State of California
AIR RESOURCES BOARD

Staff Report: Initial Statement of Reasons
for Proposed Rulemaking

PUBLIC HEARING TO CONSIDER THE ADOPTION OF ONBOARD REFUELING VAPOR RECOVERY STANDARDS AND TEST PROCEDURES AND MODIFICATIONS TO EVAPORATIVE TEST PROCEDURES APPLICABLE TO 1998 AND SUBSEQUENT MODEL-YEAR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

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Agenda Item No.: 95-

A. INTRODUCTION

Evaporative hydrocarbon (HC) emissions associated with the transfer of fuel from underground storage tanks (USTs) to motor vehicles are known as refueling emissions. The sources of these emissions include displaced vapor from the vehicle fuel tank, vapor loss from the fuel, fuel spitback, fuel spillage, and any losses from the UST or leaks in the fueling system as a result of the refueling process.

The 1990 federal Clean Air Act (CAA) amendments require the implementation of two distinct refueling emission control measures. First, Section 182(b)(3) requires owners or operators of gasoline dispensing systems to incorporate gasoline vapor recovery systems (Stage II) in ozone non-attainment areas to reduce the emissions generated by the refueling of motor vehicles. Second, Section 202(a)(6) requires the United States Environmental Protection Agency (U.S. EPA) to promulgate vehicle-based or onboard refueling vapor recovery (ORVR) standards for the control of the same refueling emissions. The 1990 CAA amendments also state that once ORVR standards are promulgated, non-attainment areas classified as moderate for ozone are exempt from the Stage II requirements of Section 182(b)(3). In addition, once ORVR control systems are in widespread use throughout the vehicle fleet, the Administrator of the U.S. EPA may exempt areas classified as serious, severe, or extreme from the Stage II requirements.

The U.S. EPA Administrator signed the final rule for ORVR regulations on January 24, 1994. In response to the U.S. EPA's rule and the requirements of the CAA, the staff of the California Air Resources Board (ARB) investigated the application of ORVR in California and its effect on the California Stage II requirements. In order to align with the U.S. EPA's ORVR rule and reduce manufacturers' testing burden, the staff is proposing the adoption of ORVR standards and test procedures with certain minor modifications.

The adoption of ORVR test procedures require modifications to the California evaporative test procedures due to common preconditioning steps. In addition, manufacturers have requested greater alignment of the California and federal evaporative test procedures to ease testing burden. The staff has incorporated the ORVR and evaporative alignment changes into the proposed California evaporative test procedure.

In addition to examining the ORVR standards and test procedures, the staff also reviewed the need for changes to the vehicle fill-pipe specifications. The changes were initially considered to improve the vapor collection efficiency of certain Stage II systems. However, the adoption of the ORVR regulations would negate the need for the changes to the fill-pipe due to the design changes initiated by an ORVR system.

II. BACKGROUND

A. Stage II Vapor Recovery

Vapor recovery control applied at the gasoline dispensing facility during bulk fuel drops into the UST is referred to as Stage I and during the refueling of vehicles is referred to as Stage II. Both work on the principle that as fuel is dispensed, the displaced vapor is recovered and routed back to replace the fuel being dispensed from the fuel truck or UST. The basic premise of Stage II is to capture the vapor expelled from the vehicle's fuel tank during refueling and return it to the UST to replace the void left by the liquid that is dispensed into the vehicle. This process not only provides a means of control at the vehicle's fill-pipe but also helps maintain a state of equilibrium in the UST. A large portion of the captured vapor is eventually returned to a gasoline blending facility and used in fuel formulation.

California currently maintains effective control of vehicle refueling emissions with Stage II vapor recovery systems. These systems were first required and used for control of refueling emissions in 1974 within the San Diego and Bay Area Air Quality Management Districts. By 1980, Stage II systems were in widespread use in the metropolitan areas of California. Statewide Stage II requirements were subsequently adopted in 1989 for the control of benzene emissions associated with refueling. The staff estimates that 95 percent of the total gasoline sales in California are through Stage II nozzles. Only extremely low sales volume stations and dedicated off-road refueling sources are currently uncontrolled. With regard to nationwide requirements, Stage II vapor recovery is only required in ozone non-attainment areas.

The in-use efficiencies of California Stage II systems have been measured in the range of 86-92 percent in districts which have an annual enforcement program. A review of a U.S. EPA technical guidance document supports these findings.(1) These efficiency measurements include the coverage of transfer emissions (losses at the nozzle/fill-pipe interface) and breathing losses (losses from the vent pipe of the UST). Stage II-specific regulations, to improve the efficiency of Stage II systems, are being developed and scheduled to be presented to the Board in summer 1995.

