisions (b), (e), (f), and (g) of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

(iv) For 2007 and subsequent model year engines not having a NOx FEL less than 1.50 g/bhp-hr, the brake-specific NOx and NMHC exhaust emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.25 times the applicable emission standards or FELs specified in California Code of Regulations, title 13, §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in paragraphs (b), (e), (f), and (g) of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

(v) For 2007 and subsequent model year engines, the brake-specific exhaust PM emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.5 times the applicable PM emission standards or FEL (for FELs above the standard only) specified in California Code of Regulations, title 13, §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in paragraphs (b), (e), (f), and (g) of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

(2) ~~[Reserved]~~ For engines equipped with emission controls that include discrete regeneration events, if a regeneration event occurs during the NTE test, then the averaging period must be at least as long as the time between the events multiplied by the number of full regeneration events within the sampling period. The requirement in this paragraph (d)(2) only applies for engines that send an electronic signal indicating the start of the regeneration event.

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(f) NTE cold temperature operating exclusion. 2007 and subsequent model year engines equipped with exhaust gas recirculation (EGR) whose operation within the NTE control area specified in §86.1370(b) when operating during cold temperature conditions as specified in paragraph (f)(1) of this section are not subject to the NTE emission caps during the specified cold temperature operation conditions.

(1) Cold temperature operation is defined as engine operating conditions meeting either of the following two criteria:

(i) Intake manifold temperature (IMT) less than or equal to the temperature defined by the following relationship between IMT and absolute intake manifold pressure (IMP) for the corresponding IMP.

$P = 0.0875 \times IMT - 7.75$ Equation (1)

Where;

P = absolute intake manifold pressure in bars

IMT = intake manifold temperature in degrees Fahrenheit

(ii) Engine coolant temperature (ECT) less than or equal to the temperature defined by the following relationship between ECT and absolute intake manifold pressure (IMP) for the corresponding IMP.

$P = 0.0778 \times ECT - 9.8889$ Equation (2)

Where;

P = absolute intake manifold pressure in bars

ECT = engine coolant temperature in degrees Fahrenheit

(2) [Reserved]

# # # # #

(i) Deficiencies for NTE requirements. (1) For model years 2005 through ~~2007~~ 2009, upon application by the manufacturer, the Executive Officer may accept a HDDE as compliant with the NTE requirements even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: technical feasibility of the given hardware and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Deficiencies will be approved on a engine model and/or horsepower rating basis within an engine family, and each approval is applicable for a single model year. A manufacturer's application must include a description of the auxiliary emission control device(s) which will be used to maintain emissions to the lowest practical level, considering the deficiency being requested, if applicable. An application for a deficiency must be made during the certification process; no deficiency will be granted to retroactively cover engines already certified.

(2) Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Executive Officer. The NTE deficiency should only be seen as an allowance for minor deviations from the NTE requirements. The NTE deficiency provisions allow a manufacturer to apply for relief from the NTE emission requirements under limited conditions. ARB expects that manufacturers should have the necessary functioning emission control hardware in place to comply with the NTE.

(3) For model years 2010 through 2013, the Executive Officer may allow up to three deficiencies per engine family. The provisions of §86.007-11 (a)(4)(iv)(A) and §86.007-11 (B) apply for deficiencies allowed by §86.007-11 (a)(4)(iv)(C). In determining whether to allow the additional deficiencies, the Executive Officer may consider any relevant factors, including the factors identified in §86.007-11 (a)(4)(iv)(A). If additional deficiencies are approved, the Executive Officer may set any additional conditions that he/she determines to be appropriate.

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(k) NOx and NMHC aftertreatment warm-up. For 2007 and subsequent engines equipped with one or more aftertreatment devices that reduce NOx or NMHC emissions, the NTE NOx and NMHC emission caps do not apply when the exhaust gas temperature is measured within 12 inches of the outlet of the aftertreatment device and is less the 250 deg.C. For multi-bed systems, it is the temperature at the outlet of the device with the maximum flow rate that determines whether the NTE caps apply.

Final Regulation Order

Amend Title 13, California Code of Regulations, section 1900 to read:

§1900. Definitions.

[No changes to subsections (a) through (b)(10).]

<u>(11)</u> “<u>Motorcycle Engine” means an engine which is used to propel a new, street-use motorcycle.</u>

(~~11~~<u>12</u>) “Passenger car” means any motor vehicle designed primarily for transportation of persons and having a design capacity of twelve persons or less.

(~~12~~<u>13</u>) “Recall” means:

(A) The issuing of notices directly to consumers that vehicles in their possession or control should be corrected, and/or

(B) Efforts to actively locate and correct vehicles in the possession or control o<u>f</u> consumers.

(~~13~~<u>14</u>) “Replacement part” means any aftermarket part intended to replace an original emission-related part and which is functionally identical to the original equipment part in all respects which in any way affect emissions (including durability), or a consolidated part.

(~~14~~<u>15</u>) “Subgroup” means a set of vehicles within an engine family distinguishable by characteristics contained in the manufacturer’s application for certification.

(~~15~~<u>16</u>) [Reserved]

(~~16~~<u>17</u>) “Reactivity adjustment factor” means a fraction applies to the NMOG emissions from a vehicle powered by a fuel other than conventional gasoline for the purpose of determining a gasoline-equivalent NMOG level. The reactivity adjustment factor is defined as the ozone-forming potential of clean fuel vehicle exhaust divided by the ozone-forming potential of gasoline vehicle exhaust.

Note: Authority cited: Sections 39600, 39601,43013, 43018, 43101 and 43104, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39500, 40000, 43000, 43013, 43101, 43101.5, 43102, 43103, 43104, 43106 and 43204, Health and Safety Code; and Section 27156, Vehicle Code.

Amend Title 13, California Code of Regulations, section 1958 to read:

§1958. Exhaust Emission Standards and Test Procedures ─ Motorcycles <u>and Motorcycle Engines</u> Manufactured on or after January 1, 1978.

