

State of California  
AIR RESOURCES BOARD

**CALIFORNIA EXHAUST EMISSION STANDARDS  
AND TEST PROCEDURES FOR 1988-2000  
~~AND SUBSEQUENT~~ MODEL PASSENGER CARS,  
LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES**

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Note: The amendments proposed herein are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures adopted March 19, 1998. The only amendment is to sunset this version of the Test Procedures in the 2000 Model Year.

**CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES  
FOR 1988-2000 AND SUBSEQUENT MODEL  
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES**

The provisions of Subparts A, B, and C, Part 86, Title 40, Code of Federal Regulations as set forth in Appendix I, to the extent they pertain to Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles, are hereby adopted as the California Exhaust Emission Standards and Test Procedures for 1988-2000 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, with the following exceptions and additions.

**1. Applicability**

a. These test procedures are applicable to 1988-2000 and subsequent model gasoline, gaseous, diesel, and, ~~beginning in for the 1993-2000 model years,~~ 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 1992-2000 and subsequent model-year gasoline and diesel, and to 1993-2000 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 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. ~~The Supplemental Federal Test Procedure (SFTP) is applicable to 2001 and subsequent model gasoline, diesel, and hybrid electric passenger cars and light-duty trucks, and to 2003 and subsequent model gasoline, diesel, and hybrid electric low-emission, ultra-low emission, and super-ultra-low-emission vehicles in the medium-duty vehicle class under 8,501 pounds gross vehicle weight rating.~~

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

c. Regulations concerning EPA hearings, EPA inspections, specific language on the Certificate of Conformity, evaporative emissions, high-altitude vehicles and testing, particulate and oxides of nitrogen averaging and engine family standards applicable in such averaging, alternative useful life, selective enforcement audit and heavy-duty engines and vehicles shall not be applicable to these procedures, except where specifically noted.

d. Any reference to gasoline-powered vehicles shall also apply to vehicles powered by gaseous fuels.

e. Regulations both herein and in Title 40, CFR Part 86, Subparts A, B, and C, concerning Otto-cycle and diesel-cycle vehicles shall be applicable to alcohol vehicles, except where specifically noted otherwise.

f. Regulations concerning alcohol vehicles shall also be applicable to fuel-flexible vehicles, except where specifically noted otherwise.

g. For engines used in medium-duty vehicles which are not distinctly diesel engines nor derived from such, the Executive Officer shall determine whether the engines shall be subject to diesel or Otto-cycle engine regulations, in consideration of the relative similarity of the engines' torque-speed characteristics and vehicle applications with those of Otto-cycle and diesel engines.

**2. Definitions -- [No change.]**

**3. Standards**

Subsections a. through b. -- [No change.]

c. The exhaust emissions from new 1993-~~2000~~ ~~and subsequent~~ model dedicated alcohol vehicles and fuel-flexible vehicles shall meet all the requirements in Sections 3.b., 3.e, and 3.f. of these test procedures with the following modifications and additions:

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**1993 ~~THROUGH 2000~~ ~~AND SUBSEQUENT~~ METHANOL-SPECIFIC AND ETHANOL-SPECIFIC FORMALDEHYDE EXHAUST EMISSION STANDARDS**

Vehicle Type <sup>1</sup>	Loaded Vehicle Weight (lbs.) <sup>3</sup>	Durability Vehicle Basis (mi)	Formaldehyde (mg/mi)	
			Certification	In-Use Compliance <sup>2</sup>
PC	All	50,000	15	23 (1993-1995) 15 (1996- <del>2000</del> and later)
LDT,MDV	0-3750	50,000	15	23 (1993-1995) 15 (1996- <del>2000</del> and later)
LDT,MDV	3751-5750	50,000	18	27 (1993-1995) 18 (1996- <del>2000</del> and later)
MDV	5751-8500	50,000	22	33 (1993-1995) 22 (1996- <del>2000</del> and later)
MDV	8501-10,000	50,000	28	36 (1995) 28 (1996- <del>2000</del> and later)



