Appendix C

Alternate Fuel Retrofit Systems Final CARB Regulatory Orders

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FINAL REGULATORY ORDER

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This final regulatory order consists of the following documents:

Attachment A: Amendments to the "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years"

Attachment B: Amendments to the "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas Fuels"

Attachment C: Amendments to the "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels"

Attachment D: Amendments to Article 5, Chapter 1, Division 3, Title 13 of the California Code of Regulations

Amendments to Section 2030 of Chapter 5

Amendments to Section 2031 of Chapter 5

Attachment E: Section 1956.9 Optional Exhaust Emissions Standards for Retrofitted Heavy-Duty Engines

ATTACHMENT A

MODIFICATIONS TO THE
"CALIFORNIA CERTIFICATION AND INSTALLATION PROCEDURES
FOR ALTERNATIVE FUEL RETROFIT SYSTEMS FOR MOTOR VEHICLES
CERTIFIED FOR 1994 AND SUBSEQUENT MODEL YEARS"
AS DECIDED AT THE BOARD HEARING ON JULY 27, 1995

State of California
AIR RESOURCES BOARD

CALIFORNIA CERTIFICATION AND INSTALLATION PROCEDURES FOR ALTERNATIVE FUEL RETROFIT SYSTEMS FOR MOTOR VEHICLES CERTIFIED FOR 1994 AND SUBSEQUENT MODEL YEARS AND FOR ALL MODEL YEAR MOTOR VEHICLE RETROFIT SYSTEMS CERTIFIED FOR EMISSION REDUCTION CREDIT

Adopted: March 11, 1993
Amended: April 26, 1995
Amended: November 21, 1995

Note: Changes approved by the Board on July 27, 1995, are indicated by strike-out (deletion) and underline (addition).

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California Certification and Installation Procedures
for Alternative Fuel Retrofit Systems for Motor Vehicles
Certified for 1994 and Subsequent Model Years
and for all Model Year Motor Vehicle Retrofit Systems
Certified for Emission Reduction Credit

1. APPLICABILITY

(a) "Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years and Retrofit Procedures for Emission Reduction Credit for all Model Years" ("these Procedures") apply to alternative fuel retrofit systems designed for installation on gasoline- or diesel-fueled light-, medium-, and heavy-duty motor vehicles for 1994 and subsequent model years, and alternative fuel and conventional fuel retrofit systems for emission reduction credits for all model years.

(b) Only these procedures shall be used to certify a retrofit system for the purpose of generating emission reduction credits. Each retrofit system manufacturer shall certify all engine family systems to be used for generating emission reduction credits regardless of model year (MY) or fuel used.

(c) Only these Procedures shall be used to certify a retrofit system for installation on a transitional low-emission vehicle ("TLEV"), low-emission vehicle ("LEV"), or ultra-low-emission vehicle ("ULEV") or to certify a retrofit system designed to convert a vehicle to TLEV, LEV, or ULEV emission standards (as defined in Section 1960.1, Title 13, CCR).

(d) Each manufacturer shall certify a minimum of 15 percent of 1994, 55 percent of 1995, 55 percent of 1996, and 100 percent of 1996~~7~~ and subsequent model year engine family retrofit systems according to the requirements of these Procedures except as provided in paragraph 1.(b). "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels," (for certifying liquefied petroleum gas or natural gas retrofit systems) and "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels" (for certifying alcohol and alcohol/gasoline retrofit systems) shall be used to certify the remaining percentage of 1994, 1995, and 1996~~6~~ model year engine family systems and 1993 and prior model year engine family systems, except as provided in paragraph 1.(b) and 1.(e) The percentages shall be determined from the total number of retrofit systems certified and shall be met prior to the end of the next respective calendar year.

~~(b)~~
(e) A retrofit system manufacturer may as an option use these Procedures to certify non-credit generating alternative fuel retrofit systems designed for installation on pre-1994 model year gasoline- or diesel-fueled light-, medium-, and heavy-duty motor vehicles, with the following addition: the Executive Officer may order 25,000 mile durability vehicle testing for alternative fuel retrofit systems designed for installation on pre-1994 model year vehicles which include hardware or components other than the fuel conversion system as part of the overall retrofit system.

~~(c)~~
(f) A certification for an alternative fuel retrofit system issued pursuant to these Procedures shall have the effect of a certification of an alternative fuel retrofit system pursuant to Health and Safety Code Section 43006~~,~~. A certification for retrofit equipment utilizing any fuel, issued pursuant to these regulations, ~~and~~shall ~~also~~have the effect of an exemption issued pursuant to Vehicle Code Sections #27156 and 38395.

2. DEFINITIONS

"Alternative fuel" refers to liquefied petroleum gas, natural gas, alcohol and alcohol/gasoline fuels.

An "alternative fuel retrofit system" ~~or "retrofit system"~~is a package of fuel, ignition, emission control, and engine components that are modified, removed, or added during the process of modifying a motor vehicle to operate on an alternative fuel. Such systems can be optionally certified to generate credits.

"Conventional fuel" means gasoline or diesel fuel.

"Credit-generating conventional fuel retrofit system" is a retrofit system that is certified to generate credits and that operates exclusively on the fuel for which the engine family was originally certified.

"Credits" refers to mobile source emission reduction credits.

"Driveability" of a vehicle refers to the smooth delivery of power, as demanded by the driver. Typical causes of driveability degradation are rough idling, misfiring, surging, hesitation, or insufficient power. Conversion from gasoline to gaseous fuels usually entails a loss of volumetric efficiency, resulting in some power loss. Normal power loss shall not be considered to be driveability degradation.

"Dual fuel" refers to a retrofit system which utilizes both an alternative fuel and a conventional fuel without further hardware changeover required.

"Installer" refers to a person who installs alternative fuel or credit-generating conventional fuel retrofit systems on motor vehicles.

"Retrofit system" is a package of fuel, ignition, emission control, and engine components that are modified, removed, or added during the process of modifying an engine to operate at an emission rate lower than the rate to which the engine family was originally certified.

"Retrofit system manufacturer" or "manufacturer" refers to a person who manufactures or assembles an alternative fuel or credit-generating conventional fuel retrofit system for sale in California and requests or is granted the Executive Order certifying the alternative fuel or credit-generating conventional fuel retrofit system.

"Tier 1" refers to the emission standards applicable to 1995 and subsequent model year light-duty vehicles, not considered as TLEV's, ULEV'S or LEV'S, and as described in Section 1960.1, Title 13, California Code of Regulations.

For purposes of these Procedures "useful life" is the duration, expressed in miles, of the longest durability period for the new vehicle or engine emission standards to which the vehicle or engine family was certified. (This is typically 50,000 miles for light-duty vehicles. However, as of the 1993 model year, a phase-in of new, more stringent, light-duty standards with 100,000 mile useful life requirements will begin.)

3. GENERAL REQUIREMENTS

(a) Product Specifications:

In addition to all other standards or requirements imposed, the following general requirements shall apply to all alternative fuel or credit-generating conventional fuel retrofit systems to be certified for installation on California-certified gasoline or diesel-fueled motor vehicles:

(i) Alternative fuel retrofit systems for gaseous fuels shall be equipped with a lockoff valve, actuated by an electrical or vacuum signal, preventing delivery of fuel to the carburetor, or fuel injection system, while the engine is shut down.

(ii) The driveability of a vehicle equipped with a retrofit system shall not be degraded in such a way as to encourage consumer tampering. To verify that the driveability of a retrofitted vehicle is acceptable, the Executive Officer may require that an independent laboratory evaluate driveability. The Executive Officer's determination that driveability must be evaluated shall be based on an engineering evaluation of the retrofit system described in the application for certification or on reports or observations that retrofit systems similar in design to the system for which certification is sought have caused driveability degradation. The cost of this evaluation shall be borne by the applicant.

(iii) If the vehicle to be retrofitted was certified with an on-board diagnostic (OBD) system pursuant to Section 1968 or 1968.1, Title 13, California Code of Regulations (CCR), the proper

function of the on-board diagnostic system shall not be impaired as a result of the installation and operation of the alternative fuel or credit-generating conventional fuel retrofit system. This requirement may necessitate modification of the OBD system to prevent it from storing erroneous trouble codes (e.g., storing a code signifying faulty operation of the evaporative canister purge valve because the evaporative emission control system has been removed). All modifications to OBD components, programming or wiring, must be fully specified as parts of the retrofit system. If the retrofit system includes modifications to the OBD system, the applicant must submit an analysis showing that these modifications will not adversely affect OBD performance. Notwithstanding, for 1998 and previous model year vehicles, retrofit system manufacturers may request Executive Officer approval to disable specific on-board diagnostic monitoring strategies for which monitoring may not be reliable with respect to the use of alternative fuels (e.g., oxygen sensor response rate checks). The manufacturer shall submit data and/or an engineering evaluation to justify the request.

(iv) With the exception of idle speed control and throttle position control, no component or calibration of the fuel system that could affect emission performance shall be adjustable by the system installer or the vehicle's user.

(b) Emission Control Labels:

"California Motor Vehicle Emission Control Label Specifications," incorporated by reference in Title 13, CCR, Section 1965, shall apply to installations of alternative fuel or credit-generating conventional fuel retrofit systems, with the following additions:

(i) The retrofit system manufacturer shall provide a supplemental Emission Control Information label, which shall be affixed in a permanent manner to each retrofitted vehicle, in a location adjacent to the original Emission Control Information Label. If the supplemental label cannot be placed adjacent to the original label, it shall be placed in a location where it can be seen by a person viewing the original label.

(ii) The supplemental label shall clearly state that the vehicle has been equipped with an alternative fuel retrofit system designed to allow it to operate on a fuel other than gasoline or diesel, and shall identify the fuel(s) which the vehicle is designed to use. The labelshall show the vehicle model year; the Executive Order number certifying the retrofit system; the retrofit system manufacturer's name, address, and telephone number; and shall state that the retrofitted vehicle complies with California emission requirements. If the retrofit system has been certified as being capable of converting the vehicle into a Tier 1, TLEV, LEV, or ULEV, the label shall prominently display the title, "Tier 1 Vehicle," "Transitional Low-Emission Vehicle," "Low-Emission Vehicle," or "Ultra-Low-Emission Vehicle," as appropriate. If the retrofit system has been certified for credit-generation use on a heavy-duty vehicle, the label will

state the applicable credit standards, as defined in Section 1956.9, Title 13, California Code of Regulations. The label shall also list any original parts that were removed during installation of the retrofit system, as well as any changes in tune-up specifications required for the retrofit system. In addition, the label shall show the installer's name, address, and telephone number; the date on which the retrofit system was installed; and the mileage (retrofitted vehicle odometer reading) and date at which the retrofit system warranty expires. It is not necessary for emission control labels installed with retrofit systems to be machine readable. The supplemental label for an alternative fuel retrofit vehicle shall clearly state that the vehicle has been equipped with an alternative fuel retrofit system designed to allow it to operate on a fuel other than gasoline or diesel, and shall identify the fuel(s) that the vehicle is designed to use.

(iii) The retrofit system manufacturer shall provide a vacuum hose routing diagram for each alternative fuel retrofit system sold, and for any other retrofit that includes changes to the vacuum hose routing. The vacuum hose routing diagram shall be placed underhood in a permanent manner at a visible and accessible location and shall show modifications to the original vacuum system.

(c) Owner's Manuals:

Each retrofit system installed shall include an owner's manual containing at least the following information:

(i) a brief description of the retrofit system, including major components and their theory of operation;

(ii) the correct refueling procedure for alternative fuel retrofits;

(iii) a listing of necessary service and service intervals, as well as tune-up data, which differ from the service requirements specified by the vehicle's or engine's original manufacturer;

(iv) the name, address, and phone number of the installer, as well as a list of the names, addresses, and phone numbers of the major dealers in California who supply parts for, or service, the retrofit system; and

(v) warranty information.

(d) Manufacturer Recordkeeping Requirement:

Manufacturers of retrofit systems shall maintain a record of the vehicle identification numbers and California license plate numbers of those vehicles on which their product has been installed. As part of this record, manufacturers shall identify the installation date and the certification number of those systems installed on each vehicle and shall identify the vehicles' owners at the time of installation, including the owners' current addresses and phone numbers at the time of installation. The retrofit system

manufacturer shall supply a copy of all installation information to the Executive Officer upon request.

(e) Installer Recordkeeping Requirement:

Installers of retrofit systems shall maintain a record as specified in paragraph 3(d) and shall provide this information to retrofit system manufacturers upon request.

4. REQUEST FOR CERTIFICATION

(a) A request for certification of an alternative fuel or credit-generating conventional fuel retrofit system may be submitted by an authorized representative of the retrofit system manufacturer intending to offer the retrofit system for sale or installation in the State of California.

(b) A separate request shall be required for each model year, even though the emission standards for certifying new vehicles may be the same for consecutive model years. The request shall include all test data and other information required pursuant to these Procedures, except where other provisions of these Procedures allow carry-over or carry-across of test data from an engine family to the engine family(ies) for which certification is sought. Procedures governing carry-over and carry-across are discussed under paragraph 6, "Approval."

(c) The request for certification shall be submitted in writing, signed by an authorized representative of the retrofit system manufacturer, and shall include the following:

(i) Identification and description of the engine families for which the retrofit system to be certified is designed; the emission standards applicable to those engine families; and if applicable, a statement that the retrofit system is designed [A] to convert conventional vehicles into either TLEVs, LEVs or ULEVs, [B] to convert a TLEV into either an LEV or ULEV, ~~or~~ [C] to convert an LEV into a ULEV, [D] to convert 1994 or earlier model year vehicles into Tier 1 Vehicles, or [E] to convert heavy-duty vehicles for emission reduction credit. For [E] include the credit standard(s) proposed for certification from the "Optional Exhaust Emission Standards for Retrofitted Heavy-Duty Engines", as contained in Section 1956.9, Title 13, California Code of Regulations.

(ii) A complete description of the alternative fuel retrofit system, including details of the carburetor, mixer, regulator, vaporizer, or fuel injection system; the feedback mixture control system (if applicable), part number(s), calibration data, hose routing, specifications for the fuel tank, and pressure regulator; a sample of the emission control label as specified in 3.(b); a sample of the warranty statement as specified in 9(a) and (b); and all necessary modifications to the engine, emission control system, or other parts of the vehicle.