(a) This section shall be applicable to motorcycles<u>, motorcycle engines, and the manufacturers of either motorcycles or motorcycle engines</u> produced on or after January 1, 1978. Motorcycles <u>and motorcycle engines</u> are excluded from the requirements of this section if:

(1) The engine displacement is less than 50 cubic centimeters, or

(2) An 80 kilogram (176 pound) driver cannot:

(A) start from a dead stop using only the engine, or

(B) exceed a maximum speed of 40 kilometers per hour (24.9 miles per hour) on a level paved surface.

(b) Exhaust emissions from new street-use motorcycles and motorcycle engines, subject to registration and sold and registered in this state, shall not exceed:

~~Exhaust Emission~~ Table of Standards
~~(grams per kilometer)~~

Model-Year	Engine Displacement (in cubic centimeters)	Exhaust Emission Standards (grams per kilometer)	
		Hydrocarbon (HC) + Oxides of Nitrogen (NOx)	Carbon Monoxide
1978 to 1979	50 to less than 170	5.0 (HC only)	17
1978 to 1979	170 to less than 750	5.0 + 0.0155(D-170)* (HC only)	17
1978 to 1979	750 or greater	14 (HC only)	17
1980 to 1981	All (50 cc or larger)	5.0 (HC only)	17
1982 and subsequent	50 cc to 279 cc	1.0 (HC only)	12
1982 through 1985 (manufactured prior to March 1, 1985)	280 cc or greater	2.5 (HC only)	12
1985 (manufactured after February 28, 1985) through 1987	280 cc or greater	1.4 (HC only), applied as a corporate average, ** provided that each engine family shall have only one applicable standard	12
1988 ~~and subsequent~~ through 2003	280 cc to 699 cc	1.0 (HC only), applied as a corporate average, ** provided that each engine family shall have only one applicable standard	12
1988 ~~and subsequent~~ through 2003	700 cc or greater	1.4 (HC only), applied as a corporate average, ** provided that each engine family shall have only one applicable standard	12
2004 through 2007	280 cc or greater	1.4 (HC + NOx), applied as a corporate average, ** provided that each engine family shall have only one applicable standard	12
2008 and subsequent	280 cc or greater	0.8 (HC + NOx), applied as a corporate average, ** provided that each engine family shall have only one applicable standard	12

*D = engine displacement of motorcycles in cubic centimeters.
**Compliance with a standard to be applied as a “corporate average” shall be determined as follows:

$$\frac{\sum_{J=1}^{n} (PROD_{jx})\ (STD_{jx})}{\sum_{J=1}^{n} (PROD_{jx})} = STD_{Ca}$$

where,

n = Class III motorcycle engine families (engines with displacement of 280 cc or greater manufactured after February 28, 1985).

$PROD_{jx}$ = Number of units of Class III engine family j produced for sale in California in model year x

STD_{jx} = The manufacturer designated HC or HC + NOx emission standard, whichever applies, for engine family j in model year x, which shall be determined by the manufacturer subject to the following conditions:

(1) ~~no individual engine family exhaust emission standard shall exceed 2.5 g/km, and~~
for Model Year 1988 through 2003 motorcycle engines and motorcycles with engine displacement of 280 cc or greater, no individual engine family exhaust emission standard shall exceed 2.5 g/km HC, and
(2) for Model Year 2004 and subsequent motorcycle engines and motorcycles with engine displacement of 280 cc or greater, no individual engine family exhaust emission standard shall exceed 2.5 g/km HC+NOx, and
(3) no engine family designation or engine family exhaust emission standard shall be amended in a model year after the engine family is certified for the model year, and
(4) prior to sale or offering for sale in California, each engine family shall be certified in accordance with Section 1958(c) and shall be required to meet the manufacturer's designated HC or HC + NOx standard, whichever applies, as a condition of the certification Executive Order. Prior to certification the manufacturer shall also submit estimated production volumes for each engine family to be offered for sale in California.

STD_{Ca} = A manufacturer's corporate average HC or HC + NOx exhaust emissions, whichever applies, from those California motorcycles or motorcycle engines subject to the California corporate average HC or HC + NOx exhaust emission standard, as established by an Executive Order certifying the California production for the model year. This order must be obtained prior to the issuance of certification Executive Orders for individual engine families for the model year and shall include but not be limited to the following requirements:

(1) During the manufacturer's production year, for each engine family, the manufacturer shall provide the following information to the Executive Officer within 30 days after the last day in each calendar quarter:

(~~a~~A) vehicle identification numbers and an explanation of the identification code;

(~~b~~B) the total number of vehicles or motorcycle engines produced for sale in California and their applicable designated emissions standards.

(2) The manufacturer's average HC or HC + NOx exhaust emissions, whichever applies, shall meet the applicable corporate average standard at the end of the manufacturer's production for the model year.

[No changes to subsections (b)(3) through (e)]

(f) (1) Small Volume Manufacturers: Exhaust emission standards for ~~from~~ Class III motorcycles and motorcycle engines ~~of~~ produced by small volume manufacturers ~~shall not be exceeded 2.5 grams per kilometer hydrocarbon for the 1984, 1985, 1986, and 1987 model years.~~ are as follows:

(A) For Model Years through 2007, Class III motorcycles and motorcycle engines shall meet the applicable HC-only and CO emission limits specified in the Table of Standards in subsection 1958(b).

(B) For Model Year 2008 and subsequent, Class III motorcycles and motorcycle engines shall emit no more than 12 grams of CO per kilometer and 1.4 grams per kilometer HC + NOx, applied as a corporate average, provided that no engine family shall emit greater than 2.5 grams per kilometer HC + NOx.

(2) To obtain certification as a small volume manufacturer pursuant to this subsection, the manufacturer shall submit product information and estimated sales data with the certification application for each engine family sold in California. As a condition of obtaining certification as a small volume manufacturer, the manufacturer shall submit annually to the ~~state board~~ Executive Officer a summary of its efforts and progress toward meeting more stringent ~~hydrocarbon~~ HC + NOx exhaust emission standards. The summary shall include a description of the manufacturer's current ~~hydrocarbon~~ HC + NOx emission control development status, along with supporting test data, and future planned development work.