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

Vehicle Type <sup>1</sup>	Loaded Vehicle Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category <sup>2</sup>	Non-Methane Organic Gases <sup>3,4</sup>	Carbon Monoxide	Oxides of Nitrogen <sup>5</sup>
PC and LDT	All 0-3750	50,000	TLEV	0.125	3.4	0.4
			LEV	0.075	3.4	0.2
			ULEV	0.040	1.7	0.2
			ZEV <sup>2+</sup>	--	--	--
	100,000	TLEV	0.156	4.2	0.6	
		LEV	0.090	4.2	0.3	
		ULEV	0.055	2.1	0.3	
		ZEV <sup>2+</sup>	--	--	--	
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 <sup>2+</sup>	--	--	--
	100,000	TLEV	0.200	5.5	0.9	
		LEV	0.130	5.5	0.5	
		ULEV	0.070	2.8	0.5	
		ZEV <sup>2+</sup>	--	--	--	

- (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 section (g)(2), note (4) or (5); NMOG credits under section (g)(2), note (7); and ZEV credits under section (g)(2), note (9)a.~~

[No change to the remainder of subsection (g)(1)]

h. 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 by a manufacturer each model year from 1994 through 2000 shall not exceed:

**FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION  
REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES**<sup>7,8,9</sup>  
[grams per mile" (or "g/mi")]

Vehicle Type <sup>1</sup>	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi) <sup>7</sup>	Model Year	Fleet Average Non-Methane Organic Gases <sup>2,3,4,5,6</sup>
PC and LDT	All 0-3750	50,000	1994	0.250
			1995	0.231
			1996	0.225
			1997	0.202
			1998	0.157
			1999	0.113
			2000	0.073
			<del>2001</del>	<del>0.070</del>
			<del>2002</del>	<del>0.068</del>
			<del>2003 and subsequent</del>	<del>0.062</del>
LDT	3751-5750	50,000	1994	0.320
			1995	0.295
			1996	0.287
			1997	0.260
			1998	0.205
			1999	0.150
			2000	0.099
			<del>2001</del>	<del>0.098</del>
			<del>2002</del>	<del>0.095</del>
			<del>2003 and subsequent</del>	<del>0.093</del>

[Footnotes (1) through (8) -- No change.]

(9) ~~**ZEV Requirements.** While meeting the fleet average requirements, each manufacturer shall certify, produce, and deliver for sale in California at least 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 NMOG 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 test 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 test 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 2003 model year shall be treated as if earned in the 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 which sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the 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:

$$(\text{No. of ZEVs required to be produced and delivered for sale in California for the model year}) - (\text{No. of ZEVs actually produced and delivered for sale in California for the model year}) - [(\text{Amount of ZEV credits submitted for the model year}) / (\text{the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model year})].$$

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.

i. The exhaust emissions from new 1995-2000 and subsequent model medium-duty vehicles shall not exceed:

**1995-2000 AND SUBSEQUENT MODEL-YEAR MEDIUM-DUTY VEHICLE  
EXHAUST EMISSIONS STANDARDS<sup>1,2,3,7,8</sup>  
(grams per mile)**



[The remainder of section -- No change.]

j. The exhaust emission levels from new 1992-2000 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**<sup>8,9,10, 11, 12, 13,14, 15, 16</sup>  
[grams per mile (or "g/mi")]

