State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1988 AND SUBSEQUENT MODEL PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted: May 20, 1987
Amended: December 20, 1989
Amended: January 22, 1990
Amended: December 26, 1990
Amended: July 12, 1991
Amended: August 12, 1992
Amended: October 23, 1992
Amended: May 28, 1993
Amended: September 17, 1993
Amended: September 22, 1993
Amended: September 22, 1994
Amended: June 24, 1996
Amended: *July 24, 1996*

NOTE: The regulatory amendments proposed in this rulemaking are shown in *italics* to indicate additions and ~~strikeout~~ to indicate deletions from the version of the test procedures adopted on June 24, 1996.

The numbering convention employed in this document, in order of priority, is: 1.a.1.i.A. Any references within specific sections in the Code of Federal Regulations are denoted in order of priority as: (a)(1)(i)(A) - the same numbering system employed in the Code of Federal Regulations.

Amend the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" as follows:[1]

(a) Revise the title page and the first page of the Table of Contents of the test procedures to read as follows:

[1] The material that follows includes excerpts from the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" incorporated by reference in section 1960.1(k), title 13, California Code of Regulations. Only those sections of the test procedures amended in this proceeding are shown in this document. All other sections of the test procedures are unchanged.

Upon approval by the Office of Administrative Law, the full test procedure document with the amendments adopted as part of this rulemaking action will be available from the ARB by writing to the Air Resources Board, 9528 Telstar Avenue, El Monte, California 91731 in accordance with 13 CCR 1902, or from the ARB Information System (ARB IS) electronic bulletin board (via modem at 916-322-2826 [choose "Low Emission Vehicle Program" from "Mobile Source Programs" under the "System Features" menu] or via the Internet at "http://www.arb.ca.gov/ [choose "LEV Program" under "CARB Programs" from the main menu].

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(b) In section 1 of the test procedures, amend subsection (a) to read as follows:

a. These test procedures are applicable to 1988 and subsequent model gasoline, gaseous, diesel, and, beginning in 1993, alcohol passenger cars, light-duty trucks, and medium-duty vehicles. Procedures specific to transitional low-emission, low-emission, ultra-low-emission, and super-ultra-low-emission vehicles are applicable to 1992 and subsequent model-year gasoline and diesel, and to 1993 and subsequent model-year alternate fuel and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles. Procedures specific to zero-emission vehicles are applicable to ~~1992~~ *2003* and subsequent model-year passenger cars, light-duty trucks and medium-duty vehicles. References to "light-duty trucks" in 40 CFR 86 shall apply both to "light-duty trucks" and "medium-duty vehicles" in these procedures.

(c) In section 2 of the test procedures, amend the definition of "All-Electric Range Test" and "Zero-emission vehicle" to read as follows:

"**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 ~~alternating~~ the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see 9.f. of these test procedures).

"**Zero-emission vehicle**" or "**ZEV**" means any vehicle ~~which is~~ certified ~~by the Executive Officer to produce zero emissions of any criteria pollutants under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40° F and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions~~ *to* zero-emission standards.

(d) In section 3 of the test procedures, make the following changes:

(i) Amend note (11) of subsection f to read:

(11) Each manufacturer shall certify PCs or LDTs to the exhaust emission standards of Sections 3.f. and 3.g. of these test procedures~~, or as Zero-Emission Vehicles,~~ such that the manufacturer's fleet average NMOG values for California-certified PCs and LDTs from 0-3750 lbs. Loaded Vehicle Weight (or "LVW"), and LDTs from 3751-5750 lbs. LVW produced and delivered for sale in California are less than or equal to the requirement for the corresponding Model Year, Vehicle Type, and LVW Class in section 3.h. of these test procedures.