(~~2~~3) ~~For purposes of this subsection, a small volume manufacturer is one which sells less than 5,000 new Class I, II, and III motorcycles per model year in California.~~
For purposes of subsection 1958(f)(1), the following provisions apply:

For Model Years (MY)	Small Volume Manufacturer (SVM) definition is	Applicable Exhaust Emissions Requirements
prior to 1984	not applicable	For all manufacturers, Section 1958(f)(1)(A) and 1958(b) apply.
1984 through 1987	one which sells less than 5,000 new Class I, II, and III motorcycles per model year in California	For SVMs, 2.5 grams per kilometer HC-only and 12 grams per kilometer CO apply only to Class III motorcycles. For all other manufacturers and Class I and II motorcycles, Section 1958(f)(1)(A) and 1958(b) apply.
1988 through 2007	not applicable	For all manufacturers, Section 1958(f)(1)(A) and 1958(b) apply.
2008 and subsequent	one which sells no more than 300 (combined) new Class I, II, and III motorcycles per model year in California, starting with the 2004 MY .	For SVMs, Section 1958(f)(1)(B) applies only to Class III motorcycles. For all other manufacturers and Class I and II motorcycles, Section 1958(b) applies.

(g) Early-Compliance Credits

(1) Manufacturers which sell Class III motorcycles or motorcycle engines in California certified as meeting either a 0.8 g/km or 0.4 g/km HC+NOx level prior to Model Year 2008 can receive credits for use in the Model Year 2008 corporate average upon written approval by the Executive Officer. Each unit of Class III motorcycle or motorcycle engine sold between Model Years 1999 and 2008 and which meets the requirements of this subsection shall be multiplied by whichever X multiplier applies, as shown in the following table:

Table of Multipliers to Encourage Early Compliance with
the 0.8 g/km HC + NOx Standard and Beyond

Model Year Sold	Multiplier (X) for Use in MY 2008 Corporate Averaging	
	Certified at 0.8 g/km HC + NOx or below	Certified at 0.4 g/km HC+NOx or below
1999 through 2004	1.5	3.0
2005	1.375	2.5
2006	1.250	2.0
2007	1.125	1.5
2008 and subsequent	1.0	1.0

Note: Each unit of an early compliant certified motorcycle and motorcycle engine is counted cumulatively toward the MY 2008 corporate average.

(2) Applications for early compliance credits pursuant to this subsection shall include in writing all emissions data, test protocols, equipment specifications, operating conditions, and any other technical information requested by the Executive Officer.

(3) The Executive Order approving early compliance credits under this subsection shall specify the exact amount of credits granted, the date of expiration for the credits, and all enforcement provisions applicable to the use of early compliance credits. Each motorcycle and each motorcycle that incorporates an engine for which early compliance credits have been granted pursuant to this subsection shall specify on its "California Motor Vehicle Emission Control And Smog Index Label" (Section 1965, Title 13, California Code of Regulations), in addition to all other existing requirements, the actual HC + NOx engine family exhaust emissions level for which the vehicle or engine has been granted early compliance credit.

(h) Sunset Review

Within five years from the effective date of adoption or date of implementation, which ever comes later, the Air Resources Board, in consultation with the Secretary for Environmental Protection, shall review the provisions of this section to determine whether it should be retained, revised, or repealed.

Note: Authority cited: Sections 39600, 39601, 43013, 43101, 43104, and 43107, Health and Safety Code. Reference: Sections 39002, 39003, 43000, 43013, 43100, 43101, 43104, and 43107, Health and Safety Code; and Cal. Stats. 83, Ch. 103.

Amend Title 13, California Code of Regulations, section 1965 to read:

§1965. Emission Control and Smog Index Labels — 1979 and Subsequent Model-Year Motor Vehicles.

In addition to all other requirements, emission control labels required by California certification procedures and smog index labels shall conform to the "California Motor Vehicle Emission Control and Smog Index Label Specifications," adopted March 1, 1978, as last amended ~~February 26, 1999~~ October 22, 1999, which is incorporated herein by reference.

Note: Authority cited: Sections 39600, 39601 and 43200, Health and Safety Code. Reference: Section 39002, 29003, 43000, 43013, 43100, 43101, 43102, 43103, 43104, 43107 and 43200, Health and Safety Code.

State of California
AIR RESOURCES BOARD

CALIFORNIA MOTOR VEHICLE
EMISSION CONTROL AND SMOG INDEX LABEL SPECIFICATIONS

Adopted: March 1, 1978
Amended: June 16, 1982
Amended: April 26, 1984
Amended: April 8, 1965
Amended: April 25, l986
Amended: June 2, l988
Amended: July 21, l988
Amended: January 22, 1990
Amended: May 15, l990
Amended: July 12, 199l
Amended: March 24, l994
Amended: June 29, 1995
Amended: September 20, 1996
Amended: February 26, 1999
Amended: October 22, 1999

Amendments to “Emission Control and Smog Index Label Specifications,”
incorporated by reference in Section 1965, Title 13, California Code of Regulations

[No changes to Section 1. “Purpose.”]

2. Applicability.

(a) The specifications for tune-up labels, vehicle emission configuration bar-code labels, and vehicle identification number bar-code labels shall apply to all new 1979 and subsequent model-year passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty engines, and to all new 1982 and subsequent model year motorcycles and motorcycle engines certified to the applicable emission standards pursuant to California Health and Safety Code Sections 43100 and 43107. The “unleaded gasoline only” labeling requirements in section 3.(d) do not apply to 1997 and subsequent model year vehicles.

[No changes to subsections (b) and (c) of this section.]

(d) The responsibility for compliance with these specifications shall rest with the motorcycle, motorcycle engine, light-duty vehicle, medium-duty vehicle, or heavy-duty engine manufacturer who certified such vehicles or engines.

3. Emission Control Labels.

[No changes are proposed for paragraph 1 of this subsection.]

In selecting an acceptable location, the manufacturer shall consider the possibility of accidental damage (e.g., possibility of tools or sharp instruments coming in contact with the label) and accessibility for a bar-code scanner, as applicable. Each label shall be affixed in such as manner that it cannot be removed without destroying or defacing the label, and shall not be affixed to any part which is likely to be replaced during the vehicle’s useful life. For motorcycles and motorcycle engines, passenger cars, light-duty trucks, and medium-duty vehicles, the label(s) shall not be affixed to any equipment which is easily detached from the vehicle.