Test Weight (lbs) <sup>1</sup>	Durability Vehicle Basis (mi)	Vehicle Emission Category <sup>2</sup>	Non-Methane Organic Gases <sup>1,3,4</sup>	Carbon Monoxide	Oxides of Nitrogen <sup>3,5</sup>	Particulates <sup>6,7</sup>	
0-3750	50,000	LEV	0.125	3.4	0.4	n/a	
		ULEV	0.075	1.7	0.2	n/a	
		ZEV <sup>2+</sup>	--	--	--	--	
	120,000	LEV	0.180	5.0	0.6	0.08	
		ULEV	0.107	2.5	0.3	0.04	
		ZEV <sup>2+</sup>	--	--	--	--	
3751-5750	50,000	LEV	0.160	4.4	0.4	n/a	
		ULEV	0.100	4.4	0.4	n/a	
		SULEV	0.050	2.2	0.2	n/a	
		ZEV <sup>2+</sup>	--	--	--	--	
	120,000	LEV	0.230	6.4	0.6	0.10	
		ULEV	0.143	6.4	0.6	0.05	
		SULEV	0.072	3.2	0.3	0.05	
		ZEV <sup>2+</sup>	--	--	--	--	
	5751-8500	50,000	LEV	0.195	5.0	0.6	n/a
			ULEV	0.117	5.0	0.6	n/a
			SULEV	0.059	2.5	0.3	n/a
			ZEV <sup>2+</sup>	--	--	--	--
120,000		LEV	0.280	7.3	0.9	0.12	
		ULEV	0.167	7.3	0.9	0.06	
		SULEV	0.084	3.7	0.45	0.06	
		ZEV <sup>2+</sup>	--	--	--	--	
8501-10,000	50,000	LEV	0.230	5.5	0.7	n/a	
		ULEV	0.138	5.5	0.7	n/a	
		SULEV	0.069	2.8	0.35	n/a	
		ZEV <sup>2+</sup>	--	--	--	--	

	120,000	LEV	0.330	8.1	1.0	0.12
		ULEV	0.197	8.1	1.0	0.06
		SULEV	0.100	4.1	0.5	0.06
		ZEV <sup>2+</sup>	--	--	--	--
10,001- 14,000	50,000	LEV	0.300	7.0	1.0	n/a
		ULEV	0.180	7.0	1.0	n/a
		SULEV	0.09	3.5	0.5	n/a
		ZEV <sup>2+</sup>	--	--	--	--
	120,000	LEV	0.430	10.3	1.5	0.12
		ULEV	0.257	10.3	1.5	0.06
		SULEV	0.130	5.2	0.7	0.06
		ZEV <sup>2+</sup>	--	--	--	--

(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 section (g)(2), note (9)a. and (9)e.~~

[The remainder of section -- No change.]

k. The cold temperature exhaust carbon monoxide emission levels from new 1996-~~2000~~ and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles shall not exceed:

**~~1996-2000 AND SUBSEQUENT MODEL-YEAR COLD TEMPERATURE  
CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER  
CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES<sup>1,2</sup>~~**  
(grams per mile)

[The remainder of section -- No change.]

t. The Supplemental Federal Test Procedure (SFTP) exhaust emission levels from new 2001 and subsequent model passenger cars and light-duty trucks, other than low-emission vehicles, ultra-low-emission vehicles, and zero-emission vehicles, shall not exceed:

**SFTP EXHAUST EMISSION STANDARDS FOR 2001 AND SUBSEQUENT MODEL-YEAR PASSENGER CARS AND LIGHT-DUTY TRUCKS OTHER THAN LOW-EMISSION VEHICLES, ULTRA-LOW-EMISSION VEHICLES, AND ZERO-EMISSION VEHICLES**  
(grams per mile)<sup>4,5,6,7,8,9,10</sup>

Vehicle Type <sup>†</sup>	Loaded Vehicle Weight (lbs.)	Durability Vehicle Basis (mi)	Fuel Type	NMHC <sup>2</sup> +NOx <sup>†</sup> Composite <sup>3</sup>	CO <sup>†</sup>		
					A/C <sup>†</sup> Test	US06 <sup>†</sup> Test	Composite Option <sup>3</sup>
PC	All	-50,000	Gasoline	0.65	3.0	9.0	3.4
			Diesel	1.48	NA	9.0	3.4
		100,000	Gasoline	0.91	3.7	11.1	4.2
			Diesel	2.07	NA	11.1	4.2
LDT	0-3750	-50,000	Gasoline	0.65	3.0	9.0	3.4
			Diesel	1.48	NA	9.0	3.4
		100,000	Gasoline	0.91	3.7	11.1	4.2
			Diesel	2.07	NA	11.1	4.2
LDT	3751-5750	-50,000	Gasoline	1.02	3.9	11.6	4.4
			Diesel	NA	NA	NA	NA
		100,000	Gasoline	1.37	4.9	14.6	5.5
			Diesel	NA	NA	NA	NA

(†) **Abbreviations:**

"PC" means passenger car.