B. Onboard Refueling Vapor Recovery

ORVR systems are similar to Stage II vapor recovery systems in that both capture the fuel tank vapors displaced during the refueling of vehicles. However, the ORVR system routes the captured vapor to an onboard canister instead of the UST. The onboard captured vapor is then recycled as a fuel source by routing the vapor to the vehicle's engine for use in combustion. Unlike Stage II systems, ORVR systems do not help maintain a state of liquid/vapor equilibrium in the UST. In fact, in some cases, an ORVR system may upset the equilibrium of a Stage II system. The effects of ORVR/Stage II interaction are discussed in the Discussion section.

In a U.S. EPA report released on August 8, 1984, titled "Evaluation of Air Pollution Regulatory Strategies for Gasoline Marketing Industry," it was concluded that ORVR control of refueling emissions was a feasible and desirable option. A Federal Register notice published on August 19, 1987 announced the U.S. EPA's plan to implement ORVR standards and test procedures. However, the National Highway Traffic Safety Administration (NHTSA) released a report in July of 1991 indicating unresolved safety issues arising from ORVR systems. Based on the NHTSA report and subsequent meetings with the public, the U.S. EPA released a public notice on April 15, 1992, stating its intentions not to implement onboard control of refueling emissions due to the safety issues.

Subsequent to the U.S. EPA's 1992 announcement, several parties filed petitions for review with the U.S. Court of Appeals for the District of Columbia. The court ruled that the U.S. EPA was mandated by section 202(a)(6) of the CAA to promulgate ORVR standards. Shortly thereafter, the U.S. EPA reopened the ORVR item comment period and held a public hearing on July 22, 1993 to obtain comments on their ORVR rulemaking efforts. In November of 1993, NHTSA released a report stating that ORVR test procedure changes, recent technological advancements, and other U.S. EPA regulatory changes reduced the safety concerns associated with ORVR systems. The final rule for ORVR standards and test procedures was published in the April 6, 1994, Federal Register notice of final rulemaking, requiring implementation to begin in the 1998 model year.(2)

The U.S. EPA final rule requires that 40 percent of the 1998 model-year passenger cars have ORVR systems, 80 percent in 1999, and 100 percent in 2000. Light-duty trucks, less than 6000 pounds gross vehicle weight rating (GVWR), begin the same implementation schedule beginning with the 2001 model-year, and medium-duty vehicles, 6001-8500 pounds GVWR, begin in the 2004 model year. Heavy-duty vehicles, with a GVWR greater than 8500 pounds, are exempt from the refueling standards.

The U.S. EPA estimates that the in-use efficiency of ORVR systems will be 97 percent in ozone non-attainment areas. The high efficiency rate is attributed not only to the stringency of the test procedure, but to other non-attainment area requirements such as the application of enhanced Inspection/Maintenance programs, the sophistication of onboard diagnostics, and commercial fuel volatility limits. The efficiency estimates do not include the impact of Stage II systems (whether they be positive or negative).

C. Staff Review of ORVR

Because California has statewide coverage of refueling emissions through the use of Stage I and Stage II controls, the ARB staff investigated the effects of adopting ORVR regulations in relation to Stage I and Stage II systems. Staff provided three informational mailings and conducted two public workshops. The ARB staff initially estimated that increases in emissions would occur from refueling operations when allowing ORVR-equipped vehicles to certify in California due to reduced vapor recovery efficiencies and interactions with the current Stage II systems. These initial findings prompted staff to recommend that ORVR systems not be required in the state of California. This recommendation was proposed in a February 9, 1994 mailing and discussed at a workshop on March 15, 1994.(3) Since that workshop, additional research and information indicate that the adverse effects are less than originally estimated and the interaction effect may be controlled with Stage I and Stage II certification and test procedure changes. Thus, to accommodate consistent vehicle design for all fifty states and to reduce testing burdens for vehicle manufacturers, the ARB staff now proposes the adoption of the U.S. EPA's ORVR standards and test procedures, with minor modifications to address California-specific concerns.

D. Evaporative Test Procedure Modifications

The ORVR test procedure is linked to the evaporative test procedure through common canister and vehicle preconditioning steps. A few modifications to the evaporative test procedures are necessary to align the ORVR and evaporative test procedures. The changes are mostly text additions allowing the preconditioning of integrated and non-integrated refueling canisters.