(a) The tune-up label shall 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:

i. The label heading shall read: “Vehicle Emission Control Information” for passenger cars~~,~~ ~~and~~ motorcycles and motorcycle engines; “Important Vehicle Information” for light-duty and medium-duty trucks; and “Important Engine Information” for heavy-duty engines.

[No changes to subsections ii and iii in this section.]

iv. Engine family identification, model designation, engine displacement (in cubic centimeters or liters), and for all 1993 and subsequent model-year vehicles the statement, "_______ (specify OBDI or OBDII, as applicable) certified" or "OBD Exempt" for all 1990 and subsequent model-year vehicles which do not have an Air Resources Board approved on-board diagnostic system. Motorcycles, motorcycle engines, and ZEVs are exempt from these requirements.

[No changes to subsections v and vi in this section.]

vii. For motorcycles and motorcycle engines only, any specific fuel or engine lubricant requirements (e.g., lead content, research octane number, engine lubricant type).

[No change to subsection viii in this section.]

ix. An unconditional statement of compliance with the appropriate model-year California regulations; for example, "This vehicle (or engine, as applicable) conforms to California regulations applicable to __ model-year new __ (for 1992 and subsequent model years, specify TLEV, LEV, ULEV, SULEV, or ZEV, as applicable) (specify motorcycles, motorcycle engines, passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty Otto-cycle engines, or heavy-duty diesel engines, as applicable)." 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." For Class III motorcycles and motorcycle engines for sale in California, the statement must include the phrase "is certified to __HC engine family exhaust emission standard in California." In addition, for Class III motorcycles and motorcycle engines for sale in California that meet the requirements of Section 1958(g) "Early Compliance Credits" (Title 13, CCR), the statement must also include the phrase "is certified to __ (actual certified engine family exhaust emissions level) gram per kilometer HC+NOx engine family exhaust emissions level." For incomplete light-duty truck and incomplete medium-duty vehicles the label shall contain the following statement in lieu of the above:

[No other changes to the remainder of subsection ix in this section or the remaining sections of the "Emission Control and Smog Index Label Specifications" regulation.]

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

Adopted: December 12, 2002
Amended: September 1, 2006

NOTE: The proposed amendments are indicated by underline for additions and ~~strikeout~~ for deletions compared to the adopted test procedures. Only those portions of the existing language containing the proposed modifications are included. All other portions remain unchanged and are indicated by the symbol "* * * * *" for reference. A complete set of the adopted test procedures (without the proposed amendments) is available at http://www.arb.ca.gov/regact/levhdg02/levhdg02.htm .

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

The following provisions of Subparts A, I, and N, Part 86, Title 40, Code of Federal Regulations, as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the 40 CFR Part 86 section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty diesel engines and vehicles, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," except as altered or replaced by the provisions set forth below.

Part I. GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS.

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

1. General Applicability. [86.xxx-1]

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11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

A. Federal provisions.

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B. California provisions.

1. **Urban Bus Standards**.

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6. **Heavy-Duty Diesel Engine Idling Requirements.**

6.1 **Engine Shutdown System**. The requirements in this subsection apply to engine manufacturers and original equipment manufacturers, as applicable, that are responsible for the design and control of engine and/or vehicle idle controls.

6.1.1 **Requirements**. Except as provided in subsections 11.B.6.2 and 3, all new 2008 and subsequent model-year heavy-duty diesel engines shall be equipped with an engine shutdown system that automatically shuts down the engine after 300 seconds of continuous idling operation once the vehicle is stopped, the transmission is set to "neutral" or "park", and the parking brake is engaged. If the parking brake is not engaged, then the engine shutdown system shall shut down the engine after 900 seconds of continuous idling operation once the vehicle is stopped and the transmission is set to "neutral" or "park." The engine shutdown system must be tamper-resistant and non-programmable. A warning signal, such as a light or sound indicator inside the vehicle cabin, may be used to alert the driver 30 seconds prior to engine shutdown. The engine shutdown system must be capable of allowing the driver to reset the engine shutdown system timer by momentarily changing the position of the accelerator, brake, or clutch pedal, or other mechanism within 30 seconds prior to engine shutdown. Once reset, the engine shutdown system shall restart the engine shutdown sequence described in this paragraph above, and shall continue to do so until the engine shuts down or the vehicle is driven.

6.1.2 **Engine Shutdown System Override**. The engine shutdown system may be overridden, to allow the engine to run continuously at idle, only under the following conditions:

(1) If the engine is operating in power take-off (PTO) mode. The PTO system shall have a switch or a setting that can be switched "on" to override the engine shutdown system and will reset to the "off" position when the vehicle's engine is turned off or when the PTO equipment is turned off. Subject to advance Executive Officer approval, other methods for detecting or activating PTO operation may be allowed; or,

(2) if the vehicle's engine coolant temperature is below 60°F. The engine shutdown system shall automatically be activated once the coolant temperature reaches 60°F or above. The engine coolant temperature shall be measured with the engine's existing engine coolant temperature sensor used for engine protection, if so equipped. Other methods of measuring engine coolant temperature may be allowed, subject to advance Executive Officer approval.

(3) if an exhaust emission control device is regenerating, and keeping the engine running is necessary to prevent aftertreatment or engine damage, the engine shutdown system may be overridden for the duration necessary to complete the regeneration process up to a maximum of 30 minutes. Determination of what constitutes the need for regeneration will be based on data provided by the manufacturer at time of certification. Regeneration events that may require longer than 30 minutes of engine idling to complete shall require advance Executive Officer approval. At the end of the regeneration process, the engine

shutdown system shall automatically be enabled to restart the engine shutdown sequence described in subparagraph 11.B.6.1.1. above. A vehicle that uses a regeneration strategy under engine idling operating conditions shall be equipped with a dashboard indicator light that, when illuminated, indicates that the exhaust emission control device is regenerating. Other methods of indicating that the exhaust emission control device is regenerating may be used with advance Executive Officer approval.