"LDT" means light-duty truck.

"NMHC+NOx" means non-methane hydrocarbon plus oxides of nitrogen emissions.

"CO" means carbon monoxide emissions.

"A/C" means air-conditioning.

"US06" means the test cycle designed to evaluate emissions during aggressive and microtransient driving.

- (2) **Non-Methane Hydrocarbon Emissions.** For PCs and LDTs certified to the FTP exhaust standards in Section 3.f., hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Hydrocarbon Test Procedures", as last amended May 15, 1990. For PCs and LDTs certified as transitional low-emission vehicles, hydrocarbon emissions shall be measured in accordance with Part B (Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures" as incorporated by reference in Section 3.g., note (3). For alcohol-fueled vehicles certifying to these standards, including flexible-fuel vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."
- (3) **Composite Standards.** Compliance with the composite standards shall be demonstrated using the calculations set forth in the 40 CFR 86.164-00.
- (4) **SFTP.** SFTP means the additional test procedure designed to measure emissions during aggressive and microtransient driving, as described in 40 CFR 86.159-00 over the US06 cycle, and also the test procedure designed to measure urban driving emissions while the vehicle's air conditioning system is operating, as described in 40 CFR 86.160-00 over the SC03 cycle.
- (5) **Applicability to Alternative Fuel Vehicles.** These SFTP standards do not apply to vehicles certified on fuels other than gasoline and diesel fuel, but the standards do apply to the gasoline and diesel fuel operation of flexible-fuel vehicles and dual-fuel vehicles.
- (6) **Air to Fuel Ratio Requirement.** With the exception of cold-start conditions, warm-up conditions and rapid-throttle motion conditions ("tip-in" or "tip-out" conditions), the air to fuel ratio shall not be richer at any time than, for a given engine operating condition (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters), the leanest air to fuel mixture required to obtain maximum torque (lean best torque), with a tolerance of six percent of the fuel consumption. The Executive Officer may approve a manufacturer's request for approval to use additional enrichment in subsequent testing if the manufacturer demonstrates that additional enrichment is needed to protect the vehicle, occupants, engine, or emission control hardware.
- (7) **A/C-on Specific Calibrations.** A/C-on specific calibrations (e.g. air to fuel ratio, spark timing, and exhaust gas recirculation), may be used which differ from A/C-off calibrations for given engine operating conditions (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters). Such calibrations must not unnecessarily reduce the NMHC+NO<sub>x</sub> emission control effectiveness during A/C-on operation when the vehicle is operated under conditions which may reasonably be expected to be encountered during normal operation and use. If reductions in control system NMHC+NO<sub>x</sub> effectiveness do occur as a result of such calibrations, the manufacturer shall, in the Application for Certification, specify the circumstances under which such reductions do occur, and the reason for the use of such calibrations resulting in such reductions in control system effectiveness. A/C-on specific "open-loop" or "commanded enrichment" air-fuel enrichment strategies (as defined below), which differ from A/C-off "open-loop" or "commanded enrichment" air-fuel enrichment strategies, may not be used, with the following exceptions: cold-start and warm-up conditions, or, subject

to Executive Officer approval, conditions requiring the protection of the vehicle, occupants, engine, or emission control hardware. Other than these exceptions, such strategies which are invoked based on manifold pressure, engine speed, throttle position, or other engine parameters shall use the same engine parameter criteria for the invoking of this air-fuel enrichment strategy and the same degree of enrichment regardless of whether the A/C is on or off. "Open-loop" or "commanded" air-fuel enrichment strategy is defined as enrichment of the air to fuel ratio beyond stoichiometry for the purposes of increasing engine power output and the protection of engine or emissions control hardware. However, "closed-loop biasing," defined as small changes in the air-fuel ratio for the purposes of optimizing vehicle emissions or driveability, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy. In addition, "transient" air-fuel enrichment strategy (or "tip-in" and "tip-out" enrichment), defined as the temporary use of an air-fuel ratio rich of stoichiometry at the beginning or duration of rapid throttle motion, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy.