In addition, the ARB and the U.S. EPA staffs have worked cooperatively to align the California and federal evaporative test procedures and to resolve any remaining technical issues. Vehicle manufacturers have requested that the U.S. EPA and the ARB align their evaporative procedures to make vehicle certification testing less costly and burdensome. Both agencies have worked together and with Industry to formulate a nearly identical evaporative test procedure while still maintaining the necessary stringency needed for California evaporative emission control. The staff has incorporated the ORVR and evaporative alignment changes into the California evaporative test procedure.

E. Fill-Pipe Specification

The staff initially proposed changes to the vehicle fill-pipe specifications, as part of this regulatory item at the March 15, 1994 workshop. The changes were designed to improve the efficiency of Stage II vapor recovery systems and included specifications for the location of the fuel tank vent within the fill-pipe and a continuation of the leaded restrictor plate requirement. However, because of the expected design requirements of ORVR systems, these changes would no longer be necessary on an ORVR-equipped vehicle. Therefore, staff is not proposing any changes to the fill-pipe specifications at this time. If the Board determines that ORVR systems shall not be required in California, staff would return with fill-pipe specification changes to improve Stage II efficiency.

Initially, the ARB was also considering fill-pipe changes to prevent the misfueling of methanol into a gasoline-fueled vehicle. However, in a consensus reached at the California Energy Commission workshop on December 13, 1993, between fuel retailers, vehicle manufacturers, and nozzle equipment manufacturers, methanol will be dispensed through a standard unleaded nozzle with material changes and some type of dispensing unit access restriction. The methanol dispensing would require a special key, personal identification number, notched ignition key, etc., to be inserted to authorize refueling. The final accessing method will be determined at a later date. Thus, staff does not propose any changes in the fill-pipe design at this time to accommodate methanol fuel.

Future fill-pipe specification changes may be necessary to further minimize Stage II/ORVR interactions. One possible change would involve a "smart nozzle" which would recognize an ORVR-equipped vehicle. Staff will continue to investigate the Stage II/ORVR interaction issue. A proposed ARB research contract will investigate Stage II/ORVR interaction effects and is expected to begin in the fall of 1996. If staff determines that a "smart" mechanism between the refueling nozzle and vehicle fill-pipe is necessary, staff will propose fill-pipe specifications to accommodate the proposed nozzle design in a future rulemaking.

III. SUMMARY OF RECOMMENDED ACTION

The staff recommends that the Board add a new section 1978 to Title 13, California Code of Regulations (CCR), titled "Standards and Test Procedures for Motor Vehicle Onboard Refueling Vapor Recovery" (Appendix A) to incorporate standards and test procedures for ORVR. The staff also recommends the U.S. EPA's ORVR standards and test procedures, with modifications, be incorporated into the "California Onboard Refueling Emissions Standards and Test Procedures for 1998 and Subsequent Model Motor Vehicles" (Appendix B). In addition, the staff recommends the Board amend section 1976, Title 13, CCR (Appendix C), and the incorporated "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Vehicles" (Appendix D) to accommodate the text changes needed for the alignment of the ORVR test procedure sequence. A brief description of the refueling standards and requirements is provided below. More detailed descriptions, including the minor differences between the U.S. EPA and proposed ARB procedures, are included in section IV "Discussion."

The staff also recommends that the Board amend the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Vehicles" to align the California procedure with the U.S. EPA evaporative procedure.

Table 1

ORVR Model Year Phase-In Schedule

Class of Vehicle	40% Fleet	80% Fleet	100% Fleet
Passenger Cars	1998	1999	2000
Light-Duty Trucks	2001	2002	2003
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)	2004	2005	2006