(iii) Procedures for installing and maintaining the retrofit system, including tune-up specifications and discussion of any special tools or techniques required for proper installation, maintenance, or operation.

(iv) An agreement to supply the Air Resources Board, within 45 calendar days of the Executive Officer's request, with any one or more of the vehicles used for certification testing, or to provide Air Resources Board personnel with the equipment to inspect and test such vehicles at the applicant's facility, if requested by the Executive Officer.

(v) For retrofit systems being certified for credit-generation, the manufacturer shall provide, in writing, the name(s) and address(es) of the fabrication, assembly line(s), and test facility(ies) where the retrofit kit is manufactured and tested.

(vi) For retrofit systems being certified for credit-generation, the manufacturer shall provide an engineering analysis upon request from the Executive Officer. Such analysis shall describe the detailed operating theory of the retrofit system based on accepted scientific and engineering principles. Final certification will require ARB acceptance and approval of the analysis.

(vii) For conventional fuel retrofits for credit-generation, the manufacturer shall provide a complete description of the major components of the retrofit system and part number(s).

5. TEST PROCEDURES

(a) Description of Vehicle Categories:

For the purposes of these certification Procedures, the motor vehicle fleet is divided into three major categories:

I. Passenger cars, light-duty trucks, and medium-duty vehicles as defined in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (as incorporated by reference in Section 1960.1, Title 13, CCR), which were certified to an exhaust emission standard based on a chassis-dynamometer test procedure;

II. Vehicles with gross vehicle weight ratings less than or equal to 14,000 lbs and not originally certified to a chassis dynamometer-based exhaust emission standard; and

III. Vehicles with gross vehicle weight ratings greater than 14,000 lbs.

(b) Test Procedures for Vehicles in Category I:

Vehicles in Category I may certify under these provisions, or under the alternate test procedures given in 5(g).

For vehicles in Category I, the emission standards and test procedures set forth in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" also apply to the certification of alternative fuel or credit-generating conventional fuel retrofit systems, with the following exceptions:

(i) The applicable emission standards shall be at least as stringent as the emission standards applicable to the engine families for which the retrofit systems to be certified are designed. For credit-generation, the applicable emission standards shall be the Tier 1 and LEV program standards. Dual-fuel vehicles must be certified on each of the two fuels. For dual-fuel vehicles certified for credit, the certification standards for the two fuels shall be no more than one tier apart. In addition, vehicles retrofitted to operate on a given alternative fuel shall also be subject to any additional emission standards applicable to new motor vehicles that are designed to operate on the alternative fuel, and that are of the model year and vehicle class for which certification is sought. A maximum of one emission-data vehicle per engine family for which certification is sought shall be required. Where durability testing is required, a bench-test vehicle may be substituted for a durability vehicle and may also be considered an emission-data vehicle. Prior to the commencement of testing, the choice of durability vehicle or bench-test vehicle, emission-data vehicle(s) and engine(s) must be approved by the Executive Officer as being representative of the range of engine families for which certification is sought.

(ii) For the purpose of applying the provisions of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" to certification testing of alternative fuel or credit-generating conventional fuel retrofit systems, test vehicles equipped with an alternative fuel or credit-generating conventional fuel retrofit system shall be assumed to have zero miles of mileage accumulation at the time that the retrofit system is installed. Mileage may be subsequently accumulated by driving the vehicle on the road, following a typical suburban route, or on a chassis dynamometer using the Automobile Manufacturer's Association mileage accumulation cycle (40 C.F.R., Part 86, Appendix IV, as adopted January 28, 1977).

(iii) Vehicle mileage accumulation on a durability vehicle or bench aging of retrofit system components shall be conducted to determine deterioration factors. Prior to the commencement of any emission or bench aging, the applicant's test plan must be approved by the Executive Officer. Approval of the test plan shall be contingent upon a demonstration by the applicant that bench aging produces deterioration factors at least as great as durability vehicle testing.

(iv) Bench aging conducted in lieu of vehicle mileage accumulation shall be conducted for a period of time such that the resulting

deterioration of the retrofit system is equivalent to that which would occur during durability vehicle mileage accumulation over a mileage equal to the useful life of the vehicle.

(v) Vehicle mileage accumulation on a durability vehicle shall be performed in conjunction with emission testing. Before beginning vehicle mileage accumulation of the retrofit system, the system shall be installed on the durability vehicle, the vehicle shall be driven 4,000 ± 100 miles and then tested. An alternative fuel retrofit the vehicle shall be tested using the alternative fuel. A dual-fuel retrofit system shall be emission tested using each fuel that it is capable of operating on. At the conclusion of vehicle mileage accumulation, a second emission test or series of tests shall be performed.

Alternatively, if bench aging is used to determine deterioration factors, then bench aging shall be performed in conjunction with emission testing of a bench-test vehicle. Before beginning bench aging of the retrofit system, it shall be installed on the bench-test vehicle, the vehicle shall be driven for 4,000 ± 100 miles, and the vehicle shall then be emission tested. Alternative fuel retrofits shall be tested using the alternative fuel. A dual-fuel retrofit system shall be emission tested using each fuel that it is capable of operating on. After the emission tests are completed, the retrofit system shall be removed from the vehicle and subjected to bench aging. At the conclusion of bench aging, the retrofit system shall be reinstalled on the bench-test vehicle, and a second emission test or series of tests shall be performed.

(vi) For exhaust emissions of each regulated pollutant measured during the vehicle mileage accumulation or bench-test procedure, a deterioration factor shall be calculated by dividing the emission rate obtained during the second emission test by that obtained during the first. If the resulting quotient is less than one, the deterioration factor shall be assigned a value of one. The deterioration constant for evaporative emissions shall be calculated by subtracting the evaporative emissions found during the first emission test from those found during the second test. If the resulting difference is less than zero, the deterioration constant shall be assigned a value of zero.

(vii) Choices of vehicle models, engines, and transmissions for use in emission-data vehicles shall be approved by the Executive Officer as being representative of the engine families for which certification is sought, prior to the commencement of testing. Following installation of the retrofit system, the emission-data vehicle shall be driven 4,000 ± 100 miles to stabilize emission rates. After the specified mileage has been accumulated, the emission-data vehicles' exhaust and evaporative emissions, where applicable, shall be tested, using the appropriate procedure as set forth in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty

Vehicles." Dual fuel vehicles shall be emission tested using each fuel that the vehicle is capable of operating on.

(viii) The deteriorated emissions of emission-data vehicles shall be calculated using the deterioration factors and constants found during vehicle mileage accumulation or bench testing. The useful life exhaust emission values are defined as the product of each emission value at 4,000 miles times the corresponding deterioration factor. For evaporative emissions, the certification emission value is equal to the sum of the emissions measured at, or extrapolated to 4,000 miles, plus the deterioration constant. The durability vehicle, bench-test vehicle, and all emission-data vehicles shall meet the applicable new vehicle useful life emission standards, as well as all applicable emission standards for intermediate mileage levels, for the vehicles' model year and fuel type(s).

(c) Test Procedures for Vehicles in Category II Not Being Certified for Credit-Generation Purposes:

Vehicles in Category II not being certified for credit may certify under these provisions, or under the alternate test procedures given in 5(g).

For durability, bench-test and emission-data vehicles in Category II, test vehicles shall have accumulated a total mileage greater than 4,000 miles and less than 10,000 miles with the original fuel system, prior to emission testing. If the manufacturer chooses to use the option as described in 1~~(b)~~ (e) for pre-1994 model year vehicles, then the 10,000 mile limit shall not be applicable. A test vehicle's engine and emission control system shall be equipped and calibrated as certified. The vehicle shall then be tested for exhaust and, if applicable, evaporative emissions using the test procedures set forth in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles". The inertia weight setting shall be equal to the average of the vehicle's curb weight and gross vehicle weight rating and road load horsepower based on the frontal area of the vehicle without modifications, as determined in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," Section 9.b. The test results shall be defined as the baseline emission rates. After the baseline emission rates have been measured, the retrofit system shall be installed.

(i) The procedures outlined in paragraphs 5(b)(iii) through 5(b)(vi) shall be used with the following modifications: "useful life" shall equal 120,000 miles for vehicles in Category II; the durability or bench-test vehicle's emission rates of regulated pollutants measured at 4,000 ± 100 miles after the installation of the retrofit system shall not exceed 1.10 times the baseline rates; the deteriorated exhaust emissions of regulated pollutants projected to 120,000 miles shall not exceed 1.3 times the baseline emissions; and the deteriorated evaporative emissions of regulated pollutants

projected to 120,000 miles shall not exceed the baseline emissions plus 0.5 grams.

(ii) When the Executive Officer determines that deterioration factors determined in paragraph 5(c)(i) may be carried across or carried over to other engine families in Category II, the representative emission-data vehicles shall be tested as specified in paragraph 5(b)(vii). Emission rates measured at 4,000 ± 100 miles after installation of the retrofit system shall not exceed 1.10 times the vehicles' baseline rates.

(d) Test Procedures for Vehicles in Category III Not Being Certified for Credit-Generation Purposes:

Vehicles in Category III not being certified for credit may certify under these provisions, or under the alternate test procedures given in 5(g).

Applicants requesting certification for retrofit systems for use in Category III vehicles shall submit a test plan ~~utilizing eight mode chassis dynamometer testing,~~ subject to the Executive Officer's approval, to verify that the retrofit system will not cause excess emissions from engine families for which certification is sought. Test vehicles shall have accumulated a total mileage greater than 4,000 miles ~~and less than 10,000 miles~~ with the original fuel system prior to emission testing. ~~If the manufacturer chooses to use the option as described in 1(b) for pre-1994 model year vehicles, then the 10,000 mile limit shall not be applicable.~~ A test vehicle's engine and emission control system shall be equipped and calibrated as certified. The vehicle shall then be tested for exhaust emissions ~~using the eight mode chassis dynamometer test~~ as specified in the test plan. The test result shall be defined as the baseline emission rate. After the baseline emission rate has been measured, the retrofit system shall be installed. Emission rates shall then be measured at 4,000 ± 100 miles after installation of the retrofit system using the ~~eight mode chassis dynamometer~~ test specified in the test plan.

~~(i) Subject to the Executive Officer's approval of the applicant's test plan prior to commencing testing, testing utilizing procedures other than the eight mode chassis dynamometer test shall be allowed.~~

(i) Emission testing shall be conducted to determine exhaust emission rates of carbon monoxide and the sum of non-methane hydrocarbons plus nitrogen oxides. Emissions shall not exceed 1.10 times the baseline rates.

(ii) The procedures outlined in paragraphs 5(b)(iii) through 5(b)(vi) shall be used with the following modifications: "useful life" shall equal 180,000 miles for vehicles in Category III; the durability or bench-test vehicle's emission rates of CO, and the sum of non-methane hydrocarbons plus NOx measured at 4,000 ± 100 miles shall not exceed 1.10 times the baseline rates; the deteriorated exhaust emissions projected to 180,000 miles shall not exceed 1.3 times the baseline

emissions; and, the deteriorated evaporative emissions projected to 180,000 miles shall not exceed baseline emissions plus 0.5 grams. For the purposes of this section, the evaporative baseline emissions shall be estimated by the manufacturer based on good engineering principles and judgment. The manufacturer's test plan shall specify the evaporative baseline emissions estimate and describe how this estimate was derived.

(~~i~~viii) The Executive Officer may allow carry-across of durability data from certification bench testing of retrofit systems designed for vehicles in Categories I or II to Category III retrofit system applications, if the Executive Officer determines that the carry-across durability data will adequately represent the durability performance of the retrofit system to be certified.

(iv) Applicants requesting certification for retrofit systems designed to allow Category III vehicles to operate on an alternative fuel in addition to diesel fuel shall conduct smoke opacity testing on the emission-data vehicle(s) utilizing the peak smoke opacity standards and procedures set forth in "Heavy-Duty Diesel Vehicle Smoke Opacity Test Procedure," as incorporated by reference in Title 13, CCR, Section 2182. Smoke opacity testing shall be conducted using each fuel that the retrofitted vehicle is designed to operate on. The applicable peak smoke opacity standard shall be that set for the model year for which certification is sought.

(v~~i~~) The selection of duty cycle(s) and all other aspects of the test procedure shall be subject to approval by the Executive Officer, and emission testing shall commence only after the Executive Officer has approved the test plan. The Executive Order shall be issued following review of the test data and determination that they meet the criteria specified in the test plan.

(e) Test Procedures for Vehicles in Category II Certified for Emission Reduction Credit

Vehicles in Category II certified for emission reduction credit may use these provisions, or the alternate test plan as given in 5(h).

The procedures outlined in paragraphs 5(c)(i) and (ii) shall be used with the following modifications:

(i) Certification for credit-generation purposes shall be conducted on the retrofitted engine system, utilizing an engine dynamometer, and not on the engine and vehicle combination. The test procedure used shall be the same procedure used to certify the engine family when new.

(ii) Emissions for any pollutant shall not exceed the baseline rate by more than a factor of 1.10. Baseline emissions for pre- and post-retrofit comparison purposes will be the certification emission levels determined during the original engine family certification, except:

[A] The baseline for particulate matter (PM) emissions for diesel engines whose PM emission levels were not determined during the new engine family certification process shall be 0.6 gram/bhp-hr.

[B] Formaldehyde emissions from any 1993 and earlier model year engine operating on methanol- or ethanol-based fuel shall be at or below the 1993 model year standard. Formaldehyde emissions from any 1994 or subsequent model year engine operating on methanol- or ethanol-based fuel shall be at or below the formaldehyde standard for that model year.

[C] For diesel engines, baseline carbon monoxide and hydrocarbon emissions shall be the original emission certification value for the engine's model year.

[D] For engine families originally certified to a combined HC plus NOx standard, the baseline HC and NOx standards will be the combined standard pro-rated by the HC and NOx portions, respectively, of the original emission certification levels. If the original emission certification levels are not available, the HC and NOx baseline standards will be pro-rated by the HC and NOx certification standards of the next later model year with separate HC and NOx standards.