(4) if servicing or maintenance of the engine requires extended idling operation. The engine's electronic control module may be set to temporarily deactivate the engine shutdown system for up to a maximum of 60 minutes. The deactivation of the engine shutdown system shall only be performed with the use of a diagnostic scan tool. At the end of the set deactivation period, the engine's electronic control module shall reset to restart the engine shutdown system sequence described in subparagraph 11.B.6.1.1 above.

6.2 **Exempt Vehicles**. Heavy-duty diesel engines to be used in buses as defined in California Vehicle Code §§ 233, 612 and 642, school buses as defined in California Vehicle Code § 545, recreational vehicles as defined in Health and Safety Code 18010, medium duty vehicles as defined in § 1900(b)(13) of title 13, California Code of Regulations (CCR), military tactical vehicles as defined in §1905 of title 13, CCR, and authorized emergency vehicles as defined in California Vehicle Code § 165 are exempted from these requirements.

6.3 **Optional NOx Idling Emission Standard**. In lieu of the engine shutdown system requirements specified in subsection 11.B.6.1 above, an engine manufacturer may elect to certify its new 2008 and subsequent model-year heavy-duty diesel engines to an optional NOx idling emission standard of 30 grams per hour. Compliance with this optional standard will be determined based on testing conducted pursuant to the supplemental NOx idling test cycle and procedures specified in section 86.1360-2007.B.4 below. The manufacturer may request an alternative test procedure if the technology used cannot be demonstrated using the procedures in section 86.1360-2007.B.4, subject to advance approval of the Executive Officer. Manufacturers certifying to the optional NOx idling standard must not increase emissions of CO, PM, or NMHC, determined by comparing results from the supplemental NOx idling test cycle and procedures specified in section 86.1360-2007.B.4 below, to emission results from the idle mode of the supplemental steady state test cycle or emission results from idle portions of the transient test cycle for heavy duty diesel engines, respectively specified in sections 86-1360-2007 and 86.1327-98, below. With advance Executive Officer approval, a manufacturer may use other methods of ensuring that emissions of CO, PM, and NMHC are not adversely affected in meeting the optional NOx requirement. Also, manufacturers shall state in their application for certification that meeting the optional NOx idling requirement will not adversely affect the associated emissions of CO, PM and NMHC.

An engine manufacturer certifying its engine to the optional NOx idling emission standard must also produce a vehicle label, as defined in subsection 35.B.4, below.

(D) Optional Alternatives to Main Engine Idling. All new 2008 and subsequent model year heavy duty diesel engines may also be equipped with idling emission reduction devices that comply with the compliance requirements specified in title 13, CCR section 2485(c)(3).

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12. Alternative certification procedures. [§86.080-12] April 17, 1980. [No change.]

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21. Application for certification. [§86.xxx-21]

A. Federal provisions.

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B. California provisions

1. For 2004 and subsequent model-year medium-duty ultra-low emission and super-ultra-low emission vehicles and engines not powered exclusively by diesel fuel, the manufacturer shall submit projected California sales and fuel economy data two years prior to certification.

2. **Heavy-Duty Diesel Engine Idling Requirements**.

2.1 For 2008 and subsequent model-year heavy-duty diesel engines, the manufacturer must provide a statement in the application for certification that the heavy-duty diesel engine for which certification is being requested will comply with the automatic engine shutdown requirements to control idle emissions as specified in subsection 11.B.6.1. If the heavy-duty diesel engine for which certification is being requested is explicitly designed for exempt vehicles, per the provisions in 11.B.6.2, then the manufacturer must also provide a statement in its application for certification so stating.

2.2 A manufacturer that elects to certify engines to the optional NOx idling emission standard, specified in subsection 11.B.6.3, must provide in the application for certification information pertaining to the NOx idling emission certification test conducted under 86.1360-2007.B.4, below, including emissions data for total particulate matter, non-methane hydrocarbons or total hydrocarbons, oxides of nitrogen, carbon monoxide, and carbon dioxide in grams per hour, the test load in brake-horsepower, and engine test speeds in revolutions per minute for both mode 1 and mode 2 testing. With advance

Executive Officer approval, a manufacturer may use an alternative procedure to show compliance with the optional NOx idling emission standard. Regardless of the procedure used, the manufacturer shall also provide the appropriate labels to be affixed to the vehicle on which the engine is going to be installed as required in subsection 35.B.4, below. The manufacturer must maintain records at the manufacturer's facility that contain all test data, engineering analyses, and other information which provide the basis for the compliance statement, where such information exists. The manufacturer must provide such information to the Executive Officer within 30 days upon request.

2.3 If the heavy-duty diesel engine for which certification is being requested incorporates any of the alternative idle emission control strategies contained in title 13, CCR, section 2485(c)(3), then the manufacturer must provide in its application for certification a description of the alternative strategy or technology including the type, brand name, model identification number, and where applicable emissions data and power rating. In addition, the manufacturer must also provide the appropriate labels to be affixed to the outside of the vehicle as required in subsections 35.B.4. If the alternative technology is a fuel-fired heater, then the manufacturer must provide with the application for certification the information required under subsection H.4.4, Part I of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," as incorporated by reference in title 13, CCR, section 1961(d).

22. Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges. [§86.001-22]
April 6, 1994. [No change.]

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35. Labeling. [§86.xxx-35] ~~,~~

A. Federal Provisions.

1. **§86.001-35** January 18, 2001.

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

1.2 Subparagraphs (a)(1) through (a)(3)(iii)(G). [No change.]

1.3 Amend ~~Add the following language to~~ subparagraph (a)(3)(iii)(H) as follows: ~~.~~

1.3.1 An unconditional statement of compliance with the appropriate model year California regulations; for example, "This engine conforms to

California regulations applicable to XXXX model year new heavy-duty diesel engines." It may also state that the engine conforms to any applicable federal or Canadian emission standards for new heavy-duty diesel engines.

1.3.2~~1~~ For 2004 through 2006 model year heavy heavy-duty diesel-fueled, dual-fuel, and bi-fuel engines to be used in urban buses that are certified to the optional reduced emission standards and are sold to any transit agency exempted under paragraphs (c)(8) and (d)(7), title 13, CCR, §1956.2 from the requirements of paragraphs (c)(5) and (d)(4), title 13, CCR §956.2.