A. Refueling Standards and Applicability

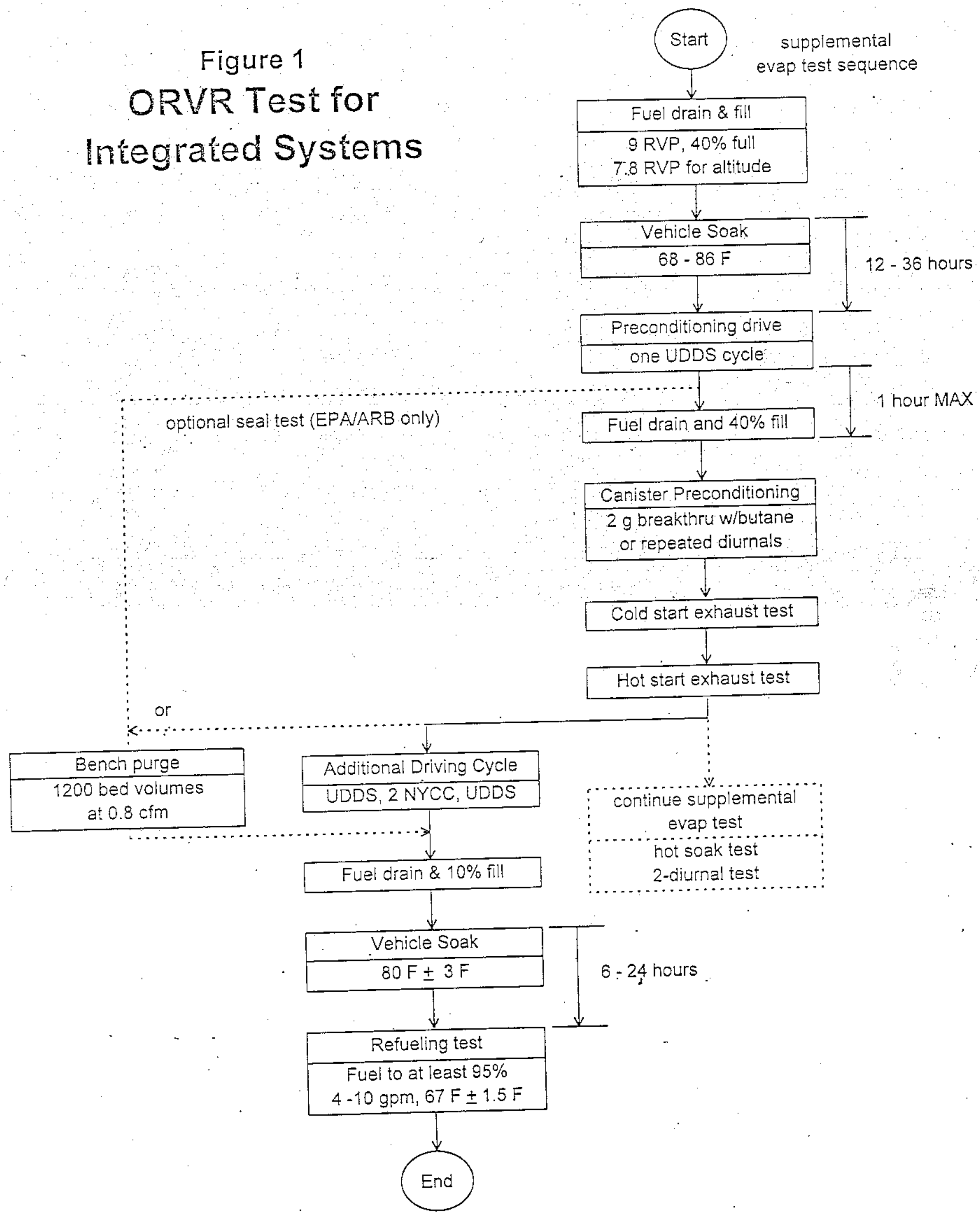
A 0.20 grams per gallon refueling emission standard is proposed for all gasoline, diesel, alcohol, fuel-flexible, and hybrid electric fueled vehicles with a 8500 pound or less GVWR. As shown in Table 1, a three year phase-in schedule of 40, 80, and 100 percent will begin with the 1998 model-year for passenger cars, with the 2001 model-year for light-duty trucks and medium-duty vehicles from 0-6000 pounds GVWR, and 2004 model-year for medium-duty vehicles from 6001-8500 pounds GVWR. The standard does not apply to medium-duty or heavy-duty vehicles with a GVWR greater than 8,500 pounds. The rule includes test procedures for both "integrated" and "non-integrated" ORVR/evaporative systems. Although the refueling test is an independent test, it is in series with the supplemental evaporative emissions test sequence. It applies to all gasoline-, diesel-, and alcohol-fueled vehicles, but includes a provision to exclude inherently low-emitting vehicle/fuel combinations. Small volume manufacturers are given an extension for the phase-in of ORVR in their passenger cars until the model year 2000.

B. Refueling Test Requirements

Staff is proposing that the U.S. EPA's refueling test and associated preconditioning steps be incorporated into Title 13, CCR, as an independent test. California's existing enhanced evaporative test procedure would be modified to include procedures to allow the ORVR test to be conducted in sequence with the supplemental portion of the evaporative test. Because of the inherently different designs of integrated and non-integrated systems (Discussion, Section B), the preconditioning steps for these two types of ORVR systems will vary.

While several options for the placement of the refueling test within the scheme of the evaporative emissions test procedure were considered, the U.S. EPA adopted the sequence as shown in Figure 1 for integrated systems. The sequencing of the refueling test allows sufficient time to fully purge the evaporative canister, and therefore allows the

Figure 1
ORVR Test for Integrated Systems



practical use of an integrated refueling/evaporative control system. The canister purging and loading steps will be consistent with the procedures described in the U.S. EPA and California supplemental evaporative test procedures.