- (8) **"Lean-On-Cruise" Calibration Strategies.** In the Application for Certification, the manufacturer shall state whether any "lean-on-cruise" strategies are incorporated into the vehicle design. A "lean-on-cruise" air-fuel calibration strategy is defined as the use of an air-fuel ratio significantly greater than stoichiometry, during non-deceleration conditions at speeds above 40 mph. "Lean-on-cruise" air-fuel calibration strategies shall not be employed during vehicle operation in normal driving conditions, including A/C-usage, unless at least one of the following conditions is met:

1. Such strategies are substantially employed during the FTP or SFTP, or
2. Such strategies are demonstrated not to significantly reduce vehicle NMHC + NO<sub>x</sub> emissions control effectiveness over the operating conditions in which they are employed, or
3. Such strategies are demonstrated to be necessary to protect the vehicle, occupants, engine, or emissions control hardware.

If the manufacturer proposes to use a "lean-on-cruise" calibration strategy, the manufacturer shall specify the circumstances under which such a calibration would be used, and the reason or reasons for the proposed use of such a calibration.

The above provisions shall not apply to vehicles powered by "lean-burn" engines or Diesel-cycle engines. A "lean-burn" engine is defined as an Otto-cycle engine designed to run at an air-fuel ratio significantly greater than stoichiometry during the large majority of its operation.

- (9) **Phase-In Requirements.** For the purposes of this Section 3.1. only, each manufacturer's PC and LDT fleet shall be defined as the total projected number of PCs and LDTs from 0-5750 pounds loaded vehicle weight certified to the FTP exhaust standards of Section 3.f. and certified as transitional low-emission vehicles sold in California. As an option, a manufacturer may elect to have its total PC and LDT fleet defined, for the purposes of this

Section 3.1. only, as the total projected number of the manufacturer's PCs and LDTs, other than zero-emission vehicles, certified and sold in California:

a. Manufacturers of PCs and of LDTs, except small volume manufacturers, shall certify a minimum percentage of their PC and LDT fleet according to the following phase-in schedule:

Model Year	Percentage of PC and LDT Fleet
2001	25
2002	50
2003	85
2004 and subsequent	100

b. Small volume manufacturers of PCs and LDTs shall certify 100% of their PC and LDT fleet in the 2004 and subsequent model years.

(10) **Single-Roll Electric Dynamometer Requirement.** For all vehicles certified to the SFTP standards, a single-roll electric dynamometer or a dynamometer which produces equivalent results, as set forth in 40 CFR 86.108-00, must be used for all types of emission testing to determine compliance with the associated emission standards:

m. The Supplemental Federal Test Procedure (SFTP) standards in this Section represent the maximum SFTP exhaust emissions at 4,000 miles  $\pm$  250 miles or at the mileage determined by the manufacturer for emission-data vehicles, according to 40 CFR 86.090-26 as modified by these test procedures. The SFTP exhaust emission levels from new 2001 and subsequent model low-emission vehicles and ultra-low-emission vehicles in the passenger car and light-duty truck class, and new 2003 and subsequent low-emission vehicles, ultra-low-emission vehicles, and super-ultra-low-emission vehicles in the medium-duty class, shall not exceed:

**SFTP EXHAUST EMISSION STANDARDS  
FOR LOW-EMISSION VEHICLES, ULTRA-LOW-EMISSION VEHICLES, AND  
SUPER-ULTRA-LOW-EMISSION VEHICLES IN THE PASSENGER CAR, LIGHT-  
DUTY TRUCK, AND MEDIUM-DUTY VEHICLE CLASSES**  
(grams per mile)<sup>6,7,8,9,10,11</sup>

Vehicle Type <sup>†</sup>	Loaded Vehicle Weight (lbs.) <sup>2</sup>	US06 Test <sup>†,5</sup>		A/C Test <sup>†,6</sup>	
		NMHC <sup>†,7</sup> NOx <sup>†</sup>	CO <sup>†</sup>	NMHC <sup>†,7</sup> NOx <sup>†</sup>	CO <sup>†</sup>
PC	All	0.14	8.0	0.20	2.7

LDT	0-3750	0.14	8.0	0.20	2.7
LDT	3751-5750	0.25	10.5	0.27	3.5
MDV	3751-5750	0.40	10.5	0.31	3.5
MDV	5751-8500 <sup>s</sup>	0.60	11.8	0.44	4.0

(1) **Abbreviations:**

"PC" means passenger car.