> "This engine conforms to California regulations applicable to XXXX model year new urban bus or heavy-duty diesel engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standards of 0.01 g/bhp-hr)."

1.3.3~~2~~ For all other 2004 through 2006 model year heavy-duty diesel cycle engines, including those used in urban buses, that are certified to the optional reduced-emission standards, the label shall contain the following statement:

> "This engine conforms to California regulations applicable to XXXX model year new (specify urban bus or heavy-duty diesel) engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standard of 0.03 g/bhp-hr, 0.02 g/bhp-hr, or 0.01 g/bhp-hr)."

1.4 Subparagraphs (a)(3)(I) through (i). [No change.]

2. **§86.007-35**. January 18, 2001.

2.1 Subparagraphs (a) through (i). [No change except that the amendments set forth in §86.001-35 apply.]

B. California provisions.

1. For 2004 and later model year heavy-duty diesel engines certified under the requirements of title 13, CCR, §1956.8(a)(3), the statement of compliance requirements of this subsection shall be repeated for each of the two fueling modes of operation. Appended to the statement for the lower emitting fueling mode of operation shall be the following sentence:

> "This certification is valid only while operating on ___ (indicate the fuel or fuel combination under which this mode of operation was certified) fuel. Operation using any other fueling mode will result in significant increases in exhaust emissions and significantly reduce engine performance."

2. 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. Statements shall not be used on labels placed on engines that, in fact, do not comply with all applicable California regulations.

4. **Vehicle Labels for Heavy-Duty Diesel Engine Idling Requirements.** For each 2008 and subsequent model year heavy-duty diesel engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3 or equipped with a certified/verified auxiliary power system (APS) pursuant to title 13, CCR, section 2485(c)(3)(A), a single label shall be produced and affixed, as applicable, on each vehicle equipped with such heavy-duty diesel engine.

4.1 The labeling requirements for engine manufacturers, aftermarket APS manufacturers and installers, and original equipment manufacturers are as follows:

4.1.1 Engine manufacturers. The engine manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each new engine or APS pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the original equipment manufacturer.

4.1.2 Aftermarket APS manufacturers and installers. An aftermarket APS manufacturer that has certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each APS system pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the party that is responsible for installing the APS on the vehicle.

4.1.3 Original equipment manufacturer. An original equipment manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce and affix the appropriate label on the outside of the vehicle pursuant to paragraphs 35.B.4.2 or 35.B.4.3, whichever is applicable.

4.2 **Label Format.** Figure 1 shows a facsimile of the label format for an engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3. Figure 2 shows a facsimile of the label format for an engine in a certified/verified APS pursuant to title 13, CCR, section 2485(c)(3)(A). The engine manufacturer, APS manufacturer or original equipment manufacturer, whichever is applicable, that produces and affixes the label on the vehicle must ensure that the label has the following characteristics:

Figure 1

Figure 2

4.2.1 Oval shape.

4.2.2 Dimensions of no less than 6 inches wide by 4 inches high.

4.2.3 The color of the outer and inner ellipses shall be dark blue and the stars in red. The background of the label shall be light blue in color. The size of the stars shall be equal to the size of the characters as specified in paragraph 35.B.4.2.4 below.

4.2.4 A vehicle equipped with an engine that is certified pursuant to paragraph 11.B.6.3 shall have a label with the word “CERTIFIED,” and below it the phrase “CLEAN IDLE,” as shown in Figure 1. A vehicle equipped with an APS certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall have a label with the word “VERIFIED,” and below it the phrase “CLEAN APS,” as shown in Figure 2. The label information shall be written in the English language with sans serif font, black in color, and in upper case letters. The size of the font shall be at least 7/16 inch (or 32 points) and the spacing of the fonts must be such that the longest phrase (for example, “CLEAN IDLE”) extends from the left edge to the right edge of the inner edge of the inner ellipse, without touching the edges. The label information shall be centrally aligned, both vertically and horizontally.

4.2.5 A hologram as shown in Figure 3 shall be embedded within the proposed label. The hologram must cover the entire label. The hologram shall have the phrase “Clean Skies” repeatedly written from edge to edge of the label boundaries and each phrase shall be separated by a circular bullet. The position of the circular bullet in each line shall be exactly above the space between the words “Clean” and “Skies” of the line below. The color of the font shall be orange. The font size“ shall be less than or equal to a quarter of the font size of the phrase “CLEAN IDLE” or “CLEAN APS” as specified in subsection 35.B.4.2.4, above. The hologram shall have the map of the State of California, in orange color, overlaid over the text and positioned in the center of the label as shown in Figure 3, below.

Figure 3

4.3 Label Location and Attachment Requirements

4.3.1 The appropriate label shall be permanently affixed to the exterior on the driver’s side of the hood, in an area within one foot by one foot from the top and front edges of the hood. If such an attachment is not feasible, the label may be attached at a different location subject to advance approval by the Executive Officer.

4.3.2 Each label must be affixed in such a manner that it can not be removed without destroying or defacing the label. The label must not be affixed to any vehicle component that can easily be detached from the vehicle.

4.3.3 The label and any adhesives used must be designed to withstand, for a period of 10 years, typical environmental conditions. Typical environmental conditions include, but are not limited to, exposure to extreme heat or cold, moisture, engine fuels, lubricants and coolants.

4.4 The party that certifies/verifies the engine pursuant to paragraph 11.B.6.3 or the APS pursuant to title 13, CCR, section 2485(c)(3)(A) shall be the ultimate party responsible for ensuring that the labels are correctly produced. Samples of labels produced pursuant to this subsection must be submitted to the Executive Officer with the applicable certification or verification application.

4.5 Labels on vehicles may also be applied by original equipment manufacturers, distributors, or dealers. However, the party that certified the engine or the APS and produced the labels remains the ultimate party responsible for ensuring that the labels are correctly administered. If the labels are administered by the original equipment manufacturer, dealer, or distributor, the producer of the label shall include its name and a serial number on the label. The location of the producer's name and serial number on the label shall be written in the lower part of the label, in the space vertically centered between the label wording and the inner ellipses, and the font must contrast the label background. The serial numbers of the labels administered must be recorded by the original equipment manufacturer, distributor, or dealer and reported to the party responsible for producing the labels. This information shall be maintained by the party responsible for producing the labels for a period of 10 years, and shall be made available to the Executive Officer upon request.