(iii) The "useful life" shall be 120,000 miles for vehicles in Category II, and 180,000 miles for vehicles in Category III. Deteriorated exhaust emissions projected to the useful life shall not exceed the baseline rate by more than a factor of 1.30, except for the pollutant(s) for which credits will be generated, which will not exceed the credit standard declared on the certification application as required under 4(c)(i). The deteriorated evaporative emissions, if any, projected to the useful life shall not exceed baseline emissions.

(f) Test Procedures for Vehicles in Category III Certified for Emission Reduction Credit

Vehicles in Category III certified for emission reduction credit may use these provisions, or the alternate test plan as given in 5(h).

The procedures outlined in paragraphs 5(d)(i) through (v) shall be used with the modifications listed in 5(e)(i) through 5(e)(iii).

(g) Alternate Test Procedure for Vehicles in Category I, or for Vehicles in Categories II, or III Not Being Certified for Credit Generation Purposes

The manufacturer shall submit data from durability testing conducted using the test procedures used in new vehicle or engine certification. The deteriorated useful life emission levels shall meet the applicable emission standards for vehicles or engines of that model year and fuel type. The Executive Officer may certify the retrofit system based on review of the durability

test data. If durability test data are not available, the manufacturer shall use the following procedures:

(i) The retrofit manufacturer shall submit derived deterioration factors. The manufacturer shall submit test data that shows similar performance characteristics between the retrofitted vehicle or engine and the original equipment manufacturer vehicle or engine. The manufacturer shall submit test data showing component durability of the retrofit system. The manufacturer shall also submit a test plan describing the procedures that will be used to validate the derived deterioration factors within two years. The manufacturer derived deterioration factors and the test plan must be reviewed and approved by the Executive Officer.

(ii) The retrofit system shall be installed on the test vehicle or engine. Certification shall be conducted on the retrofitted vehicle or engine, using the same test procedure used to certify the engine family when new. Deteriorated useful life emissions based on manufacturer derived deterioration factors shall meet the applicable new engine emission standards.

(iii) Following retrofit system certification, the manufacturer will conduct engine aging, either in-use or on a dynamometer, according to the specified test plan. Emissions testing shall be conducted on the aged retrofit vehicle or engine system using the same test procedure used to certify the engine family when new. Deteriorated useful life emissions based on durability testing shall meet the applicable new vehicle or engine emission standards for that vehicle model. The manufacturer shall submit test data to verify the derived deterioration factors within two years of certification of the retrofit system.

(iv) Vehicles in Category III must meet the requirements of 5(d)(iii) and 5(d)(iv).

(h) Alternate Test Procedure for Vehicles in Category II or Category III Certified for Credit Generation Purposes

The procedures outlined in 5(g) shall be used, with the following modifications:

(i) The manufacturer shall also meet the requirements in 5(e)(i) and 5(e)(ii).

(ii) Deteriorated useful life emissions based on durability testing shall not exceed the original equipment manufacturer engine certification emissions level by more than a factor of 1.30, except for the pollutant(s) for which credits will be generated, which will not exceed the credit standard declared on the certification application

as required under 4(c)(i). The deteriorated evaporative emissions, if any, projected to the useful life, shall not exceed baseline emissions.

6. APPROVAL

(a) Issuance of Executive Orders:

If, after reviewing the test data and other information submitted by the retrofit system manufacturer, the Executive Officer determines that the retrofit system meets the applicable emission standards or the criteria of an approved test plan, as applicable, an Executive Order shall be issued certifying the retrofit system for sale and installation on vehicles in the engine families specified in the application. The Executive Order shall specify, if applicable, that the retrofit system is certified as [A] converting a conventional motor vehicle into a TLEV, LEV or ULEV, [B] converting a TLEV into a LEV or ULEV, ~~or~~[C] converting a LEV into a ULEV or [D] for heavy-duty credit conversions, the applicable credit standard(s).

(b) Carry-Over and Carry-Across:

(i) Carry-over of emission test data from the previous model year to the following model year will be allowed, if the Executive Officer determines that the carry-over data will adequately represent the emissions performance of the retrofit system to be certified.Carry-across to similar engine families will also be allowed.

(ii) An original equipment manufacturer (OEM) that produces retrofit hardware which upgrades an old engine to the identical configuration of a newer engine family that the manufacturer also produces, may carry-across the newer engine family certification test data for the retrofit hardware certification process. (For these purposes, the term "identical" means that all engine parts on the retrofitted engine which affect emissions, such as pistons, cylinder heads, etc., must be of the same design and construction as those on the newer engine family. Engine calibration, including injection timing must also be identical.)

(iii) Applications for carry-over and carry-across must be accompanied by an engineering analysis demonstrating that the emissions and durability of the retrofit system and engine family for which certification is being sought will be adequately represented by a certified retrofit system/engine family application.

(iv) Applications for carry-over and carry-across will be evaluated according to the the criteria contained in EPA Advisory Circular 17F, which is incorporated herein by reference, and paragraph 4.~~b~~4 c.5 of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." These include, but are not limited to, similarity of catalyst location and configuration,

similarity of fuel metering system, similarity of emission control system logic and design, and similarity of any other features that may affect the durability of the retrofit system's emission performance.

7. INSTALLATION REQUIREMENTS

(a) Prior to releasing a converted vehicle to the consumer, the installer of an alternative fuel or credit-generating conventional fuel retrofit system shall submit the converted vehicle to a Bureau of Automotive Repair Referee Smog Check Station for inspection and testing except as provided in 7 (b).

(i) The installer of an alternative fuel or credit-generating conventional fuel retrofit system shall keep a copy of the certificate of compliance, issued by the Bureau of Automotive Repair Referee Smog Check Station, as part of the record specified in paragraph 3(e). The certificate of compliance shall contain, but need not be limited to, the following: the vehicle's identification number, the vehicle's model year and make, the date of installation, and the emissions category to which the retrofitted system is certified (i.e., conventional vehicle, TLEV, LEV, or ULEV) or, for heavy-duty vehicles, the credit standard to which the system is certified. The original certificate of compliance shall be submitted to the vehicle owner upon the vehicle's release.

(ii) The installer of an alternative fuel or credit-generating conventional fuel retrofit system shall not release the converted vehicle to the consumer without the issuance of a certificate of compliance for the vehicle by a Bureau of Automotive Repair Referee Smog Check Station.

(iii) The installer of an alternative fuel or credit-generating conventional fuel retrofit system shall also meet the requirements of paragraph 9(c).

(b) The retrofit system installer may request Air Resources Board approval to use the alternative inspection schedule for fleet installation of the same retrofit kit on more than 10 vehicles with engines from similar engine families. If approval is granted, the installer shall submit ten vehicles with engines from similar engine families, retrofitted with the same kit, to a Bureau of Automotive Repair Station as provided in 7 (a)(i) and 7 (a)(ii).

(i) If all ten vehicles receive a certificate of compliance, for subsequent applications of the same type, the installer need only submit every tenth retrofitted vehicle to the Bureau of Automotive Repair pursuant to 7 (a)(i) and 7 (a)(ii). For the remaining vehicles included in the alternative inspection schedule that are not submitted to the Bureau of Automotive Repair, the installer shall maintain a record of the vehicle's identification number, the vehicle's model year and make, the engine size, the manufacturer and fuel type of the retrofit kit, the date of installation, and the emissions category to which the retrofitted system is certified (i.e., conventional vehicle, TLEV, LEV, or ULEV), or for heavy-duty vehicles, the credit standard to which the system is certified. The Air

Resources Board may require random inspection of any vehicles subject to the alternative inspection schedule.

(ii) If any of the ten vehicles fail to pass inspection, the next set of ten retrofitted vehicles shall be subject to inspection at the Bureau of Automotive Repair, until an entire group of 10 passes.

8. IN-USE ENFORCEMENT TEST REQUIREMENTS

(a) Manufacturers of alternative fuel or credit-generating conventional fuel retrofit systems shall, upon order by the Executive Officer, perform in-use enforcement emission testing of their products. The Executive Officer may order in-use enforcement emission testing of not more than 20 percent of a manufacturer's certified retrofit systems/engine family applications per year. If 20 percent constitutes less than one of a manufacturer's certified systems, the Executive Officer may order in-use enforcement emission testing of not more than one certified system/engine family application per year. Manufacturers shall be required to perform emission testing of not less than ten vehicles per certified retrofit system/engine family application selected by the Executive Officer for in-use enforcement emission testing. Upon order by the Executive Officer, manufacturers shall perform the applicable emission tests pursuant to the following:

(i) No vehicle shall be accepted by the manufacturer as a representative vehicle for enforcement testing unless the following criteria are met:

(1) California certified and registered.

(2) Odometer indication of less than certified useful-life mileage and vehicle age within useful-life time period.

(3) No indication of abuse (e.g., racing, overloading, misfueling, or other misuse), neglect, improper maintenance or other factors that would have an effect on emission performance.

(4) No major repair to engine or major repair of vehicle resulting from collision.

(5) Lead content of fuel sample from the vehicle tank meets applicable standards.

(6) No indication of any problem that might jeopardize the safety of laboratory personnel.

(ii) The manufacturer shall, under ARB supervision, perform diagnosis or restorative maintenance on those vehicles selected for in-use enforcement testing. The manufacturer or a laboratory approved by the Executive Officer shall (1) identify part numbers of all essential emission control system components; (2) check air filter, all drive belts, all fluid levels, radiator cap, all vacuum hoses and electrical wiring related to emission control for integrity; check fuel metering

and emission control system components for maladjustments and/or tampering, and record all discrepancies; (3) check ignition system with oscilloscope and replace any defective components; i.e., spark plugs, wires, etc.; (4) check compression; (5) check and adjust engine parameters to manufacturer's specifications; and (6) perform maintenance if the vehicle is within 500 miles of scheduled maintenance service.

(iii) For vehicles in Category I, the manufacturer or a laboratory approved by the Executive Officer shall perform the applicable emission test procedures set forth in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." The applicable emission standards shall be the vehicle's useful life standards as well as any intermediate emission standards, as stated in the Executive Order.

(iv) For vehicles in Category II not certified for credit generation, in-use enforcement exhaust and, if applicable, evaporative emissions shall be performed using the test procedures set forth in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles". The inertia weight setting shall be equal to the average of the vehicle's curb weight and gross vehicle weight rating and road load horsepower based on the frontal area of the vehicle without modifications, as determined in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," Section 9.b. For vehicles in Category III not certified for credit generation, in-use enforcement exhaust emission tests shall be performed in accordance with the test plan approved by the Executive Officer prior to certification testing of the engine family applications specified for in-use enforcement testing. For vehicles in Categories II and III which are certified for credit generation, in-use enforcement testing will consist of repeating the procedures and requirements of paragraphs 5(e) and 5(f), respectively, except as provided for in paragraph 8(a)(viii), below.

(v) The applicable exhaust emission standards for vehicles in Categories II and III shall be the baseline emission rates established during certification testing of the engine family applications specified for in-use enforcement testing times 1.3 except as provided in paragraphs 5(e) and 5(f) for credit generating systems. The applicable evaporative emission standards for vehicles in Categories II and III shall be the baseline emission rates established during certification testing of the engine family applications specified for in-use enforcement testing plus 0.5 grams except as provided in paragraphs 5(e) and 5(f) for credit generating systems.

(vi) Manufacturers shall complete in-use enforcement testing within 6 months of the issuance of the in-use compliance testing order and shall submit all test data to the Executive Officer within 30 calendar days following completion of testing.

(vii) Following review of manufacturer in-use enforcement test data, the Executive Officer may conduct confirmatory in-use enforcement testing.

(viii) OEM upgrade systems certified for credit-generation use as described in paragraph 6(b), shall be subject to the new engine family in-use testing requirements for the engine family on which the system is originally certified. Such systems will not be subject to the in-use enforcement testing requirements of these Procedures.

(b) If the results of the in-use vehicle emission tests conducted pursuant to paragraphs 8(a)(i) through 8(a)(viii) indicate that the average emissions of the test vehicles for any pollutant exceed the applicable emission standards or specified limits for credit generation certification, the entire vehicle population so represented shall be deemed to exceed such standards. Upon order by the Executive Officer, the manufacturer shall have 45 days to submit an influenced recall plan in accordance with Sections 2111 through 2121, Title 13, CCR. If no such recall plan is submitted, the Executive Officer may order corrective action including recall of the affected vehicles in accordance with Sections 2122 through 2135, Title 13, CCR. For the purpose of these Procedures, the term "manufacturer," as referenced in Sections 2111 through 2135, Title 13, CCR, shall mean "retrofit system manufacturer."

9. WARRANTY REQUIREMENTS

(a) Requirements of Manufacturers:

The manufacturer of an alternative fuel or credit-generating conventional fuel retrofit system shall warrant to the person having the vehicle retrofitted and to each subsequent purchaser of the vehicle that the alternative fuel or credit-generating conventional fuel retrofit system is designed and manufactured to conform with the applicable requirements of these Procedures and is free from defects in materials and workmanship which cause the alternative fuel or credit-generating conventional fuel retrofit system to fail to conform with the applicable requirements of these Procedures or cause damage to any part on the retrofitted vehicle. This warranty shall be effective for three years or 50,000 miles, whichever first occurs, of customer service, and shall cover the full repair or replacement costs including the costs of diagnosis, labor, and parts (including any part on the retrofitted vehicle that is damaged due to a defect in the alternative fuel or credit-generating conventional fuel retrofit system).

(b) Extended Warranty Requirements:

Each manufacturer of an alternative fuel or credit-generating conventional fuel retrofit system shall identify in its application for certification the warranted parts whose individual replacement cost, at the time of certification, exceeds the cost limit defined in paragraph 9(b)(i). The replacement cost shall include the cost of the diagnosis, parts, and labor. The costs shall be those of the highest cost metropolitan area of California. Each manufacturer shall warrant to the person having the vehicle

retrofitted and to each subsequent purchaser of the vehicle that those parts identified in its application for certification as exceeding the cost limit defined in paragraph 9(b)(i) are free from defects in materials and workmanship which cause the alternative fuel or credit-generating conventional fuel retrofit system to fail to conform with the requirements of these Procedures or cause damage to any part on the retrofitted vehicle, for seven years or 70,000 miles, whichever first occurs.