Since non-integrated ORVR systems do not use the same canister as the vehicle's evaporative emissions control system, the refueling canister only holds vapors emitted during refueling episodes. A preconditioning drive to reduce the fuel level down to 85 percent of the fuel tank capacity is required prior to the refueling test. The non-integrated refueling test sequence is shown in Figure 2.

The actual refueling test steps are common to both integrated and non-integrated systems. The refueling test would follow these steps: a) disconnect the vapor line from the fuel tank to the canister, b) drain the fuel tank, c) refuel with test fuel to 10 percent of the nominal tank capacity, d) soak the vehicle for six to 24 hours at 80°F (±3°F), e) reconnect the vapor line, and f) refuel the vehicle with test fuel at a rate of 9.8 (±0.3) gallons per minute at 67°F (±1.5°F) in a sealed enclosure while measuring emissions (fueling is terminated at automatic shut-off after at least 85 percent of the nominal tank capacity has been dispensed).

C. Evaporative Test Procedure Modifications

In addition to the ORVR test sequencing changes, the staff has worked extensively with the U.S. EPA and Industry to align the California procedure with the federal evaporative procedure to ease manufacturers' testing burden. The staff is also proposing clarification and technical changes to the California evaporative test procedures. These changes are primarily text additions or deletions, or formula modifications recommended by Industry to improve the technical soundness of the test. The modifications will not affect the stringency of the evaporative procedure or increase the cost of evaporative testing.

IV. DISCUSSION

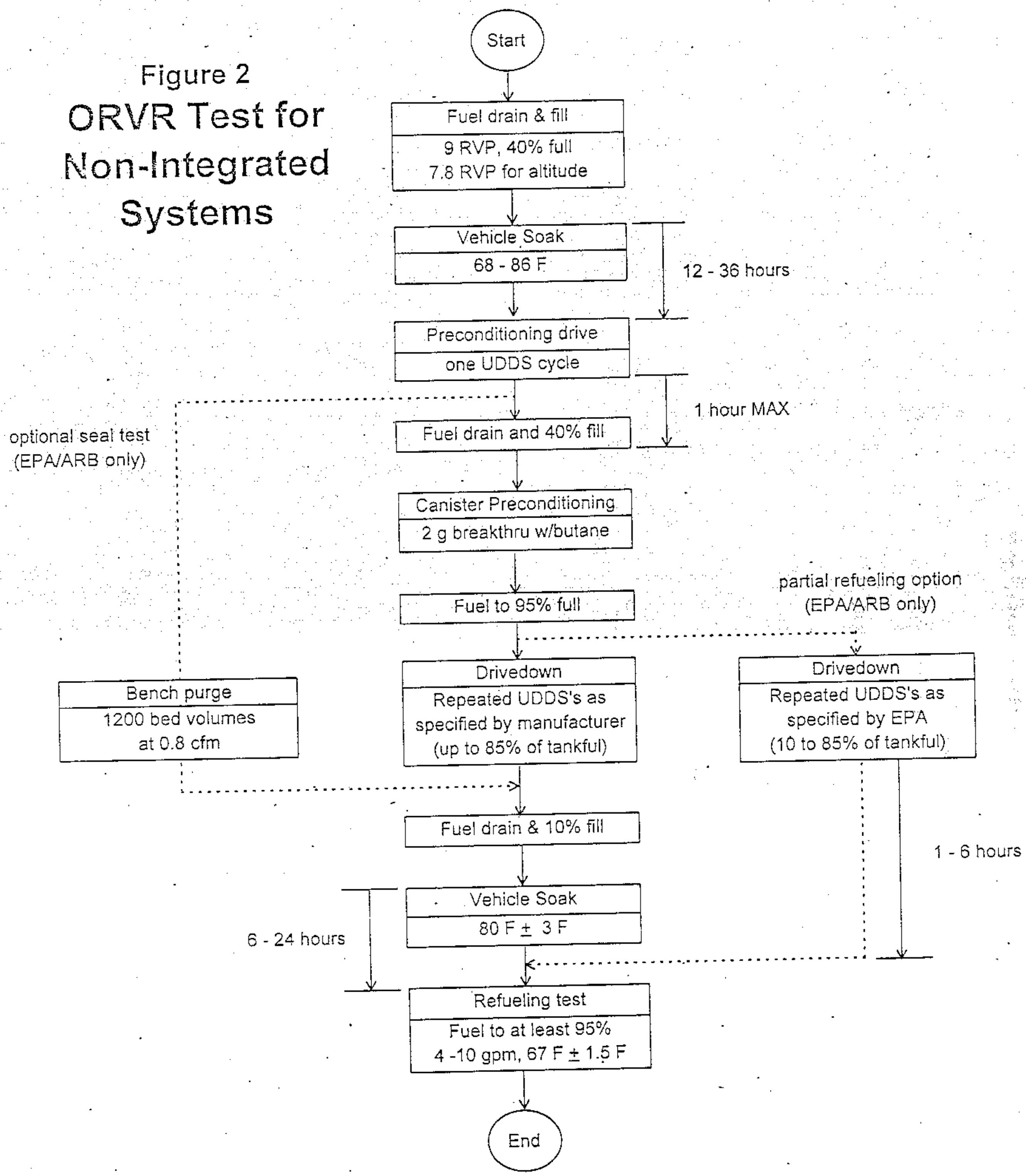
The development of the proposed regulations has been influenced primarily by the potential interaction effects of Stage II and ORVR systems. Consequently, following a discussion on the "basics" of Stage II and ORVR systems, most of the discussion focuses on these interaction effects. This is followed by a discussion of the proposed certification refueling test.