4.6 A heavy-duty diesel engine that has been certified pursuant to subsection 11.B.6.3 shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2220 through 2225.

4.7 An idling emission reduction device or system that has been certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2470 through 2476.

36. Submission of vehicle identification numbers. [§86.079-36] [n/a]

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PART II TEST PROCEDURES

Subpart I - Emission Regulations for New Diesel-Fueled Heavy-Duty Engines; Smoke Exhaust Test Procedure

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Subpart N - Emission Regulations for New Otto-Cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

*** * * * ***

86.1360-2007 Supplemental steady-state test; test cycle and procedures. January 18, 2001.

A. Federal provisions

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B. California provisions

1. **Emission testing caps for the 2005 and subsequent model years**.

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4. **Determination of NOx Idling Emissions**. The requirements set forth in this subparagraph apply to 2008 and subsequent model year heavy-duty diesel engines certifying to the optional NOx idling emission standard specified in subsection 11.B.6.3, above. To determine whether an engine meets the optional NOx idling emission standard, emissions shall be measured by testing the engine on an engine dynamometer as described below.

4.1 **Test Cycle**. The following 2 mode duty cycle shall be performed on a dynamometer on the test engine:

Mode	**Engine Speed (rpm)**	**Time in mode (seconds)**	**Engine Load**
1	Manufacturer Recommended Curb idle	1800	See subparagraph 4.1.1 below
2	1100	1800	See subparagraph 4.1.2 below

4.1.1 For mode 1, the dynamometer load or torque applied shall be based on the vehicle power requirements during curb idle operation.

The engine manufacturer shall determine the curb idle speed and the appropriate test load for the test engine. The load shall include curb idle power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps and any other engine accessory operated during curb idle of the engine. The load for mode 1 may not include power requirements for operating the air conditioning compressor or for operating on-board accessories, such as a microwave, refrigerator, television, computer, etc., that the vehicle operator may use during rest periods.

4.1.2 For mode 2, the dynamometer load or torque applied shall be based on the vehicle power requirements during idle speed operations of 1100 revolutions per minute (rpm). The engine manufacturer shall determine the appropriate test load for the test engine. The load shall include high engine idle speed power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps, air conditioning compressor set at maximum capacity, and any other engine accessory operated during the idle operation of the engine. The total test load shall be equal to the test load so determined plus an additional load of 2 kilowatts to take into account the power needs for operating on-board accessories such as a television, refrigerator, microwave, computer, etc.

4.2 **Test Requirements.**

4.2.1 **Pre-conditioning**. Prior to measuring emissions, bring the engine to a warm condition as follows:

(a) If the idling test follows directly after testing over the Federal Test Procedure or the supplemental emission tests, consider the engine warm. Bring down the engine to the manufacturer recommended curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes.

(b) If the engine is cold, warm-up the engine by operating it at any speed above peak-torque speed and between 65 to 85% of maximum mapped power until the engine coolant’s temperature is within 2% of its mean value for at least 2 minutes or until the engine thermostat controls engine temperature.

4.2.2 **Test Sequence**. Following engine warm-up as described in subparagraph 4.2.1, the test shall be performed first for mode 1. Bring down the engine to the curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes. Upon completion of mode 1 testing, the engine speed shall be ramped up to 1100 rpm. Once the engine starts operating at 1100 rpm, apply the appropriate load as determined in subparagraph 4.1.2, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes. The engine shall be operated for the prescribed time in each mode. The specified test speed shall be held to within ±50 rpm and the specified torque shall be held to within ±2 percent of the maximum torque at the test speed.

4.2.3 **Calculations.** For each test mode, calculate the modal average mass emissions level for each regulated pollutant, in grams per hour, the modal average power, in brake horsepower and the modal average speed, in rpm. For compliance, the calculated average NOx emissions of each mode shall not exceed the optional NOx idling emission standard of 30 grams per hour specified in subsection 11.B.6.3 above.

86.1370-2007 Not-To-Exceed test procedures. January 18, 2001.

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State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

Adopted:	December 12, 2002
Amended:	July 24, 2003
Amended:	September 1, 2006
Amended:	July 26, 2007
Adopted:	October 17, 2007
Amended:	October 14, 2008
Amended:	September 27, 2010
Amended:	October 12, 2011

NOTE: The amendments in this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures adopted by the Board. [Existing intervening text that is not amended in this rulemaking is indicated by "* * * *". A complete set of the test procedures, as amended on October 12, 2011, is available at http://www.arb.ca.gov/msprog/onroadhd/hddtps_clean_warranty_12-10.pdf.

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

The following provisions of Subparts A, I, N, S, and T, Part 86, and of Subparts A through K, Part 1065, Title 40, Code of Federal Regulations, as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the applicable section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty diesel engines and vehicles, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," except as altered or replaced by the provisions set forth below.

PART 86 – CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

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

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Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

1. General Applicability. [86.xxx-1]

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2. Definitions. [§86.xxx-2]

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B. California Provisions.

"Administrator" means the Executive Officer of the Air Resources Board.
"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.
"**EPA**" shall also mean Air Resources Board or Executive Officer of the Air Resources Board.
"EPA Enforcement Officer" means the Executive Officer or his delegate.
"Measurement allowance" means accuracy margin.

“Medium-duty engine” means a heavy-duty engine that is used to propel a medium-duty vehicle.

“Medium-duty vehicle” means 2004 through 2006 model year heavy-duty low-emission vehicle, ultra-low-emission vehicle, super-ultra-low-emission vehicle or zero-emission vehicle certified to the standards in title 13, CCR, section 1960.1(h)(2) having a manufacturer's gross vehicle weight rating of 14,000 pounds or less; and any 2004 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in title 13, CCR section 1956.8(h), having a manufacturer’s gross vehicle weight rating between 8,501 and 14,000 pounds.

“NTE standard” means NTE emission limit.

“**Warranty period**” [For guidance see title 13, CCR, §2036].