(i) The cost limit shall be calculated using the following equation:

$$\text{Cost limit}_n = \$300 \times (CPI_{n-2}/121.9)$$

where:
Cost limit_n is the cost limit for the year in which the alternative fuel or credit-generating conventional fuel retrofit system is to be certified.

n is the year in which the alternative fuel or credit-generating conventional fuel retrofit system is to be certified.

CPI is the annual average consumer price index for California published by the United States Bureau of Labor Statistics.

(ii) The cost limit shall be revised annually by the Executive Officer. The highest cost metropolitan area in California shall be identified by the Executive Officer.

(iii) Each manufacturer shall submit to the Executive Officer the documentation used to identify the warranted parts required in this subsection. The documentation shall include the estimated retail parts costs, labor rates in dollars per hour, and the labor hours necessary to replace the parts.

(c) Requirements of Installers:

Each installer of an alternative fuel or credit-generating conventional fuel retrofit system shall warrant to the person having the vehicle retrofitted and to each subsequent purchaser of the vehicle that the alternative fuel or credit-generating conventional fuel retrofit system will not fail to conform with the applicable requirements of these Procedures due to incorrect installation, and that no part on the retrofitted vehicle will be damaged due to incorrect installation. Installers of alternative fuel or credit-generating conventional fuel retrofit systems shall install only those systems of a certified configuration and shall agree to indemnify the person having the vehicle retrofitted and to each subsequent purchaser of the vehicle for the cost of repair of any vehicle upon which a noncertified configuration was installed. In addition, the installer shall agree to indemnify the person having the vehicle retrofitted and to each subsequent purchaser of the vehicle for any tampering fines that may be imposed as a result of improper installation of the alternative fuel or credit-generating conventional fuel retrofit system. The warranties and agreements to indemnify shall be effective for three years or

50,000 miles, whichever first occurs, of customer service, and shall cover the full repair or replacement costs including the costs of diagnosis, labor, and parts (including any part on the retrofitted vehicle that is damaged due to incorrect installation of the alternative fuel or credit-generating conventional fuel retrofit system).

Before an installer installs an alternative fuel or credit-generating conventional fuel retrofit system, he or she shall have submitted to the ARB a sample of the warranty statement to be provided by the installer in accordance with this paragraph.

ATTACHMENT B

AMENDMENTS TO THE CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE LIQUEFIED PETROLEUM GAS OR NATURAL GAS FUELS

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE LIQUEFIED PETROLEUM GAS OR NATURAL GAS FUELS

Adopted: April 16, 1975
Amended: April 18, 1981
Amended: September 14, 1984
Amended: March 11, 1993
Amended: November 21, 1995

Note: Changes approved by the Board on July 27, 1995, are indicated by strike-out (deletion) and underline (addition).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE LIQUEFIED PETROLEUM GAS OR NATURAL GAS FUELS

The authority for these Exhaust Emission Standards and Test Procedures is found in Sections 43004 and 43006 of the California Health and Safety Code which contain the following:

> 43004. "--the standards applicable under this part for exhaust emissions for gasoline-powered motor vehicles shall apply to motor vehicles which have been modified or altered to use a fuel other than gasoline or diesel."
>
> 43006. "The state board may certify the fuel system of any motor vehicle powered by a fuel other than gasoline or diesel which meets the standards specified by Section 43004 and adopt test procedures for such certification."

1. GENERAL APPLICABILITY

"California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels" ("these test procedures" or "these procedures") are applicable to any single- or dual-fuel motor vehicle conversion system using liquefied petroleum gas (LPG) or natural gas (NG) in lieu of the original gasoline or diesel fuel system for 1993 and earlier model year emission-controlled vehicles used or registered in the State of California.

A retrofit system manufacturer may apply these test procedures to certify conversion systems for 1994, ~~and~~ 1995, and 1996 model-year vehicles in accordance with the following implementation phase-in schedule. Each manufacturer may certify a maximum of 85 percent of its total 1994 model-year engine family conversion systems, ~~and~~ 45 percent of its total 1995 model-year systems, and 45 percent of its total 1996 model-year systems, according to the requirements of these test procedures and "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels." The remaining percentage of each manufacturer's certified 1994, ~~and~~ 1995, and 1996 model-year engine family conversion systems and all of 1996~~7~~ and subsequent model-year engine family conversion systems shall be certified according to "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems For Motor Vehicles Certified For 1994 and Subsequent Model Years and for All Model-Year Motor Vehicle Retrofit Systems Certified for Emission Reduction Credit." The percentages shall be determined from the total number of conversion systems certified and shall be met prior to the end of the ~~applicable~~ next respective calendar year. If the above referenced 85 percent maximum is exceeded for 1994 or the above referenced 45 percent maximum is exceeded for 1995 or 1996, the Executive Officer shall rescind the Executive Order for those conversion systems most recently certified which caused the

percentages to be exceeded. These procedures shall not be used to certify a retrofit system for installation on a transitional low-emission vehicle ("TLEV"), low-emission vehicle ("LEV"), or ultra-low-emission vehicle ("ULEV") or to certify a retrofit system designed to convert a vehicle to TLEV, LEV, or ULEV emission standards (as defined in Section 1960.1, Title 13, CCR). These procedures shall not be used to certify retrofits for emission reduction credit.

2. DEFINITIONS

The definitions shall be the same as those in the applicable model year California exhaust emission standards and test procedures for passenger cars, light-duty trucks, and medium-duty vehicles.

All provisions of these procedures (except where specifically noted) shall apply to single-fuel liquefied petroleum gas (LPG), single-fuel natural gas (NG), AND DUAL-FUEL (LPG/gasoline or NG/gasoline)

3. GENERAL STANDARDS

(a) In addition to all other standards or requirements imposed, any modification of a gasoline- or diesel-fueled motor vehicle to allow the use of liquefied petroleum gas or natural gas as a fuel:

(i) Shall not in its operation or function cause the emission into the ambient air of any noxious or toxic substance that is not emitted in the operation of such vehicle without such modification, except as specifically permitted by regulation; and

(ii) Shall not in its operation, function, or malfunction, result in any unsafe condition endangering the motor vehicle, it occupants, other persons, or property in close proximity to the vehicle, in accordance with the safety requirements specified for the original vehicle.

(b) In the case of a dual-fuel conversion, where the vehicle may run on gasoline (or diesel) or a gaseous fuel, removal of originally required emission control systems will not be permitted. These provisions shall not apply to heated intake air systems or the original air cleaner when replaced by an air cleaner compatible with the LPG/NG carburetor.

4. NON-APPLICABLE REGULATIONS

All requirements in the referenced California exhaust emission standards and test procedures for gasoline or diesel-powered vehicles not directly related to exhaust emission test procedures shall not be applicable to these procedures.

5. APPLICATION FOR APPROVAL

a. An application for approval of a modification to use LPG and NG fuel in a gasoline- or diesel-powered engine may be made by any engine, vehicle, or conversion equipment manufacturer.

b. An application shall be required for each model year even though the exhaust emission standards for approval of new vehicles may be the same for consecutive model years.

c. The application shall be in writing, signed by an authorized representative of the manufacturer, and shall include the following:

i. Identification and description of the vehicles in each vehicle category and engine displacement ranges for which approval is requested.

There are three vehicle categories.

a) Passenger Cars (PC)

b) Light-Duty Trucks (LDT) and Medium-Duty Vehicles (MDV)

c) Heavy-Duty Vehicles (HDV) powered by Heavy-Duty Engines (HDE)

ii. A complete description and identification of the conversion system, including carburetor model number(s), carburetor configuration/calibration codes(s), vaporizer/regulator model number(s), evidence of proper assembly of the fuel tank and fuel lines, and the necessary modification to the engine or vehicle.

iii. A statement of recommended maintenance procedures, including initial installation and initial tuning, and equipment necessary to ensure that the vehicle and engine in operation conform to the regulations. If the procedures are not uniform, then the specific procedures for each difference make and model shall be given. A description of the program for training of personnel for such maintenance and installation.

iv. An agreement that upon the Executive Officer's request any one or more of the test vehicles will be supplied to the Air Resources Board (ARB) for such testing as it may require, or (by mutual consent between the ARB and applicant) will be made available at the manufacturer's facility for such testing. Provided, that in the latter case, it is further agreed that the instrumentation and equipment specified by the ARB will be made available for testing operations. Any testing conducted at a manufacturer's facility pursuant to this subparagraph will be scheduled as promptly as possible.

v. An agreement that up to two test vehicles per vehicle category will be made available to the ARB for testing for such reasonable periods as may be required. These vehicles shall be selected from time to time by the Executive Officer and shall be typical of production models available for sale to the public. They shall also be representative of the engines and transmissions offered by the vehicle manufacturers.

vi. An agreement that the modifications made in the field will be properly identified. To meet this requirement, the model number shall be permanently marked on the carburetor. A permanent label, to be affixed in the engine compartment where it may be easily read, covering the following for the specific installation, shall be furnished. The label shall set forth the following:

1. Manufacturer's name and address.
2. The California Air Resources Board certification number identified as "CARB E.O. No. B-XX."
3. Spark timing.
4. Idle speed.
5. Mixture adjustment (if used) including idle, cruise, and/or full throttle together with the method.
6. Diagrams for vacuum hose routing and electrical wiring harness.
7. Carburetor, vaporizer/regulator model numbers, and carburetor configuration/calibration codes.

vii. For retrofit systems applicable to 1994, and 1995, and 1996 model year vehicles, a complete listing of the engine families for which the manufacturer's retrofit systems are designed for installation. The number of a manufacturer's 1994, and 1995, and 1996 model-year engine family retrofit systems certified according to these test procedures shall be limited according to the phase-in schedule described in the General Applicability section of these procedures.

d. An application may be made for certification to emission standards or to typical baseline emission levels.

6. EMISSION STANDARDS AND TEST PROCEDURES FOR PC, LDT, MDV, AND HDE

(a) For certification to emission standards, the appropriate model-year exhaust emission standards to be used are the applicable California new vehicle exhaust emission standards. Test procedures shall be the applicable California new vehicle certification test procedures for the model-year of the test vehicle. Compliance is demonstrated by applying a deterioration factor to both the cold and hot start emission test results to project the emission levels to the end of the vehicle's useful life and comparing the results with the emission standards. These test results must meet the applicable emission standards. A retest is permitted if the vehicle fails the first test. The assigned deterioration factor will be based on gasoline-powered or diesel-powered vehicle certification deterioration rates as specified by the Executive Officer. In addition, dual-fuel systems will require CVS-75 tests using the original fuel with the conversion system installed. This test result (with the certification deterioration factor or, if not available, an assigned deterioration factor applied) must also meet the applicable emissions standards.

(b) For certification to typical baseline emission levels, the exhaust emission levels to be used are those from representative vehicles in good operating condition selected by the Executive Officer for testing. Test procedures shall be the applicable California test procedures for the model-year of the vehicle. Back-to-back tests must be conducted and a significant increase in the emissions from the baseline may be cause for denial. In order to improve data reliability, the manufacturer may elect to perform two back-to-back tests, in which case a significant increase in the average emissions of the two conversion system tests over the average baseline test emissions may be cause for denial. Test variability will be considered in establishing significant increases in emissions. In addition, for dual-fuel systems, a CVS-72 test using the original fuel with the conversion system is required. This test shall also not significantly increase emissions from the baseline level.

The test variability factors applicable for back-to-back tests are 1.10 for HC and NOx and 1.15 for CO emissions. The conversion system meets the compliance requirements when the emission data from the tests with the conversion system installed, are at or below the emission levels of the baseline emissions with the variability factors applied.

(c) For certification of conversion systems to be installed only on heavy-duty engines, the appropriate model-year exhaust emission standards and applicable (diesel or gasoline) exhaust emission test procedures shall be used. However, approval of a conversion system to be installed on PC or LDT/MDV shall automatically qualify the system for use with heavy-duty engines with similar or less sophisticated emission control systems without additional testing.

(d) The durability of all systems will be determined by an engineering evaluation. For cause, and based on the engineering evaluation, the Executive Officer may require durability tests.

7. SELECTION OF TEST VEHICLES FOR THE LIMITED FLEET

A maximum of two test vehicles may be required by the Executive Officer for each vehicle category. One test vehicle can represent the worst case and the other the most popular vehicle for which the conversion system is applicable. The Air Resources Board will notify the applicant in writing of the vehicles which can be used to demonstrate compliance. In requesting emission tests, the Air Resources Board will consider emission control system similarity over vehicle categories when determining the test fleet size.

8. VEHICLE TESTING

To assure better test data utilization, each applicant shall obtain prior approval in writing from the Executive Officer on the test vehicle fleet.

(a) Test Vehicles

(1) Vehicles Certifying to New Vehicle Exhaust Emission Standards

Each test vehicle shall be a California certified version having been driven a minimum of 4,000 miles on gaseous fuel. The vehicle mileage accumulation must be done by driving the vehicle on the road following a route of typical suburban type driving, or on a chassis dynamometer utilizing the Automobile Manufacturer's Association (AMA) mileage accumulation cycle. The applicant may request and the Executive Officer may allow test vehicles with less mileage if the applicant demonstrates emission stability. Emission stability can be demonstrated by performing two (2) consecutive CVS-75 emission tests with 500 miles of AMA type driving between tests and showing no change in emissions outside of test variability.

Each test vehicle must also be subjected to a thorough examination prior to any emissions test(s) to detect and correct possible defects and deviations from manufacturer's specifications in emissions-related parts.

Testing may be performed at any independent laboratory properly equipped to conduct the tests. The test vehicles shall be under the control of the laboratory for the entire test period. Return of test vehicles to the applicant during the test period may invalidate the test results.

The laboratory's report must be submitted directly to the Executive Officer and contain all related information, including failed test data. Tests performed for research and development purposes before the application is submitted need not be reported. The applicant may not edit the laboratory report but may submit additional clarifying comments or information.