A. Stage II Vapor Recovery

There are two basic types of Stage II vapor recovery systems. These are known as balance and assist. Both systems work on the principle that as liquid fuel is dispensed from the UST it is replaced with HC vapors generated during the refueling process. The balance system uses the pressure difference between the vehicle fuel tank and the UST during refueling to drive the vapors into the vapor recovery stream. As the vehicle tank is filled, the vapors are routed through the fuel tank vent tube into the vehicle fill-pipe and then into the bellows of the Stage II

Figure 2

ORVR Test for Non-Integrated Systems



vapor recovery nozzle. This process requires a seal at the nozzle/fill-pipe interface. A vent pipe on the UST also allows air to flow in or vapor to flow out of the UST as the liquid drawdown occurs. This process can lead to breathing losses (the U.S. EPA refers to them as emptying losses) out of the open vent pipe as fuel vaporization occurs. The balance system currently represents 95 percent of the Stage II systems that exist in California.

The remaining five percent of the Stage II systems are represented by assist systems. Assist systems actively draw vapors from the vehicle fill-pipe as refueling occurs by artificially creating a vacuum. The slight vacuum eliminates the requirement for a tight seal at the fill-pipe/nozzle interface, however, many assist systems still provide a close fit to improve efficiency. The newest types of assist systems, bootless nozzle systems, are becoming popular due to their resemblance to non-Stage II nozzles and their user friendliness. The primary concern with assist systems at this time is the possibility of drawing more vapor (HC and air) back to the UST as compared with the volume of fuel dispensed, i.e., a vapor/liquid ratio greater than 1.0. Some of the assist systems come equipped with vapor processors to burn off excess vapor. Excess vapor can result in increased pressure in the UST which can lead to HC releases (fugitive emissions) to the atmosphere through leaks in the Stage II system.

B. Onboard Refueling Vapor Recovery

ORVR control of refueling vapors utilizes a charcoal canister located on the vehicle to capture the vapors expelled from the fuel tank during the refueling process. The routing of the vapor to the canister requires a few hardware modifications to the vehicle. First, a seal must be established at the fill-pipe to ensure the vapor displaced from the fuel tank and the vapor liberated from the dispensing fuel are drawn into the fuel tank and not emitted at the fill-pipe outlet. Second, the fuel tank vent tube must be rerouted from the vehicle fill-pipe to the canister.

There are two basic types of ORVR systems, integrated and non-integrated. Integrated systems would use the same canister for refueling and evaporative emissions, while the non-integrated systems have separate vapor storage units. The automotive manufacturers will likely install integrated systems since they represent a simple addition to the existing evaporative systems. The design of the system must allow the canister to store and purge both the evaporative and refueling vapors during the many combinations of vehicle parking and driving events.

Non-integrated ORVR systems would use an independent vapor collection system. The vapor storage unit would be separate from the vehicle's evaporative system and would likely consist of an additional carbon canister. While not likely, an alternative control technology may be used, such as a flexible fuel tank bladder. In addition to a separate canister, separate purge lines will be needed to purge the stored vapor into the vehicle's fueling system for reburning in the engine.