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11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

A. Federal provisions.

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B. California provisions.

1. Urban Bus Standards.

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6. Heavy-Duty Diesel Engine Idling Requirements.

6.1 Engine Shutdown System. The requirements in this subsection apply to engine manufacturers and original equipment manufacturers, as applicable, that are responsible for the design and control of engine and/or vehicle idle controls.

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6.2 Exempt Vehicles. Heavy-duty diesel engines to be used in buses as defined in California Vehicle Code §§ 233, 612 and 642, school buses as defined in California Vehicle Code § 545, recreational vehicles as defined in Health and Safety Code 18010, medium duty vehicles as defined in § 1900(b)(13) of title 13, California Code of Regulations (CCR), military tactical vehicles as defined in §1905 of title 13, CCR, ~~and~~ authorized emergency vehicles as defined in California Vehicle Code § 165<u>, armored cars, as defined in California Vehicle Code § 115, and workover rigs, as defined in § 2449 of title 13, CCR</u> are exempted from these requirements.

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II. TEST PROCEDURES

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Subpart N - Emission Regulations for New Otto-Cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

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86.1370-2007 Not-To-Exceed Test Procedures. ~~July 13, 2005~~ November 8, 2010.

A. Federal Provisions.

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4.1 Amend subparagraph (d)(1) as follows: Add the following introductory sentence to subparagraph (d)(1): When operated within the Not-To-Exceed Control Area defined in paragraph (b) of this section, diesel engine emissions shall not exceed the applicable Not-To-Exceed Limits specified below when averaged over any time period greater than or equal to 30 seconds, except where a longer minimum averaging period is required by paragraph (d)(2) of this section.

(i) The emission caps specified in this section shall be rounded to the same number of significant figures as the applicable standards in Part I.11 of these test procedures using ASTM E29-93a.

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Subpart T - Manufacturer-Run In-Use Testing Program for Heavy-Duty Diesel Engines

86.1901 What testing requirements apply to my engines that have gone into service? ~~June 14, 2005~~. November 8, 2010.

86.1905 How does this program work? ~~March 13, 2008~~ November 8, 2010.

1. Subparagraphs (a) through (f). [No change.]

2. Amend subparagraph (g) as follows: For any communication related to this subpart, contact the On-Road Heavy-Duty Diesel Section Manager, Mobile Source Control Division, Air Resources Board, 9528 Telstar Avenue, El Monte, CA 91731.

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86.1910 How must I prepare and test my in-use engines? ~~June 14, 2005~~ November 8, 2010.

86.1912 How do I determine whether an engine meets the vehicle-pass criteria?

~~March 13, 2008~~. November 8, 2010.

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86.1920 What in-use testing information must I report to EPA? ~~June 14, 2005~~ November 8, 2010.

1. Amend subparagraph (a) as follows: Send us electronic reports using an approved information format to Chief, Emission Research and Regulatory Development Branch, Mobile Source Control Division, Air Resources Board, 9528 Telstar Avenue, El Monte, California, 91731. If you want to use a different format, send us a written request with justification.

2. Subparagraphs (b) to (c). [No change.]

3. Amend subparagraph (d) as follows: Send us an electronic notification at inuse@arb.ca.gov describing any voluntary vehicle/engine emission evaluation test you intend to conduct … [No change to remainder of paragraph.]

4. Amend subparagraph (e) as follows: Send us an electronic notification at inuse@arb.ca.gov within 15 days after your initial review of the test data for a selected engine family indicates that three engines in Phase 1 testing have failed to comply with the vehicle-pass criteria. [No change to remainder of paragraph.]

5. Subparagraphs (f) and (g). [No change.]

86.1930 What special provisions apply from 2005 through ~~2009~~ 2010? ~~March 13, 2008~~ November 8, 2010.

~~86.1935 What special provisions may apply as a consequence of a delay in the particulate matter accuracy margin report for portable emission measurement system? March 13, 2008~~

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PART 1065 – ENGINE-TESTING PROCEDURES.

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Subpart B – Equipment Specifications

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1065.140 Dilution for gases and PM constituents. ~~July 13, 2005~~, November 8, 2010.

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Subpart C – Measurement Instruments

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1065.260 Flame ionization detector. ~~July 13, 2005~~, November 8, 2010.

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1065.290 PM gravimetric balance. ~~July 13, 2005~~, November 8, 2010.
1065.295 PM inertial balance for field-testing analysis. ~~July 13, 2005,~~ November 8, 2010.

Subpart D – Calibrations and Verifications

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1065.307 Linearity verification. ~~July 13, 2005~~, November 8, 2010.

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1065.340 Diluted exhaust flow (CVS) calibration. ~~July 13, 2005~~, November 8, 2010.

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1065.390 PM balance verifications and weighing process verification. ~~July 13, 2005~~, November 8, 2010.

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Subpart F – Performing an Emission Test in the Laboratory

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1065.525 Engine starting, restarting, and shutdown. ~~July 13, 2005~~, November 8, 2010.
1065.526 Repeating void modes or test intervals. November 8, 2010.

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1065.550 Gas analyzer range validation, drift validation, and drift correction. ~~July 13, 2005~~, November 8, 2010.

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Subpart G – Calculations and Data Requirements

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1065.640 Flow meter calibration calculations. ~~July 13, 2005~~, November 8, 2010.
1065.642 SSV, CFV, and PDP molar flow rate calculations. ~~July 13, 2005~~, November 8, 2010.

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1065.660 THC, ~~and~~ NMHC, and CH_4 determination. ~~July 13, 2005~~, November 8, 2010.

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Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

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1065.750 Analytical gases. ~~July 13, 2005~~, November 8, 2010.

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Subpart J – Field Testing and Portable Emission Measurement Systems

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1065.905 General provisions. ~~July 13, 2005~~, November 8, 2010.

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1065.915 PEMS instruments. ~~July 13, 2005~~, November 8, 2010.
1065.920 PEMS calibrations and verifications. ~~July 13, 2005~~, November 8, 2010.
1065.925 PEMS preparation for field testing. ~~July 13, 2005~~, November 8, 2010.

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1065.940 Emission calculations. ~~July 13, 2005~~, November 8, 2010.

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