(ii) Vehicles Certifying to Typical Emission Levels

Each test vehicle shall be a California certified version having been driven a minimum of 4,000 miles on the original certification fuel as required for new vehicle certification. In the event that a manufacturer acquires a vehicle with less than 4,000 miles, the vehicle mileage must be brought to 4,000 miles by driving the vehicle on the road following a route of typical suburban type driving, or by accumulating mileage on a chassis dynamometer utilizing the AMA mileage accumulation cycle. The Executive Officer may allow test vehicles with less mileage if the applicant demonstrates emission stability. Emission stability can be demonstrated by performing two (2) consecutive CVS-75 emission tests with 500 miles of AMA type driving between tests and showing no change in emissions outside of test variability.

Each test vehicle must also be subjected to a thorough examination prior to the baseline test to detect and correct possible defects and deviations from manufacturer's specification in emissions-related parts. The baseline emissions of the test vehicle should be typical for that particular make and model-year. Typical vehicle emissions will be determined by using the vehicle surveillance test data, supplemented by assembly-line test and certification test data as required and appropriate.

If a vehicle exceeds typical emission values, the applicant may make a full diagnostic evaluation of the vehicle, make any necessary repairs, and retest the vehicle. If no abnormal conditions of the engine or the emission controls are noted, the vehicle will be accepted as a test vehicle and its emissions data will be used for comparison with conversion system test results. The applicant may forego the above and select another test vehicle from the given list of alternative vehicles.

Testing may be performed at any laboratory properly equipped to conduct the tests. The test vehicle shall be under the control of the laboratory for the entire test period. Return of the test vehicle to the applicant during the test period may invalidate prior test results.

After the baseline test has been run, prior approval must be obtained from the Executive Officer before any servicing, maintenance, or parts replacements are made, except those that are in accordance with the written instructions provided with the application. The same fuel shall be used for the back-to-back tests using gasoline or diesel. There should be sufficient fuel in the fuel tank to permit the baseline and with conversion system tests. The laboratory shall record all the above information and include it as part of the report. The laboratory's report must be submitted directly to the Executive Officer and contain all related information, including failed test data. Tests performed for research and development purposes before the application is submitted need not be reported. The applicant may not edit the laboratory report but may submit additional clarifying comments or information.

(b) Test Sequence

(i) Straight liquefied petroleum or natural gas conversions certifying to emission standards

1. Adjust vehicle to vehicle manufacturer's specification.

2. Install conversion system in accordance with conversion system manufacturer's installation instructions (permanent installation of gaseous fuel tank is not required).

3. Run one cold start CVS-75 test using gaseous fuel.

4. Run one cold start CVS-75 test using gaseous fuel (only if first CVS-75 test fails the emission standards).

(ii) Dual-fuel systems certifying to standards

1. Adjust vehicle to vehicle manufacturer's specifications.

2. Install conversion system in accordance with the conversion system manufacturer's installation instructions (permanent installation of gaseous fuel tank is not required).

3. Run one cold start CVS-75 test using gaseous fuel.

4. Run one cold start CVS-75 test using gaseous fuel (only if first CVS-75 test on gaseous fuel fails the emission standards).

5. Run one hot start CVS-72 test using gasoline or diesel fuel.

6. Run one hot start CVS-72 test using gasoline or diesel fuel (only if first CVS-72 test on gasoline or diesel fuel fails the emission standards).

(iii) Straight liquefied petroleum or natural gas conversions certifying to typical baseline emission levels

1. Adjust vehicle to vehicle manufacturer's specification.

2. Run one cold start CVS-75 test using gasoline or diesel fuel.

3. Install conversion system in accordance with conversion system manufacturer's installation instructions (permanent installation of gaseous fuel tank is not required).

4. Run one cold start CVS-75 test using gaseous fuel.

(iv) Dual-fuel systems certifying to typical baseline emission levels

1. Adjust vehicle to vehicle manufacturer's specifications.

2. Run two baseline tests using gasoline or diesel fuel. One is a cold start CVS-75, and the other is a hot start CVS-72.

3. Install conversion system in accordance with the conversion system manufacturer's installation instructions (permanent installation of gaseous fuel tank is not required).

4. Repeat cold start CVS-75 test using gaseous fuel and the hot start CVS-72 test using gasoline or diesel as the fuel.

5. As an alternative, the applicant may delete the two hot start CVS-72 tests and in their places run a cold start CVS-75 test with conversion system using gasoline or diesel fuel.

9. CALCULATION PROCEDURES

The following calculation procedures are based on the Federal CVS-1975 Test Procedure. The final reported test results shall be computed by use of the following formulas:

Meaning of Symbols

PC - Passenger cars
LDT - Light-duty trucks
MDV - Medium-duty vehicles (over 6000-8500 lbs. GVW)
HDV - Heavy-duty vehicles (those vehicles over 8500 lbs. GVW)

CO_{conc} = Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO_2 extraction, in ppm.

CO_{dm} = Carbon monoxide concentration of the dilution air sample as measured, in ppm.

CO_d = Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm.

CO_e = Carbon monoxide concentrations of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in ppm. The calculation assumes the carbon to hydrogen ratio of the fuel to be 1:3.802 for natural gas and 1:2.556 for LPG.

CO_{em} = Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.

CO_{mass} = Carbon monoxide emissions, in grams per test phase.

$CO_{2_{conc}}$ = Carbon dioxide concentration of the dilute exhaust sample corrected for background and water vapor, in percent.

CO_{2_e} = Carbon dioxide concentration of the dilute exhaust sample, in percent.

$CO_{2_{mass}}$ = Carbon dioxide emissions, in grams per test phase.

$Density_{CO}$ = Density of carbon monoxide is 32.97 g/ft^3 of 68°F and 760 mm Hg pressure.

$Density_{HC}$ = Density of hydrocarbons is 18.64 g/ft^3 for natural gas and 17.28 g/ft^3 for LPG assuming an average carbon to hydrogen ratio of 1:3.802 for natural gas and 1:2.656 for LPG, at 68°F and 760 mm Hg pressure.

$Density_{NO_2}$ = Density of oxides of nitrogen is 54.16 g/ft^3 assuming they are in the form of nitrogen dioxide, at 68°F and 760 mm Hg pressure.

DF = Dilution Factor.

H = Absolute humidity in grains of water per pound of dry air.

HC_{conc} = Hydrocarbon concentration for the dilute exhaust sample corrected for background, in ppm carbon equivalent, i.e., equivalent propane x 3.

HC_d = Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent.

HC_e = Hydrocarbon concentration of the dilute exhaust sample, in ppm carbon equivalent.

HC_{mass} = Hydrocarbon emissions, in grams per test phase.

K_H = Humidity correction factor.

N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected.

$NO_{x_{conc}}$ = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm.

NO_{x_d} = Oxides of nitrogen concentration of the dilute air as measured, in ppm.

NO_{x_e} = Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.

$NO_{x_{mass}}$ = Oxides of nitrogen emissions, in grams per test phase.

P_B = Barometric pressure, in mm Hg.

P_d = Saturated vapor pressure, in mm Hg at ambient dry bulb temperature.

P_i = Pressure depression below atmospheric measured at the inlet to the positive displacement pump.

T_p = Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected, in degrees Rankine.

R_a = Relative humidity of the ambient air, in percent.

V_{mix} = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528°R and 760 mm Hg).

Vo = Volume of gas pumped by the positive displacement pump, in cubic feet per revolution. This volume is dependent on the pressure differential across the positive displacement pump.

Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_{ht} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_s = Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

Y_{wm} = Weighted mass emissions of each pollutant, i.e., HC, CO, or NO_x, in grams per vehicle mile.

For passenger cars, light-duty trucks, and medium-duty vehicles:

(a) The mass emissions of each pollutant in grams per mile is $Y_{wm} = (0.43Y_{ct} + 0.57\ Y_{ht} + Y_s)/7.5$

(b) The mass of each pollutant for each phase of both the cold start test and the hot start test is determined from the following:

(1) Hydrocarbon mass:

$$HC_{mass} = V_{mix} \times Density_{HC} \times (HC_{conc}/1{,}000{,}000)$$

(2) Oxides of nitrogen mass:

$$NO_{x_{mass}} = V_{mix} \times Density_{NO_2} \times K_H \times (NO_{x_{conc}}/1{,}000{,}000)$$

K_H = humidity correction factor

(3) Carbon monoxide mass:

$$CO_{mass} = V_{mix} \times Density_{CO} \times (CO_{conc}/1{,}000{,}000)$$

(4) Carbon dioxide mass:

$$CO_{2_{mass}} = V_{mix} \times Density_{CO_2} \times (CO_{2_{conc}}/100)$$

$$V_{mix} = \frac{V_o \times N \times (P_b - P_i) \times 528}{(760)(T_p)}$$

$$HC_{conc} = HC_e - HC_d(1 - 1/DF)$$

$$NO_{x_{conc}} = NO_{x_e} - NO_{x_d}\ (1-1/DF)$$

$$CO_{conc} = CO_e - CO_d\ (1-1/DF)$$

$$CO_e = (1-0.02901\ CO_{2_e} - 0.000323\ R_a)\ CO_{em} \text{ for natural gas}$$

$$CO_e = (1-0.02328\ CO_{2_e} - 0.000323\ R_a)\ CO_{em} \text{ for LPG}$$

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$$CO_d = (1-0.000323\ R_a)\ CO_{dm}$$

$$K_H = \frac{1}{1-0.0047(H-75)}$$

$$H = \frac{(43.478R_a)(Pd)}{P_d - P_d \times R_a/100}$$

$$DF = \frac{9.77}{CO_{2_e} + (HC_e + CO_e) \times 10^{-4}} \quad \text{for natural gas}$$

$$DF = \frac{11.7}{CO_{2_e} + (HC_e + CO_e) \times 10^{-4}} \quad \text{for LPG}$$

For hydrocarbons the Y_{wm} value must be multiplied by the methane content correction factor (MCCF).

$$HC_{wm} = Y_{wm} \times MCCF$$

HC_{wm} = weighted mean HC mass in gms per vehicle mile after correction for methane content

For 1981 and earlier model year vehicles, the MCCF values as determined by the vehicle manufacturer and approved by the ARB during certification shall be used. In the absence of such values, the following shall apply:

Gasoline	= PC	= 0.89 (catalyst only)
	PC	= 1.0 (non catalyst cars)
	LDT	= 1.0
	MDV	= 1.0
	HDV	= 1.0
Natural Gas		= 0.5 (all vehicle categories)
LPG		= 0.75 (all vehicle categories)

In the alternative, the applicant may choose to determine the actual MCCF by using the "California Non-Methane Hydrocarbon Test Procedures" adopted May 24, 1978.

For 1982 and later model year vehicles, non-methane hydrocarbons must be determined using non-methane instrumentation. In the alternative, the applicant may measure only total hydrocarbons during all testing. However, in such event, no methane credit will be given either gasoline or gaseous fuels.

Sample Calculation:

(1) For the "transient" phase of the cold-start test assume

V_o = 0.29344 cu ft per revolution; N = 10,485;

R_a = 48.2%; P_B = 762 mm Hg; P_d = 22.225 mm Hg; P_i = 70 mm Hg;

T_p = 570°R; HC_e = 105.8 ppm carbon equivalent; NO_{x_e} = 11.2 ppm;

CO_{em} = 306.6 ppm; CO_{2e} = 1.43%; HC_d = 12.1 ppm

NO_{x_d} = 0.8 ppm; CO_{dm} = 15.3 ppm.

Then, for an LPG fueled vehicle:

$$V_{mix} = \frac{(0.29344)(10,485)(762-70)(528)}{(760)(570)} = 2595.0 \text{ cu ft per test phase}$$

$$H = \frac{(43.478)(48.2)(22.225)}{762 - (22.225 \times 48.2/100)} = 62 \text{ grains of water/pound dry air}$$

$$K_H = \frac{1}{1-0.0047\ (62-75)} = 0.9424$$

$$CO_e = (1-0.02328(1.43) - 0.000323(48.2))306.6 = 291.6 \text{ ppm}$$

$$CO_d = (1-0.000323(48.2))15.3 = 15.1 \text{ ppm}$$

$$DF = \frac{11.7}{1.43 + (105.8 + 291.6) \times 10^{-4}} = 7.961$$

$$HC_{conc} = 105.8-12.1\ (1-1/7.961) = 95.22 \text{ ppm}$$

$$HC_{mass} = (2595)(17.28)(95.22/1,000,000) = 4.270 \text{ grams per test phase}$$

$$NO_{x_{conc}} = 11.2-0.8(1-1/7.961) = 10.50 \text{ ppm}$$

$$NO_{x_{mass}} = (2595)(54.16)(10.50/1,000,000)(0.9424) = 1.391 \text{ grams per test phase}$$

$$CO_{conc} = (291.6) - 15.1(1-1/7.961) = 278.4 \text{ ppm}$$

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CO_{mass} = (2595)(32.97)(278.4/1,000,000) = 23.82 grams per test phase

(ii) For the "stabilized" portion of the cold-start test assume that similar calculations resulted in HC_{mass} = 0.62 grams per test phase; $NO_{x_{mass}}$ = 1.27 grams per test phase; and CO_{mass} = 5.98 grams per test phase.

(iii) For the "transient" portion of the hot-start test assume that similar calculations resulted in HC_{mass} = 0.51 grams per test phase; $NO_{x_{mass}}$ = 1.38 grams per test phase; and CO_{mass} = 5.01 grams per test phase.

(iv) For an LPG fueled vehicle:

$$HC_{wm} = \frac{(0.43)(4.27) + (0.57)(0.51) + 0.62}{7.50} \times 0.75 = 0.275 \text{ grams per vehicle mile}$$

$$CO_{wm} = \frac{(0.43)(23.82) + (0.57)(5.01) + 5.98}{7.50} = 2.54 \text{ grams per vehicle mile.}$$

$$NO_{x_{wm}} = \frac{(0.43)(1.391) + (0.57)(1.38) + 1.27}{7.50} = 0.354 \text{ grams per vehicle mile}$$

10. APPROVAL

(a) If, after a review of the data and other information submitted by the manufacturer, the Executive Officer determines that a modification to use LPG or NG conforms to these procedures, he or she will issue an Executive Order of approval for such modifications.