(ii) Amend the table and note (2) of and add a note (2.1) to subsection g to read:

g. The exhaust emissions from new 1992 and subsequent model-year transitional low-emission vehicles, low-emission vehicles and ultra-low-emission vehicles, *and new 2003 and subsequent model-year zero-emission vehicles* shall not exceed:

EXHAUST MASS EMISSION STANDARDS
FOR TRANSITIONAL LOW-EMISSION VEHICLES, LOW-EMISSION VEHICLES, ~~AND~~ ULTRA-LOW-EMISSION VEHICLES *AND ZERO-EMISSION VEHICLES* IN PASSENGER CAR AND LIGHT-DUTY TRUCK VEHICLE CLASSES[6,7,8,9,10]
["grams per mile" (or "g/mi")]

Vehicle Type[1]	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane OrganicGases[3,4]	Carbon Monoxide	Oxides of Nitrogen[5]
PC and	All	50,000	TLEV	0.125	3.4	0.4
LDT	0-3750		LEV	0.075	3.4	0.2
			ULEV	0.040	1.7	0.2
			ZEV[2.1]	--	--	--
		100,000	TLEV	0.156	4.2	0.6
			LEV	0.090	4.2	0.3
			ULEV	0.055	2.1	0.3
			ZEV[2.1]	--	--	--
LDT	3751-5750	50,000	TLEV	0.160	4.4	0.7
			LEV	0.100	4.4	0.4
			ULEV	0.050	2.2	0.4
			ZEV[2.1]	--	--	--
		100,000	TLEV	0.200	5.5	0.9
			LEV	0.130	5.5	0.5
			ULEV	0.070	2.8	0.5
			ZEV[2.1]	--	--	--

(1) "PC" means passenger cars.
"LDT" means light-duty trucks.
"LVW" means loaded vehicle weight.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

(2) "TLEV" means transitional low-emission vehicle.
"LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"ZEV" means zero-emission vehicle.

(2.1) *a. The Executive Officer shall certify as ZEVs vehicles that produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40°F and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.*

b. Prior to the 2003 model year a manufacturer that voluntarily produces vehicles that meet the ZEV emission standards applicable to 2003 and subsequent model year vehicles may certify those vehicles as ZEVs for the purposes of calculating fleet average NMOG exhaust emission values under note (4) or (5), section h.3. of these test procedures; NMOG credits under section h.3., note(7); and ZEV credits under section h.3., note (9)a.

(iii) Amend note (9) of subsection h to read:

(9) **ZEV Requirements**. While meeting the fleet average requirements, each manufacturer shall certify, produce, and deliver for sale in California at least ~~2% ZEVs each model year from 1998 through 2000, 5% ZEVs in 2001 and 2002, and~~ 10% ZEVs in 2003 and subsequent model years. These percentages shall be applied to the manufacturer's total production of PCs and LDTs 0-3750 lbs. LVW delivered for sale in California.

a. **Calculation of ZEV Credits**. Manufacturers that produce for sale in California more ZEVs than required in a given model year shall earn ZEV credits, which shall be expressed in units of g/mi NMOG. The amount of ZEV credits earned shall be equal to the number of ZEVs required to be produced and delivered for sale in California for the model year subtracted from the number of ZEVs produced and delivered for sale in the model year and then multiplied by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year.

In calculating the number of ZEV credits under this note (9)a, each ZEV produced and delivered for sale prior to the 2003 model year may be counted as follows:

1. ZEV Credits based on vehicle range:

Number of ZEVs	*Vehicle Range (miles)*		
	Model Years 1996 and 1997	*Model Years 1998 and 1999*	*Model Years 2000, 2001 and 2002*
2	*any*	*≥ 100*	*≥ 140*
3	*≥70*	*≥ 130*	*≥ 175*

Range shall be determined in accordance with section 9.f.(2)(a) of these procedures.

2. ZEV Credits based on the specific energy of the battery:

Number of ZEVs	*Specific Energy of Battery (w-hr/kg)*		
	Model Years 1996, 1997 and 1998	*Model Years 1999 and 2000*	*Model Years 2001 and 2002*
2	*any*	*≥ 50*	*≥ 60*
3	*≥40*	*≥ 60*	*≥ 90*

For model years 1999 through 2002, additional ZEV credits will be determined by linear interpolation between the values shown in the above schedule. Battery specific energy shall be determined in accordance with section 9.g. of these procedures.