Both types of ORVR systems would be designed to capture the vapor that is forced out of the fuel tank during refueling by establishing a seal at the vehicle's fill-pipe. The two types of designs being considered for use with ORVR systems are mechanical and liquid seals. A mechanical seal consists of a direct "leak-tight" physical connection between the fill-pipe and the nozzle. Although mechanical seals have a high theoretical efficiency, they would be prone to tampering and damage which reduce their in-use efficiency. In addition, a pressure relief valve would need to be incorporated as part of the system to prevent damage to the fuel tank or other components if overpressurization occurred. Because of the added complexity and susceptibility to tampering and other damage associated with the mechanical seal, it is likely most vehicle manufacturers will opt for the liquid seal design.

A liquid seal uses the fuel that is being dispensed as the barrier to prevent vapor from escaping from the vehicle's fill-pipe, analogous to a typical sink drain. The major concern of liquid seals is their propensity to cause air entrainment. The venturi effect created in the fill-pipe during refueling will "pull" in air from the opening of the vehicle's fill-pipe. Air entrainment can increase the quantity of vapor routed to the canister by 25 percent. However, this apparent drawback of liquid seals is relatively minor compared to its advantages, such as its simplicity, low cost, and expected low failure and tampering rates.

C. ORVR and Stage II Vapor Recovery Interactions

When an ORVR-equipped vehicle is refueled at a Stage II-equipped station, the vehicle's ORVR system is expected to capture the vast majority of the refueling vapor generated. Thus, the dispensed fuel will be replaced with air ingested through the UST vent pipe, leaks in the system, or dispensing nozzle. In this case, the station's dispensing facility would behave as an uncontrolled system, i.e., no vapor would be returned to the UST.

Air ingestion into an UST combines with the liquid fuel as HC molecules are liberated from the surface of the fuel to form vapor. The volume of the vapor created is greater than the volume of the air before the vaporization took place (vapor growth). This vapor growth may lead to a pressure increase and a subsequent expulsion of excess vapors through the UST vent pipe (i.e., breathing losses) or leaks in the system (i.e., fugitive losses).

Staff developed emission factors that could be used to assess these interactive effects of using ORVR and Stage II systems in combination. A balance type Stage II facility would perform as an uncontrolled facility if it typically fueled only ORVR-equipped vehicles. This is estimated to result in emissions of 0.84 pounds per 1000 gallons of fuel dispensed, compared with 0.08 pounds per 1000 gallons if non-ORVR vehicles are fueled. However, the installation of pressure/vacuum (P/V) valves on the vent pipe of the UST will reduce the breathing loss increase by minimizing the amount of air ingested to make up for the liquid volume dispensed and controlling the amount of vapors released to the atmosphere. The latest emission factors indicate no increase in breathing loss emissions for balance type Stage II systems when used in combination with ORVR-equipped vehicles if P/V valves are installed. Although P/V valves are not required statewide, the Bay Area Air Quality Management District already requires the installation of P/V valves and the U.S. EPA has incorporated a requirement for their use as part of the Federal Implementation Plan for California's non-attainment areas. The staff will be proposing the use of P/V valves on all Stage II systems as part of their revised certification procedures scheduled for presentation to the Board later this year.

In the case of Stage II assist systems, the P/V valves will also help prevent air/vapor exchange through the UST vent pipe. However, the valve will have no effect on the air being actively drawn from the vehicle fill-pipe and routed back to the UST. Even at a vapor/liquid ratio of 1.0, the air being forced into the system can cause pressurization due to vapor growth in the UST. This would result in fugitive losses at various weak points in the system or through the P/V valve if its pressure limit is exceeded.

Staff believes that with vapor processors, ORVR/Stage II assist system interactive effects could be virtually eliminated. Vapor processors burn off excess vapors in the system when preset pressure points are reached. Alternatively, non-vapor processor assist systems could employ some type of "smart" system to detect an ORVR-equipped vehicle and shut off the pump which draws in air to the UST. Staff has estimated that approximately two percent of the current Stage II systems in California are vacuum-assist systems that operate without vapor processors. At this two percent level, the emission increase would be approximately one ton per day statewide at full ORVR penetration if no steps were taken to mitigate the interactions.

The efficiency and emission impact estimates presented in this report for balance and assist systems are based on the assumption that the USTs, plumbing, and related hardware have good pressure integrity. A lack of pressure integrity will tend to diminish the effectiveness of the P/V valve and vapor processors, and therefore increase overall emissions. Pressure integrity has become an important link in the overall efficiency of Stage II systems both independently and in combination with ORVR systems. Field tests have indicated that many stations used for Stage II certification testing are able to pass pressure integrity (leak decay) tests only after maintenance is done. In addition, it is sometimes difficult to maintain these stations sufficiently leak free to pass subsequent tests.