(b) Such Executive Order may be issued upon such terms as the Executive Officer deems necessary to ensure that any modifications to use LPG or NG will meet the requirements of these procedures.

(c) Approval for a conversion system for a given model year is deemed as approval for all previous model years unless specifically limited in the Executive Order. Approval for subsequent model years (i.e., carryover) may be given, after request by the applicant, if further engineering evaluation and/or testing demonstrates that the system will meet the standards for the applicable model year and engine displacements.

(d) Approval for installation on vehicles with similar emission control systems (i.e., carry-across) may be given, if requested by the applicant, if further engineering evaluation and/or testing demonstrates that the system will meet standards for the applicable model-year(s) and engine displacement(s).

11. CHANGES TO CONVERSION SYSTEM AFTER APPROVAL

All changes to the conversion system, including installation changes, must be submitted to the Executive Officer. The Executive Officer may require additional testing prior to approval.

12. NON-CONVENTIONAL SYSTEMS

The Executive Officer may deviate from these procedures for non-conventional systems, such as diesel fuel used in conjunction with LPG, in the event that such systems cannot be tested using these procedures. Such deviations shall be limited to those necessary for the proper testing and evaluation of such systems.

13. INSTALLATION REQUIREMENTS

a. Beginning January 1, 1994, installers of alternative fuel retrofit systems shall submit the converted vehicles to a Bureau of Automotive Repair Referee Smog Check Station for inspection and testing, prior to releasing the converted vehicles to the consumer, except as provided in 13 b.

   i. Installers of alternative fuel retrofit systems shall not release the converted vehicle(s) to the consumer without the issuance of a certificate of compliance for the vehicle(s) by a Bureau of Automotive Repair Referee Smog Check Station.

b. The retrofit system installer may request Air Resources Board approval to use the alternative inspection schedule for fleet installation of the same retrofit kit on more than 10 vehicles with engines of the same size. If approval is granted, the installer shall submit ten vehicles with engines from similar engine families, retrofitted with the same kit, to a Bureau of Automotive Repair Referee Station.

   i. If all ten vehicles receive a certificate of compliance, for subsequent applications of the same type, the installer need only submit every tenth retrofitted vehicle to the Bureau of Automotive Repair for inspection. For the remaining vehicles included in the alternative inspection schedule that are not submitted to the Bureau of Automotive Repair for inspection, the installer shall maintain a record of the vehicle's identification number, the vehicle's model year and make, the date of installation, and the emissions category to which the retrofitted system is certified (i.e., conventional vehicle, TLEV, LEV, or ULEV), or for heavy-duty vehicles, the credit standard to which the system is certified. The Air Resources Board may require random inspections of vehicles subject to the alternative inspection schedule.

   ii. If any of the ten vehicles fail to pass inspection, the next set of ten retrofitted vehicles shall be subject to inspection at the Bureau of Automotive Repair, until an entire group of ten passes.

~~b~~c. Installation of retrofit systems certified according to the requirements of these test procedures for 1994, ~~and~~ 1995, and 1996 model years shall be restricted to those engine families listed in the Executive Order.

ATTACHMENT C

AMENDMENTS TO THE CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE ALCOHOL OR ALCOHOL/GASOLINE FUELS

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE ALCOHOL OR ALCOHOL/GASOLINE FUELS

Adopted: April 28, 1983
Amended: March 11, 1993
Amended: November 21, 1995

Note: Changes approved by the Board on July 27, 1995, are indicated by strike-out (deletion) and underline (addition).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR SYSTEMS DESIGNED TO CONVERT MOTOR VEHICLES CERTIFIED FOR 1993 AND EARLIER MODEL YEARS TO USE ALCOHOL OR ALCOHOL/GASOLINE FUELS

The authority for these Exhaust Emission Standards and Test Procedures is found in Sections 43004 and 43006 of the California Health and Safety Code which contain the following:

> 43004. "--the standards applicable under this part for exhaust emissions for gasoline-powered motor vehicles shall apply to motor vehicles which have been modified or altered to use a fuel other than gasoline or diesel."
>
> 43006. "The state board may certify the fuel system of any motor vehicle powered by a fuel other than gasoline or diesel which meets the standards specified by Section 43004 and adopt test procedures for such certification."

I. GENERAL APPLICABILITY

"California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels" ("these test procedures" or "these procedures") are applicable to any single- or dual-fuel motor vehicle conversion system using alcohol or alcohol/gasoline fuels in lieu of the original certification fuel system for 1993 and earlier model year emission-controlled vehicles used or registered in the State of California.

A retrofit system manufacturer may apply these test procedures to certify conversion systems for 1994, and 1995, and 1996 model-year vehicles in accordance with the following implementation phase-in schedule. Each manufacturer may certify a maximum of 85 percent of its total 1994 model-year engine family conversion systems, and 45 percent of its total 1995 model-year systems, and 45 percent of its total 1996 model-year systems, according to the requirements of these test procedures and "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels." The remaining percentage of each manufacturer's certified 1994, and 1995, and 1996 model-year engine family conversion systems and all of 1996~~7~~ and subsequent model-year engine family conversion systems shall be certified according to "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems For Motor Vehicles Certified For 1994 and Subsequent Model Years and for All Model-Year Motor Vehicle Retrofit Systems Certified for Emission Reduction Credit." The percentages shall be determined from the total number of conversion systems certified and shall be met prior to the end of the ~~applicable~~ next respective calendar year. If the above referenced 85 percent maximum is exceeded for 1994 or the above referenced 45 percent maximum is exceeded for 1995 or 1996, the Executive Officer shall rescind the Executive Order for those conversion systems most recently certified which caused the percentages to be exceeded. These procedures shall not be used to

certify a retrofit system for installation on a transitional low-emission vehicle ("TLEV"), low-emission vehicle ("LEV"), or ultra-low-emission vehicle ("ULEV") or to certify a retrofit system designed to convert a vehicle to TLEV, LEV, or ULEV emission standards (as defined in Section 1960.1, Title 13, CCR). These procedures shall not be used to certify retrofits for emission reduction credits.

II. DEFINITIONS

The definitions used in these test procedures shall be the same as those in the California Exhaust Emission Standards and Test Procedures for passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines and vehicles.

The term alcohol fuel shall mean methanol, ethanol, methanol/ethanol blends, methanol/gasoline blends, or ethanol/gasoline blends for purposes of these procedures, and all provisions shall apply to methanol, ethanol, and blends unless specifically noted. However, federally approved fuels or fuel additives which comply with Section 211(f) of the Clean Air Act (42 U.S.C. 7545(f)) are not deemed alcohol fuels for the purposes of this procedure. Dual-fuel vehicle shall mean a vehicle capable of operating on either the original certification fuel or alcohol fuel, but not both concurrently.

III. GENERAL STANDARDS

In addition to all other standards or requirements imposed, any modification of an original certification-fuel motor vehicle to allow the use of alcohol fuel:

A. Shall not cause, in the operation or function of the vehicle, the emission into the ambient air of any noxious or toxic substance which may present a significant hazard to public health or welfare that is not emitted in the operation of such vehicle without such modification, except as specifically permitted by regulation; and

b. Shall not result, in the operation, function, or malfunction of the vehicle, in any unsafe condition endangering the motor vehicle, its occupants, other persons, or property in close proximity to the vehicle, in accordance with the safety requirements specified for the original vehicle.

IV. EXEMPT VEHICLES

Vehicles participating in the Department of Motor Vehicles' Methanol Fuel Experimental Program may, but are not required to, have a certified conversion system. Owners or lessees of these vehicles shall, however, annually obtain a Certificate of Compliance in accordance with the provisions of Title 13, California Code of Regulations, section 2177.

V. NON-APPLICABLE REGULATIONS

All subjects in the referenced California Exhaust Emission Standards and Test Procedures for non-alcohol-powered vehicles not directly related to exhaust or evaporative emission testing shall not be applicable to these procedures.

VI. TEST FLEET

Each applicant is required to test a limited fleet to obtain certification. Emissions tests will be conducted at an independent laboratory at the conversion device manufacturer's expense. Fleet vehicles shall be selected by the Executive Officer.

A. FLEET SELECTION

The passenger car, light-duty truck, and medium-duty vehicle[1] test fleets shall consist of three to ten vehicles for each alcohol fuel system. The number of test vehicles required will depend upon the manufacturer's application outlining the vehicles for which approval is requested, and may be reduced from three if the fuel system applies to a limited number of vehicles. Vehicles will be selected to include a wide variation in engine size from different vehicle manufacturers, and engines with unusual or sensitive emission control systems.

B. SINGLE FUEL TESTING

The following test sequence shall be used when testing a fleet vehicle for straight alcohol or alcohol blend operation:

1. Adjust vehicle to manufacturer's specifications.
2. Run one cold start CVS-75 test (baseline).
3. Install conversion system in accordance with conversion system manufacturer's instructions.
4. Run one cold start CVS-75 test on the modified vehicle using alcohol fuel.

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1. For the purposes of these procedures, 1977 and older medium-duty vehicles shall be selected and tested in accordance with the heavy-duty protocol contained in Section VII.

C. DUAL-FUEL TESTING

The following test sequence shall be used when testing a dual-fuel vehicle:

1. Adjust vehicle to vehicle manufacturer's specifications.

2. Run one cold start CVS-75 test (baseline).

3. Run one hot start CVS-72 test (baseline).

4. Install conversion system in accordance with conversion system manufacturer's instructions.

5. Run one cold start CVS-75 test using the appropriate alcohol fuel.

6. Run one hot start CVS-72 using the original certification fuel.

Dual-fuel system manufacturers may elect to delete steps 3 and 6 by substituting a cold start CVS-75 gasoline test for step 6.

The Executive Officer may require Sealed Housing Evaporative Determination (SHED) tests in addition to the required emission tests for any system that, in the judgement of the Executive Officer, may increase evaporative emissions (e.g., change in fuel tank surface area).

VII. HEAVY-DUTY VEHICLES

Approval of an alcohol fuel system for passenger cars, light-duty trucks, or 1978 and newer medium-duty vehicles can qualify that system for use on heavy-duty vehicles over 8500 pounds GVWR and 1977 and older medium-duty vehicles, provided an engineering evaluation indicates similar emissions patterns are anticipated.

If approval is sought solely for heavy-duty vehicles over 8500 pounds GVWR and/or 1977 and older medium-duty vehicles, the Executive Officer shall select engines and require tests in accordance with the provisions of Section XII of this procedure.

VIII. TEST VEHICLES

Each test vehicle shall be a California certified version having between 4,000 and 50,000 miles. In the event that a manufacturer acquires a vehicle with less than 4,000 miles, the vehicle mileage must be brought to 4,000 miles by driving the vehicle on the road, or by accumulating mileage on a chassis dynamometer.

Each test vehicle shall be subjected to a thorough diagnostic examination prior to the baseline test to detect and correct possible defects and deviations from manufacturer's specifications for emissions-related parts. Baseline emission results within applicable standards shall be taken as an indicator that the vehicle is acceptable for testing. Baseline emission results exceeding applicable standards shall be grounds for rejecting a test vehicle unless the applicant chooses to perform a second diagnostic examination. If the second diagnostic examination does not reveal a malfunction in the engine/emission control system, the vehicle shall be deemed an acceptable test vehicle. If the second diagnostic test reveals a fault or maladjustment, the vehicle shall be deemed unacceptable for test purposes. The applicant may either make repairs and retest the vehicle, or may obtain another vehicle acceptable to the staff.

Any properly equipped emission test laboratory may perform the test. Test vehicles shall be under the control of the laboratory for the entire test period. Return of a test vehicle to an applicant during the test period may invalidate test results.

After a fleet baseline test has been run on the original certification fuel (e.g., Indolene fuel for gasoline-powered vehicles), prior approval is required from the Executive Officer before any servicing, maintenance, modifications, or parts replacements are made that are not listed in the applicant's written instructions. A chemical analysis of the fuel must be performed and reported. The analysis should include a determination of purity and water content. The laboratory shall record all the above information and include it as part of the report submitted to the Executive Officer. The report must be submitted directly to the Executive Officer and must contain all related information, including failed tests. Tests performed for research and development purposes before the application is submitted need not be reported. The applicant may not edit the laboratory report but may submit additional clarifying comments or information.

IX. DATA TO BE RECORDED

Vehicle:

Make, Model and Model Year
Vehicle Identification Number or License Number
Odometer Reading
Engine Displacement

Fuel System:

Original Fuel Tank Capacity
Alcohol Fuel Tank Capacity
Type of Fuel Metering System

Tuning Specifications:

Idle RPM
Ignition Timing
Carburetor Setting (specify method used)
Other

Dynamometer Setting Specifications:

Inertia Loading
Curb Weight
Road Load Horsepower at 50 mph
Drive Wheel Tire Pressure

X. CALCULATION PROCEDURE

The final reported test results shall be computed by use of the following calculations for neat methanol or neat ethanol as a guide. Calculations for blends of ethanol or methanol will be determined based on the relative proportions of the constituents. Unburned fuel (UBF) emissions shall mean unburned original certification fuel, methanol or ethanol and all other oxygenated and non-oxygenated hydrocarbon by-products of combustion. Correction factors shall be determined and applied to UBF emissions from alcohol-fueled vehicles. In the absence of an acceptable empirically derived factor, a factor of 2.5 shall be applied.

A description of the laboratory equipment used and the emission tests performed shall be attached to any emission data submitted to the Air Resources Board. An applicant shall have the option of using a gas chromatograph (GC) or equivalent to determine concentrations of unburned fuel in exhaust or evaporative gas samples. If a flame ionization detector (FID) is used, instrument calibration procedures and corrections for FID response to oxygenated hydrocarbons must be specified. A heated sample line shall be used in conjunction with a FID for measurement of UBF from alcohol-fueled vehicles.

No allowance or trade-off shall be permitted to reduce exhaust emission levels of alcohol-fueled vehicles on the basis of low evaporative emission levels.

Meaning of Symbols

CO_{conc} = Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO_2 extraction, in ppm.

CO_{dm} = Carbon monoxide concentration of the dilution air sample as measured, in ppm.