3. For purposes of calculating ZEV credits, a ZEV may be counted according to note (9)a.1. or (9)a.2. above, but not both.

4. For purposes of calculating manufacturer's fleet average NMOG value under note (4) or (5), each ZEV shall be counted as one vehicle.

All ZEV credits earned prior to the ~~1998~~ *2003* model year shall be treated as if earned in the ~~1998~~ *2003* model year and shall be discounted in accordance with note (7)c.

b. **Submittal of ZEV Credits**. A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits. These credits may be earned previously by the manufacturer or acquired from another manufacturer. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that

model year.

c. **Requirement to Make Up a ZEV Deficit**. Manufacturers that certify, produce, and deliver for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of 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 subtracting the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirements for PCs and LDTs 0-3750 lbs. LVW for the model year in which the deficit is incurred.

d. **Penalty for Failure to Meet ZEV Requirements**. Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs or submit an appropriate amount of ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code § 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 period. For the purposes of Health and Safety Code § 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation: (No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No of ZEVs actually produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model year)].

e. **ZEV Credits for MDVs and LDTs 3751-5750 lbs. LVW**. ZEVs classified as MDVs or as LDTs 3751-5750 lbs. LVW may be counted toward the ZEV requirement for PCs and LDTs 0-3750 lbs. LVW and included in the calculation of ZEV credits as specified in note (9)a., if the manufacturer so designates.

f. Small volume manufacturers *as defined in note (6)* shall not be required to meet the percentage ZEV requirements. However, small volume manufacturers may earn and market credits for ZEVs they produce and deliver for sale in California.

~~g. Intermediate volume manufacturers shall not be required to meet the percentage ZEV requirements before the 2003 model year.~~

(iv) Amend the table and note (2) of and add a note (2.1) to subsection j:

j. The exhaust emission levels from new 1992 and subsequent model-year medium-duty low-emission vehicles, ultra-low-emission vehicles~~,~~ and super-ultra-low-emission

vehicles*, and new 2003 and subsequent model-year medium-duty zero-emission vehicles* shall not exceed:

EXHAUST EMISSION STANDARDS FOR LOW-EMISSION VEHICLES, ULTRA-LOW-EMISSION VEHICLES, ~~AND~~ SUPER-ULTRA-LOW-EMISSION VEHICLES *AND ZERO-EMISSION VEHICLES* IN THE MEDIUM-DUTY VEHICLE WEIGHT CLASS[8,9,10, 11, 12, 14, 15, 16]

[grams per mile (or "g/mi")]

Test Weight (lbs.)[1]	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	Non-Methane OrganicGases[1,3,4]		
		ZEV[2.1]		0.257	
				0.130	Carbon Monoxide
				--	
0-3750	50,000	LEV			3.4
		ULEV			1.7
		ZEV[2.1]	0.125		--
	120,000	LEV	0.075		5.0
		ULEV	--		2.5
		ZEV[2.1]	0.180		--
3751-5750	50,000	LEV	0.107		4.4
		ULEV	--		4.4
		SULEV	0.160		2.2
		ZEV[2.1]	0.100		--
	120,000	LEV	0.050		6.4
		ULEV	--		6.4
		SULEV	0.230		3.2
		ZEV[2.1]	0.143		--
5751-8500	50,000	LEV	0.072		5.0
		ULEV	--		5.0
		SULEV	0.195		2.5
		ZEV[2.1]	0.117		--
	120,000	LEV	0.059		7.3
		ULEV	--		7.3
		SULEV	0.280		3.7
		ZEV[2.1]	0.167		--
8501-10,000	50,000	LEV	0.084		5.5
		ULEV	--		5.5
		SULEV	0.230		2.8
		ZEV[2.1]	0.138		--
	120,000	LEV	0.070		8.1
		ULEV	--		8.1
		SULEV	0.330		4.1
		ZEV[2.1]	0.197		--
10,001-14,000	50,000	LEV	0.100		7.0
		ULEV	--		7.0
		SULEV	0.300		3.5
		ZEV[2.1]	0.180		--
	120,000	LEV	0.09		10.3
		ULEV	--		10.3
		SULEV	0.430		5.2