"LDT" means light-duty truck.

"MDV" means medium-duty truck.

"NMHC+NOx" means non-methane hydrocarbon plus oxides of nitrogen emissions.

"CO" means carbon monoxide emissions.

"US06" means the test cycle designed to evaluate emissions during aggressive and microtransient driving.

"A/C" means air-conditioning.

(2) For MDVs, "Loaded Vehicle Weight" shall mean "Test Weight," which is the average of the vehicle's curb weight and gross vehicle weight.

(3) Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this subsection.

(4) **Non-Methane Hydrocarbon Emissions.** Hydrocarbon emissions shall be measured in accordance with Part B (Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures" as incorporated by reference in Section 3.g., note (3). For alcohol-fueled vehicles certifying to these standards, including flexible-fuel vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

(5) **A/C-on Specific Calibrations.** A/C-on specific calibrations (e.g. air to fuel ratio, spark timing, and exhaust gas recirculation), may be used which differ from A/C-off calibrations for given engine operating conditions (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters). Such calibrations must not unnecessarily reduce the NMHC+NOx emission control effectiveness during A/C-on operation when the vehicle is operated under conditions which may reasonably be expected to be encountered during normal operation and use. If reductions in control system NMHC+NOx effectiveness do occur as a result of such calibrations, the manufacturer shall, in the Application for Certification, specify the circumstances under which such reductions do occur, and the reason for the use of such calibrations resulting in such reductions in control system effectiveness. A/C-on specific "open-loop" or "commanded enrichment" air-fuel enrichment strategies (as defined below), which differ from A/C-off "open-loop" or "commanded enrichment" air-fuel enrichment strategies, may not be used, with the following exceptions: cold-start and warm-up conditions, or, subject to Executive Officer approval, conditions requiring the protection of the vehicle, occupants, engine, or emission control hardware. Other than these exceptions, such

strategies which are invoked based on manifold pressure, engine speed, throttle position, or other engine parameters shall use the same engine parameter criteria for the invoking of this air-fuel enrichment strategy and the same degree of enrichment regardless of whether the A/C is on or off. "Open-loop" or "commanded" air-fuel enrichment strategy is defined as enrichment of the air to fuel ratio beyond stoichiometry for the purposes of increasing engine power output and the protection of engine or emissions control hardware. However, "closed-loop biasing," defined as small changes in the air-fuel ratio for the purposes of optimizing vehicle emissions or driveability, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy. In addition, "transient" air-fuel enrichment strategy (or "tip-in" and "tip-out" enrichment), defined as the temporary use of an air-fuel ratio rich of stoichiometry at the beginning or duration of rapid throttle motion, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy.