CO_d = Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm.

CO_e = Carbon monoxide concentrations of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in ppm.

CO_{em} = Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.

CO_{mass} = Carbon monoxide emissions, in grams per test phase.

$CO_{2_{conc}}$ = Carbon dioxide concentration of the dilute exhaust sample corrected for background and water vapor, in percent.

CO_{2_e} = Carbon dioxide concentration of the dilute exhaust sample, in percent.

$CO_{2_{mass}}$ = Carbon dioxide emissions, in grams per test phase.

$Density_{CO}$ = Density of carbon monoxide is 32.97 g/ft^3 at 68°F and 760 mm. Hg pressure.

$Density_{CO_2}$ = Density of carbon dioxide is 51.85 g/ft^3 at 68°F and 760 mm. Hg pressure.

$Density_{NO_2}$ = Density of oxides of nitrogen is 54.16 g/ft^3 assuming they are in the form of nitrogen dioxide, at 68°F and 760 mm Hg pressure.

$Density_{USF}$ = Density of methanol (less the mass of oxygen) is 18.93 g/ft^3 and density of ethanol (less the mass of oxygen) is 17.74 g/ft^3 on a per carbon atom basis at 68°F and 760 mm Hg pressure.

DF = Dilution Factor

H = Absolute humidity in grains of water per pound of dry air.

HC_d = Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent.

K_H = Humidity correction factor.

N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected.

$NO_{x_{conc}}$ = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm.

NO_{x_d} = Oxides of nitrogen concentration of the dilute air as measured, in ppm.

NO_{x_e} = Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.

$NO_{x_{mass}}$ = Oxides of nitrogen emissions, in grams per test phase.

P_B = Barometric pressure, in mm Hg.

P_d = Saturated vapor pressure in mm Hg at ambient dry bulb temperature.

P_i = Pressure depression below atmospheric measured at the inlet to the positive displacement pump.

T_p = Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected, in degrees Rankine.

R_a = Relative humidity of the ambient air, in percent.

UBF_{conc} = Unburned fuel concentration for the dilute exhaust sample corrected for background, in ppm carbon equivalent, i.e., equivalent propane x 3.

UBF_e = Unburned fuel concentration of the dilute exhaust sample, in ppm carbon equivalent.

UBF_{mass} = Unburned fuel emissions, in grams per test phase.

V_{mix} = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528°R and 760 mm Hg).

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V_o = Volume of gas pumped by the positive displacement pump, in cubic feet per revolution. This volume is dependent on the pressure differential across the positive displacement pump.

Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_{ht} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_s = Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

Y_{wm} = Weighted mass emissions of each pollutant, i.e., UBF, CO, or NO_x, in grams per vehicle mile.

A. For passenger cars, medium-duty vehicles and light-duty trucks:

The mass of each emission in grams per mile is

$$Y_{wm} = (0.43Y_{ct} + 0.57\ Y_{ht} + Y_s)/7.5$$

B. The mass of each pollutant for each phase of both the cold start test and the hot start test is determined from the following:

1. Unburned fuel mass:

$$UBF_{mass} = V_{mix} \times Density_{UBF} \times (UBF_{conc}/1{,}000{,}000)$$

2. Oxides of nitrogen mass:

$$NO_{x_{mass}} = V_{mix} \times Density_{NO_2} \times K_H \times (NO_{x_{conc}}/1{,}000{,}000)$$

3. Carbon monoxide mass:

$$CO_{mass} = V_{mix} \times Density_{CO} \times (CO_{conc}/1{,}000{,}000)$$

4. Carbon dioxide mass:

$$CO_{2_{mass}} = V_{mix} \times Density_{CO_2} \times (CO_{2_{conc}}/100)$$

$$V_{mix} = \frac{V_c \times N \times (P_B - P_i) \times 528}{(760)(T_p)}$$

$$UBF_{conc} = UBF_e - HC_d\ (1-1/DF)$$

$$NO_{x_{conc}} = NO_{x_e} - NO_{x_d}\ (1-1/DF)$$

$$CO_{conc} = CO_e - CO_d\ (1-1/DF)$$

$$CO_e = (1-0.03\ CO_{2_e} - 0.000323\ R_a)CO_{em} \text{ for methanol}$$

$$CO_e = (1-0.025\ CO_{2_e} - 0.000323\ R_a)\ CO_{em} \text{ for ethanol}$$

$$CO_d = (1-0.000323\ R_a)\ CO_{dm}$$

$$K_h = \frac{1}{1-0.0047(H-75)}$$

$$H = \frac{(43.478R_a)(P_d)}{P_B - P_d \times R_a/100}$$

$$DF = \frac{11.57}{CO_{2_e} + (UBF_e + CO_e) \times 10^{-4}} \text{ for methanol}$$

$$DF = \frac{12.29}{CO_{2_e} + (UBF_e + CO_e) \times 10^{-4}} \text{ for ethanol}$$

For gasoline fuel the Y_{wm} value must be multiplied by the methane content correction factor (MCCF).

$$UBF_{wm} = Y_{wm} \times MCCF$$

UBF_{wm} = weighted mean unburned fuel mass in grams per vehicle mile after correction for methane content

The following MCCF values (or as determined by the vehicle manufacturer and approved by the ARB during certification) may be used on all gasoline tests:

Catalyst equipped passenger cars = 0.89
All other vehicles = 1.0

The applicant, if he or she so desires, may determine the actual MCCF of a fuel by using the "California Non-Methane Hydrocarbon Test Procedures" adopted May 24, 1978. For alcohol fuels, reference to "HC" in the non-methane test procedures shall mean "UBF" where appropriate. The fuel used to calibrate the flame ionization detector and method of calibration shall be specified.

The above HCCF values are valid through 1981 model year vehicles. Beginning with 1982 model year vehicles the non-methane unburned fuel emissions must be determined using non-methane instrumentation. The above factors can no longer be used. The applicant may test for total unburned fuel, but no factor will be permitted.

Example calculation of mass emission values:

a. For the "transient" phase of the cold-start test assume:

V_o = 0.29344 cu ft per revolution; N = 10.485;

R_a = 48.2%; P_b = 762 mm Hg; P_d = 22.225 mm Hg; P_i = 70 mm Hg;

T_p = 570°R; UBF_e = 105.8 ppm carbon equivalent; HO_{x_e} = 11.2 ppm;

CO_{em} = 306.6 ppm; CO_{2e} = 1.43%; HC_d = 12.1 ppm

HO_{x_d} = 0.8 ppm; CO_{dm} = 15.3 ppm.

Then, for a methanol fueled vehicle:

$$V_{mix} = \frac{(0.29344)(10.485)(762-70)(5291)}{(760)(570)} = 2555.0 \text{ cu ft per test phase}$$

$$H = \frac{(43.478)(48.2)(22.225)}{762 - (22.225 \times 48.2/100)} = 62 \text{ grains of water/pound dry air}$$

$$K_h = \frac{1}{1-0.0047\ (62-75)} = 0.9425$$

$$CO_e = (1-0.03(1.43) - 0.000323(48.2))306.6 = 288.7 \text{ ppm}$$

$$CO_d = (1-0.000323(48.2))15.3 = 15.1 \text{ ppm}$$

$$DF = \frac{11.57}{1.43 + (105.8 + 288.7) \times 10^{-4}} = 7.87$$

$$UBF_{conc} = 105.8-12.1\ (1-1/7.87) = 95.24 \text{ ppm}$$

$$UBF_{mass} = (2555)(18.93)(95.24/1,000,000) = 4.63 \text{ grams per test phase}$$

$$HO_{x_{conc}} = 11.2-0.8(1-1/7.87) = 10.50 \text{ ppm}$$

$NO_{x_{mass}}$ = (2595)(54.16)(10.50/1.000,000)(0.9424) = 1.391 grams per test phase

CO_{conc} = (288.7) - 15.1(1-1/7.87) = 275.5 ppm

CO_{mass} = (2595)(32.97)(275.5/1,000,000) = 23.57 grams per test phase

b. For the "stabilized" portion of the cold-start test assume that similar calculations result in UBF_{mass} = 0.31 grams per test phase;

$NO_{x_{mass}}$ = 1.27 grams per test phase; and

CO_{mass} = 5.98 grams per test phase.

c. For the "transient" portion of the hot-start test assume that similar calculations resulted in UBF_{mass} = 0.25 grams per test phase;

$NO_{x_{mass}}$ = 1.38 grams per test phase;

and CO_{mass} = 5.01 grams per test phase.

d. For a methanol fueled vehicle:

$$UBF_{vm} = \frac{(0.43)(3.68) + (0.57)(0.25) + 0.31}{7.50} = 0.33 \text{ grams per vehicle mile}$$

$$CO_{vm} = \frac{(0.43)(23.57) + (0.57)(5.01) + 5.98}{7.50} = 2.53 \text{ grams per vehicle mile.}$$

$$NO_{x_{vm}} = \frac{(0.43)(1.391) + (0.57)(1.38) + 1.27}{7.50} = 0.354 \text{ grams per vehicle mile}$$

XI. APPLICATION FOR APPROVAL

A. An application for approval to use alcohol fuel in a non-original, certification-fuel engine may be made by any engine, vehicle, or conversion system manufacturer.

B. An application shall be required for each model year even though the exhaust emission standards for approval of new vehicles may be the same for consecutive model years.

C. The application shall be in writing, signed by an authorized representative of the manufacturer, and shall include the following:

1. Identification and description of the vehicles for which approval is requested. The application may limit the years, makes, and models for which a system is applicable.

2. A complete description of all modifications and additions to the engine or vehicle.

3. A written specification of the recommended fuel and fuel composition including the amount of variation in composition that may be tolerated. Specifications allowing more than 1,000 ppm of water shall be accompanied by an explanation of the need for, or purpose of, such allowance.

4. Emissions data on such vehicles and engines tested in accordance with the applicable exhaust emission test procedures and standards.

5. A statement of recommended maintenance procedures, including initial installation and initial tuning, and equipment necessary to ensure that the vehicle and engine in operation conform to the specific procedures for each different make and model shall be given. A description of the program for training personnel for such maintenance and installation.

6. An agreement, that upon the Executive Officer's request, any one or more of the test vehicles will be supplied to the ARB, for such testing as may be required, or (by mutual consent between the ARB and applicant) will be made available at the manufacturer's facility for such testing. Provided, that in the latter case, it is further agreed that the instrumentation and equipment specified by the ARB will be made available for testing operations. Any testing conducted at a manufacturer's facility pursuant to this subparagraph will be scheduled as promptly as possible.

7. An agreement that a reasonable number of vehicles will be made available to the ARB for testing for such reasonable periods as may be required. These vehicles shall be selected from time to time by the Executive Officer and shall be typical of production models available for sale to the public.

8. A sample or facsimile of a proposed engine compartment label and an agreement that the modifications made in the field will be properly identified. The model number shall be permanently marked on the carburetor. A permanent label covering the following for the specific installation shall be furnished for installation on the air cleaner or any other area where it may be easily read. The label shall be set for the following:

   a. Manufacturer's name and address.

   b. Approved by the California ARB for use on _____ model year vehicles with engine size _____ in^3 to _____ in^3.

   c. Spark timing.

   d. Idle speed.

   e. Mixture adjustment (if used) including idle, cruise, and/or full throttle together with the method.

   f. Type of fuel.

   g. Date of installation.

   h. Carburetor Model No.

   i. A statement, "for vehicles over 8,500 lbs GVW only," if applicable.

   j. For dual-fuel systems, a description of any changes to the Original Equipment Manufacturer's evaporative emission-control systems.

9. An agreement that labels will be applied to the exterior of a modified vehicle adjacent to fill pipes specifying the correct fuel for each tank.

10. For retrofit systems applicable to 1994, and 1995, and 1996 model year vehicles, a complete listing of the engine families for which the manufacturer's conversion systems are designed for installation. The number of a manufacturer's 1994, and 1995, and 1996 model-year engine family retrofit systems certified according to these test procedures shall be limited according to the phase-in schedule described in the General Applicability section of these procedures.

XII. VEHICLES REQUIRING ALTERNATE TESTING

Vehicles equipped with the following systems require individual consideration and may require tests other than those described in this procedure. The Executive Officer shall make the determination of the required testing, taking into account any test plans submitted by the applicant.

Heavy-duty engines
Vehicles equipped with closed-loop feedback emission controls
Engines that have altered compression ratios
Engines of unconventional design

XIII. APPROVAL CRITERIA

A. EMISSIONS

The Executive Officer shall review the applicant's emission data and any other laboratory data available to determine the conversion system's effect on emissions. Test data from the vehicles must demonstrate that operation on alcohol fuel (modified configuration) results in no significant increase in emissions. A significant increase in a vehicle's emissions when operated on alcohol fuel shall be grounds for denial of certification even if the emissions are within applicable standards.

B. DRIVEABILITY

The Executive Officer shall evaluate the effects of the alcohol fuel conversion system on the vehicle's performance or

driveability. Cold starting and operating performance will be considered as part of the evaluation procedure. If the system degrades the driveability or vehicle performance such that owners may be tempted to adjust the engine settings or tamper with required emission control systems to improve driveability or vehicle performance, the Executive Officer may find that the alcohol fuel conversion system will increase emissions.

C. DURABILITY

If the Executive Officer has reason to believe, on the basis of an engineering evaluation, that an alcohol fuel conversion system will affect the durability of the vehicle emission control system, or the conversion system itself does not demonstrate durability equivalent to the part or system replaced or added to, he or she may find that the modification will increase emissions. The manufacturer may be required to submit durability data in order to show that the durability of the vehicle emission control system is not affected, and/or that the fuel conversion system demonstrates adequate durability.

XIV. FINAL APPROVAL

A. If, after a review of the data and other information submitted by the manufacturer, the Executive Officer determines that a modification to use alcohol fuel conforms to the procedures outlined in these regulations, the Executive Officer will issue an Executive Order of approval for such modifications.

B. The Executive Order may be issued upon such terms as the Executive Officer deems necessary to ensure that any modifications to use alcohol fuel will meet the requirements of the procedures outlined in these regulations.