--

Oxides of Nitrogen[5]	Particulates[6,7]
0.4	
0.2	n/a
--	n/a
0.6	--
0.3	0.08
--	0.04
0.4	--
0.4	n/a
0.2	n/a
--	n/a
0.6	--
0.6	0.10
0.3	0.05
--	0.05
0.6	--
0.6	n/a
0.3	n/a
--	n/a
0.9	--
0.9	0.12
0.45	0.06
--	0.06
0.7	--
0.7	n/a
0.35	n/a
--	n/a
1.0	--
1.0	0.12
0.5	0.06
--	0.06
1.0	--
1.0	n/a
0.5	n/a
--	n/a
1.5	--
1.5	0.12
0.7	0.06
--	0.06
	--

(1) "Test Weight" (or "TW") shall mean the average of the vehicle's curb weight and gross vehicle weight.
"Non-Methane Organic Gases" (or "NMOG") means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

(2) "LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"SULEV" means super ultra-low-emission vehicle.
"ZEV" means zero-emission vehicle.

(2.1) a. The Executive Officer shall certify as ZEVs vehicles that produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40°F and the heater is demonstrated to have zero evaporative emissions under any and all possible operational modes and conditions.

b. Prior to the 2003 model year a manufacturer that voluntarily produces vehicles that meet the ZEV emission standards applicable to 2003 and subsequent model year vehicles may certify those vehicles as ZEVs for the purposes of calculating ZEV credits under h.3., note(9)(a) and (e).

(e) In section 5 of the test procedures, amend subsection a.1.2.(i)(A)(10)(b) to read as follows:

(b) The manufacturer shall equip the vehicle with a useful life indicator for the battery system consisting of a light that shall illuminate the first time the battery system is unable to achieve an all-electric operating range (staring from a full state-of-charge) that is at least 75% of the range determined for the vehicle in the All-Electric Range-*Urban* (see section 9.f. *(2)(a)* of these test procedures) and submitted in the certification application.

(f) In section 9 of the test procedures, make the following changes:

(i) Amend subsection f.(2) to read:

(2) Driving schedule.

(a) ***Determination of All-Electric Range-Urban.*** *At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through an Urban Dynamometer Driving*

Schedule, 40 CFR., Part 86, Appendix I, until the vehicle is no longer able to maintain within 5 miles per hour of the speed requirements or within 2 seconds of the time requirements of the driving schedule. For hybrid electric vehicles this determination shall be performed without the use of the auxiliary power unit.

(b) ***Determination of All-Electric Range-Highway.*** At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through a Highway Fuel Economy Driving Schedule, found in *40 CFR,* Part 600, Appendix I ~~of the CFR, followed immediately by an Urban Dynamometer Driving Schedule, found in Part 86, Appendix I of the CFR, followed by another Highway Fuel Economy Driving Schedule and an Urban Dynamometer Driving Schedule. This sequence of driving schedules shall be repeated~~ until the vehicle is no longer able to maintain within 5 miles per hour of the speed requirements or within 2 seconds of the time requirements of the driving schedule~~s in the case of a ZEV, or unable to maintain within 5 miles per hour of the speed requirements or within 2 seconds of the time requirement of the driving schedules without the use of the auxiliary power unit in the case of a hybrid electric vehicle~~. *For hybrid electric vehicles this determination shall be performed without the use of the auxiliary power unit.*

(ii) Redesignate existing subsection g as h and add a new subsection g to read:

g. ***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 Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

***h*. Calculations; exhaust emissions**