- (6) **SFTP.** SFTP means the additional test procedure designed to measure emissions during aggressive and microtransient driving, as described in 40 CFR 86.159-00 over the US06 cycle, and also the test procedure designed to measure urban driving emissions while the vehicle's air conditioning system is operating, as described in 40 CFR 86.160-00 over the SC03 cycle.
- (7) **Applicability to Alternative Fuel Vehicles.** These SFTP standards do not apply to vehicles certified on fuels other than gasoline and diesel fuel, but the standards do apply to the gasoline and diesel fuel operation of flexible-fuel vehicles and dual-fuel vehicles.
- (8) **Air to Fuel Ratio Requirement.** With the exception of cold-start conditions, warm-up conditions and rapid-throttle motion conditions ("tip-in" or "tip-out" conditions), the air to fuel ratio shall not be richer at any time than, for a given engine operating condition (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters), the leanest air to fuel mixture required to obtain maximum torque (lean best torque), with a tolerance of six percent of the fuel consumption. The Executive Officer may approve a manufacturer's request for approval to use additional enrichment in subsequent testing if the manufacturer demonstrates that additional enrichment is needed to protect the vehicle, occupants, engine, or emission control hardware.
- (9) **"Lean-On-Cruise" Calibration Strategies.** In the Application for Certification, the manufacturer shall state whether any "lean-on-cruise" strategies are incorporated into the vehicle design. A "lean-on-cruise" air-fuel calibration strategy is defined as the use of an air-fuel ratio significantly greater than stoichiometry, during non-deceleration conditions at speeds above 40 mph. "Lean-on-cruise" air-fuel calibration strategies shall not be employed during vehicle operation in normal driving conditions, including A/C-usage, unless at least one of the following conditions is met:
- a. Such strategies are substantially employed during the FTP or SFTP, or
  - b. Such strategies are demonstrated not to significantly reduce vehicle NMHC + NOx emissions control effectiveness over the operating conditions in which they are employed, or
  - c. Such strategies are demonstrated to be necessary to protect the vehicle, occupants, engine, or emissions control hardware.



If the manufacturer proposes to use a "lean-on-cruise" calibration strategy, the manufacturer shall specify the circumstances under which such a calibration would be used, and the reason or reasons for the proposed use of such a calibration.

The above provisions shall not apply to vehicles powered by "lean-burn" engines or Diesel-cycle engines. A "lean-burn" engine is defined as an Otto-cycle engine designed to run at an air-fuel ratio significantly greater than stoichiometry during the large majority of its operation.

- (10) **Phase-In Requirements.** For the purposes of this Section 3.m. only, each manufacturer's PC and LDT fleet shall be defined as the total projected number of low-emission and ultra-low-emission PCs and LDTs from 0-5750 pounds loaded vehicle weight sold in California. Each manufacturer's MDV fleet shall be defined as the total projected number of low-emission, ultra-low-emission, and super-ultra-low-emission MDVs less than 8501 pounds gross vehicle weight rating sold in California.
- a. Manufacturers of PCs, LDTs, and MDVs, except small volume manufacturers, shall certify a minimum percentage of their PC and LDT fleet, and a minimum percentage of their MDV fleet, according to the following phase-in schedule:

Model Year	Percentage	
	PC, LDT	MDV
2001	25	NA
2002	50	NA
2003	85	25
2004	100	50
2005 and subsequent	100	100

b. Manufacturers may use an "Alternative or Equivalent Phase-in Schedule" to comply with the phase-in requirements. An "Alternative Phase-in" is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The "cumulative total" is the summation of the model-year emission reductions (e.g., a four model-year 25/50/85/100 percent phase-in schedule would be calculated as:  $(25\% * 4 \text{ years}) + (50\% * 3 \text{ years}) + (85\% * 2 \text{ years}) + (100\% * 1 \text{ year}) = 520$ ). Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by

~~the Executive Officer under the following conditions: 1) all vehicles subject to the phase-in shall comply with the respective requirements in the last model year of the required phase-in schedule and 2) if a manufacturer uses the optional phase-in percentage determination in Section 3.l., note (9), the cumulative total of model-year emission reductions as determined only for PCs and LDTs certified to this Section 3.m. must also be equal to or larger than the required cumulative total by end of the 2004 model year. Manufacturers shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as:  $(10\% * 5 \text{ years})$  and added to the cumulative total):~~

~~c. Small volume manufacturers of PCs, LDTs, and MDVs shall certify 100% of their PC and LDT fleet in 2004 and subsequent model years, and 100% of their MDV fleet in 2005 and subsequent model years.~~

- (11) ~~**Single-Roll Electric Dynamometer Requirement.** For all vehicles certified to the SFTP standards, a single-roll electric dynamometer or a dynamometer which produces equivalent results, as set forth in 40 CFR 86.108-00, must be used for all types of emission testing to determine compliance with the associated emission standards.~~

Sections 4. through 14. -- [No change.]

APPENDICES I THROUGH VIII -- [No change.]