C. Approval for a conversion system for a given model year is deemed as approval for all previous model years, unless otherwise specified in the Executive Order. Approval for subsequent model years may be given, after request by the applicant, if further evaluation and/or testing demonstrates that the system will meet the standards for the applicable model year.

XV. CHANGES TO CONVERSION SYSTEM AFTER APPROVAL

All changes made to the conversion system, including installation changes, must be submitted to the Executive Officer for approval. The Executive Officer may require additional testing prior to approval.

XVI. INSTALLATION REQUIREMENTS

A. Beginning January 1, 1994, installers of alternative fuel retrofit systems shall submit the converted vehicles to a Bureau of Automotive Repair Referee Smog Check Station for inspection and testing, prior to releasing the converted vehicles to the consumer, except as provided in B.

1. Installers of alternative fuel retrofit systems shall not release the converted vehicle(s) to the consumer without the issuance of a certificate of compliance for the vehicle(s) by a Bureau of Automotive Repair Referee Smog Check Station.

B. The retrofit system installer may request Air Resources Board approval to use the alternative inspection schedule for fleet installation of the same retrofit kit on more than 10 vehicles with engines of the same size. If approval is granted, the installer shall submit ten vehicles with engines from similar engine families, retrofitted with the same kit, to a Bureau of Automotive Repair Referee Station.

i. If all ten vehicles receive a certificate of compliance, for subsequent applications of the same type, the installer need only submit every tenth retrofitted vehicle to the Bureau of Automotive Repair for inspection. For the remaining vehicles included in the alternative inspection schedule that are not submitted to the Bureau of Automotive Repair for inspection, the installer shall maintain a record of the vehicle's identification number, the vehicle's model year and make, the date of installation, and the emissions category to which the retrofitted system is certified (i.e., conventional vehicle, TLEV, LEV, or ULEV), or for heavy-duty vehicles, the credit standard to which the system is certified. The Air Resources Board may require random inspection of any vehicles subject to the alternative inspection schedule.

ii. If any of the ten vehicles fail to pass inspection, the next set of ten retrofitted vehicles shall be subject to inspection at the Bureau of Automotive Repair, until an entire group of ten passes.

BC. Installation of retrofit systems certified according to the requirements of these test procedures for 1994, and 1995, and 1996 model years shall be restricted to those engine families listed in the Executive Order.

ATTACHMENT D

AMENDMENTS
TO ARTICLE 5, CHAPTER 1, DIVISION 3, TITLE 13
OF THE CALIFORNIA CODE OF REGULATIONS AND
TO SECTIONS 2030 AND 2031 OF ARTICLE 5

AMENDMENTS TO ARTICLE 5, CHAPTER 1, DIVISION 3, TITLE 13
OF THE CALIFORNIA CODE OF REGULATIONS
AND SECTION 2030 OF ARTICLE 5

Approval of Systems Designed to Convert Motor Vehicles to Use Fuels
Other Than the Original Certification Fuel or
to Convert Motor Vehicles for Emission Reduction Credit

Adopted: April 28, 1975
Amended: March 16, 1977
Amended: May 21, 1981
Amended: June 2, 1983
Amended: October 18, 1984
Amended: May 7, 1993
Amended: November 21, 1995

Note: Changes approved by the Board on July 27, 1995, are indicated by strike-out (deletion) and underline (addition).

Article 5. Approval of Systems Designed to Convert Motor Vehicles to Use Fuels Other Than the Original Certification Fuel or to Convert Motor Vehicles for Emission Reduction Credit

2030. Liquefied Petroleum Gas or Natural Gas Retrofit Systems.

a) Applicable Standards and Test Procedures.

The standards and test procedures for approval of systems designed to convert 1993 and earlier model year motor vehicles to use liquefied petroleum gas or natural gas fuels are contained in "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels" adopted by the State Board on April 16, 1975, as amended March ~~11, 1993~~ November 21, 1995. The standards and test procedures for approval of systems designed to convert 1994 and subsequent model year motor vehicles to use liquefied petroleum gas or natural gas fuels are contained in "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years and for all Model Year Motor Vehicle Retrofit Systems Certified for Emission Reduction Credit," adopted by the State Board March 11, 1993, as amended November 21, 1995. At the option of the retrofit system manufacturer, the standards and test procedures for approval of systems designed to convert 1994 and subsequent model year vehicles to use liquefied petroleum gas or natural gas fuels may be used for approval of systems designed to convert 1993 and earlier model year motor vehicles to use liquefied petroleum gas or natural gas fuels in lieu of the "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels."

b) Implementation Phase-In Schedule.

Notwithstanding subsection (a), a retrofit system manufacturer may apply "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels" to certify retrofit systems for 1994 and 1995 model-year vehicles in accordance with the following implementation phase-in schedule. Each manufacturer may certify a maximum of 85 percent of its total 1994 model-year engine family retrofit systems, ~~and~~ 45 percent of its total 1995 model-year systems, and 45 percent of its total 1996 model-year systems, according to the requirements of these test procedures and "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels", adopted by the State Board on April 28, 1983, as amended March ~~11, 1993~~ November 21, 1995. The remaining percentage of each manufacturer's certified 1994, ~~and~~ 1995, and 1996 model-year engine family retrofit systems and all of 1996~~7~~ and subsequent model-year engine family retrofit systems shall be certified according to "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems For Motor Vehicles Certified For 1994 and Subsequent Model Years and for all Model Year Motor Vehicle Retrofit Systems Certified for Emission Reduction

Credit." The percentages shall be determined from the total number of retrofit systems certified and shall be met prior to the end of the ~~applicable~~ next respective calendar year. "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels" shall not be applied to certify a retrofit system for installation on a transitional low-emission vehicle ("TLEV)", low-emission vehicle ("LEV)", or ultra-low emission vehicle ("ULEV)" or to certify a retrofit system designed to convert a vehicle to TLEV, LEV, or ULEV emission standards (as defined in Section 1960.1, Title 13, California Code of Regulations), or to certify a retrofit system for emission reduction credits.

NOTE: Authority cited: Sections 39515, 39600, 39601 and 43006, Health and Safety Code. Reference: Sections 43000, 43004, 43006, 43008.6, 43013 and 43108, Health and Safety Code; and Sections 27156, 38391 and 38395, Vehicle Code.

AMENDMENTS TO ARTICLE 5, CHAPTER 1, DIVISION 3, TITLE 13
OF THE CALIFORNIA CODE OF REGULATIONS
AND SECTION 2031 OF ARTICLE 5

Approval of Systems Designed to Convert Motor Vehicles to Use Fuels
Other Than the Original Certification Fuel or
to Convert Motor Vehicles for Emission Reduction Credit

Adopted: June 2, 1983
Amended: May 7, 1993
Amended: November 21, 1995

Note: Changes approved by the Board on July 27, 1995, are indicated by strike-out (deletion) and underline (addition).

Article 5. Approval of Systems Designed to Convert Motor Vehicles to Use Fuels Other Than the Original Certification Fuel or to Convert Motor Vehicles for Emission Reduction Credit

2031. Alcohol or Alcohol/Gasoline Fuels Retrofit Systems.

a) Applicable Standards and Test Procedures.

The standards and test procedures for approval of systems designed to convert 1993 and earlier model year motor vehicles to use alcohol or alcohol/gasoline fuels in lieu of the original certification fuel system are contained in "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels," adopted by the State Board April 28, 1983, as amended ~~March 11, 1993~~ November 21,1995. The standards and test procedures for approval of systems designed to convert 1994 and subsequent model year motor vehicles to use alcohol or alcohol/gasoline fuels are contained in "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years and for all Model Year Motor Vehicle Retrofit Systems Certified for Emission Reduction Credit," adopted by the State Board March 11, 1993, as amended November 21, 1995. At the option of the retrofit system manufacturer, the standards and test procedures for approval of systems designed to convert 1994 and subsequent model year motor vehicles to use alcohol or alcohol/gasoline fuels may be used for approval of systems designed to convert 1993 and earlier model year motor vehicles to use alcohol or alcohol/gasoline fuels in lieu of the "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels."

b) Implementation Phase-In Schedule.

Notwithstanding subsection (a), a retrofit system manufacturer may apply "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels" to certify retrofit systems for 1994 and 1995 model-year vehicles in accordance with the following implementation phase-in schedule. Each manufacturer may certify a maximum of 85 percent of its total 1994 model-year engine family retrofit systems, ~~and~~ 45 percent of its total 1995 model-year systems, and 45 percent of its total 1996 model-year systems, according to the requirements of these test procedures and the "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Liquefied Petroleum Gas or Natural Gas Fuels," adopted by the State Board on April 16, 1975, as amended ~~March 11, 1993~~ November 21,1995. The remaining percentage of each manufacturer's certified 1994, ~~and~~ 1995, and 1996 model-year engine family retrofit systems and all of 1996~~7~~ and subsequent model-year engine family retrofit systems shall be certified according to "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems For Motor Vehicles Certified For 1994 and Subsequent Model Years and for all Model Year Motor Vehicle Retrofit Systems Certified for Emission Reduction

Credit." The percentages shall be determined from the total number of retrofit systems certified and shall be met prior to the end of the ~~applicable~~ next respective calendar year. "California Exhaust Emission Standards and Test Procedures for Systems Designed to Convert Motor Vehicles Certified for 1993 and Earlier Model Years to Use Alcohol or Alcohol/Gasoline Fuels" shall not be applied to certify a retrofit system or installation on a transitional low-emission vehicle ("TLEV"), low-emission vehicle ("LEV"), or ultra-low-emission vehicle ("ULEV") or to certify a retrofit system designed to convert a vehicle to TLEV, LEV, or ULEV emission standards (as defined in Section 1960.1, Title 13, California Code of Regulations), or to certify a retrofit system for emission reduction credits.

NOTE: Authority cited: Sections 39515, 39600, 39601 and 43006, Health and Safety Code. Reference: Sections 43000, 43004, 43006, 43008.6, 43013 and 43108, Health and Safety Code; and Sections 27156, 38391 and 38395, Vehicle Code.

SECTION 1956.9, TITLE 13, CCR

Optional Exhaust Emission Standards for Retrofitted Heavy-Duty Engines

Adopted: November 21, 1995

SECTION 1956.9, TITLE 13, CCR

§ 1956.9 Optional Exhaust Emission Standards for Retrofitted Heavy-Duty Engines

1973 and later model-year heavy-duty engines that have been retrofitted to produce emissions less than the original certification emission level may be certified to optional emission standards as follows:

(a)(1) Total Hydrocarbons

(X - n x 0.2) grams per brake horsepower-hour

where X = 0.75 x new engine total hydrocarbon standard for the engine's model year, with the further requirement that X is rounded down to the nearest lower 0.2 grams per brake horsepower-hour increment; and where n is an integer such that n x 0.2 is greater than or equal to zero. For diesel engines, X = 0.75 x original emission certification value for the engine's model year. For engines originally certified to a combined hydrocarbon plus oxides of nitrogen standard, X = 0.75 x original engine certification standard pro-rated by the hydrocarbon portion of the original emission certification level. If the original emission certification levels are not available, the hydrocarbon baseline standard shall be pro-rated by the hydrocarbon and oxides of nitrogen values of the next later model year with separate hydrocarbon and oxides of nitrogen standards.

(a)(2) Non-methane Hydrocarbons

For engines originally certified to an optional non-methane hydrocarbon standard,

(X - n x 0.2) grams per brake horsepower-hour

where X = 0.75 x new engine non-methane hydrocarbon standard for the engine's model year, with the further requirement that X is rounded down to the nearest lower 0.2 grams per brake horsepower-hour increment; and where n is an integer such that n x 0.2 is greater than or equal to zero. For diesel engines, X = 0.75 x original emission certification value for the engine's model year.

(b) Carbon Monoxide

(X - n x 5.0) grams per brake horsepower-hour

where X = 0.75 x new engine carbon monoxide standard for the engine's model year, with the further requirement that X is rounded down to the nearest lower 5 grams per brake horsepower-hour increment; and where n is an integer such that n x 5.0 is greater than or equal to zero. For diesel engines, X = 0.75 x original emission certification value for the engine's model year.

(c) Oxides of Nitrogen

(X - n x 0.5) grams per brake horsepower-hour

where X = 0.75 x new engine oxides of nitrogen standard for the engine's model year, with the further requirement that X is rounded down to the nearest lower 0.5 grams per brake horsepower-hour increment; and where n is an integer such that n x 0.5 is greater than or equal to zero. For engines originally certified to a combined hydrocarbon plus oxides of nitrogen standard, X = 0.75 x original engine certification standard, pro-rated by the oxides of nitrogen portion of the original emission certification level. If the original emission certification levels are not available, the oxides of nitrogen baseline standard shall be pro-rated by the hydrocarbon and oxides of nitrogen values of the next later model year with separate hydrocarbon and oxides of nitrogen standards.

(d) Particulate Matter

(X - n x 0.05) grams per brake horsepower-hour

where X = 0.75 x new diesel engine particulate matter standard for the engine's model year, with the further requirement that X is rounded down to the nearest lower 0.05 grams per brake horsepower-hour increment; and where n is an integer such that n x 0.05 is greater than or equal to zero. For diesel engines that were not originally certified to a particulate matter emission standard, X = 0.75 x 0.6 grams per brake horsepower-hour. Gasoline engines may not be certified to an optional exhaust emission standard for particulate matter.

(e) 1972 and earlier model year engines may be certified to credit standards as described in (a)(1), (b), (c), and (d) using 1973 model year new engine emission standards as the basis for calculating "X."

(f) The test procedures for determining compliance with an optional standard shall be the test procedure used to originally certify the engine. To certify to an optional emission standard, a retrofitted engine must meet all of the requirements of "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years and for all Model Year Motor Vehicle Retrofit Systems Certified for Emissions Reduction Credit," adopted March 11, 1993, as amended November 21, 1995, which is incorporated by reference herein.

Note: Authority cited: Sections 43701 (b) and (c), Health and Safety Code Reference: Sections 39002, 39003, 43000, 43004, 43006, 43008, 43013, and 43108, Health and Safety Code; and Sections 27156, 38391 and 38395, Vehicle Code.