Addressing pressure integrity would improve Stage II efficiency and minimize ORVR/Stage II interaction effects. The ARB staff is presently conducting leak tests to determine the incidence of leaky stations and the locations of the leaks. A further investigation on the incidence of leaky stations is proposed as part of a research contract (scheduled to begin before the end of 1995) aimed at quantifying and resolving the fugitive emission issue. Many of the leaks can be traced to Stage I fittings and plumbing connections. These leaks could be minimized by design changes. The research contract will also attempt to quantify emissions resulting from the interaction of ORVR-equipped vehicles and Stage II systems and, if it is shown to be a significant impact, identify solutions. Addressing the fugitive emissions issue through Stage I and Stage II regulatory changes is essential to minimize the emission increase expected with the interactions of ORVR and Stage II systems. Upon completion of the research project, the fugitive emissions issues are expected to be addressed through Stage I and Stage II certification and test procedure changes at a subsequent board hearing.

D. Refueling Certification Test

Test conditions which may significantly influence the stringency of the refueling test are the fuel Reid Vapor Pressure (RVP), the vehicle tank fuel temperature, the dispensing fuel temperature, the amount of fuel filled, and the available canister capacity at the time of refueling. The U.S. EPA's refueling test specifies using a 9.0 RVP fuel, an 80°F (±3°F) vehicle tank fuel temperature, a 67°F (±1.5°F) dispensing fuel temperature and a fill of 95 percent. The sequencing of the refueling test allows sufficient time to fully purge the evaporative canister, and therefore allows the use of the full canister capacity.

The 1990 CAA amendments require that ORVR systems provide a minimum vapor capture efficiency of 95 percent. Based on the applicable vapor generation formula[1], a refueling standard of 0.25 grams per gallon would demonstrate a 95 percent capture efficiency under the U.S. EPA's specified test conditions. Therefore, the U.S. EPA's adopted standard of 0.20 grams per gallon standard provides adequate assurance that a refueling vapor capture efficiency of at least 95 percent for most in-use refueling conditions will be achieved.

While initially assessing the effectiveness of the U.S. EPA's refueling test, staff was concerned that if refueling were conducted with a partially loaded canister, the canister may become saturated, resulting in a significant emissions loss. Staff was also concerned that higher temperatures experienced in California would result in greater vapor generation and therefore higher emissions. To address these concerns, staff conducted a refueling modeling study to estimate the efficiency of ORVR canister systems under California conditions. The modeling study considered the following parameters: the refueling vapor generation (based on dispensed fuel temperature, vehicle fuel temperature, and fuel RVP), number of trips per day, vehicle refueling and driving operating scenarios, canister size and working capacity, and canister purge and overflow phenomena. At the March 15, 1994 workshop, General Motors Corporation (GM)

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1. Vapor generation formula generated through a contract at Automotive Testing Laboratories, Inc. for the Coordinating Research Council:

$$V = e^{(-1.2798 - 0.0049\Delta T + 0.0203T_d + 0.1315RVP)}$$

presented its own modeling results. Through a cooperative effort involving an understanding of the methods and assumptions used in each of the models, both GM and ARB staffs agreed that the efficiency of the U.S. EPA's refueling test would not significantly change under California-specific test conditions. That is, the efficiency losses would be 2.3 percent at 105°F and 0.5 percent at 90°F episodes (these levels were concluded to be within the uncertainty limitations of the analysis).

Spitback and spillage are two related, yet different events which occur during the refueling of vehicles.[2] The U.S. EPA has incorporated a spitback test as part of the enhanced evaporative test procedures, while the ARB has not. However, spitback is controlled in California by the ARB's "Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks Regulations." In addition, since spitback is part of the refueling process, the proposed refueling test will minimize the amount of spitback that can occur since any release of fuel will be captured in the evaporative enclosure and measured as part of the refueling emissions. This will further encourage the design of fill-pipes that minimize fuel spitback. The U.S. EPA also recognizes this added assurance of minimal spitback by allowing manufacturers to waive the U.S. EPA's spitback test if the given engine family is to be certified to the ORVR requirements. With regard to spillage, the proposed changes to the ARB's Stage II Vapor Recovery Test Procedures will require a spillage test as part of the certification of service station vapor recovery systems. Hence, both spillage and spitback will be thoroughly controlled.

E. Evaporative Test Procedure Modifications

Staff from the ARB, the U.S. EPA, and Industry have worked together to align the federal and California procedures. The U.S. EPA will also be proposing technical and text amendments to reflect the product of the joint effort. The modifications will allow the manufacturer, or testing contractors, to use common enclosures and testing steps to certify vehicles to California and federal evaporative standards.

V. ISSUES OF CONTROVERSY

Since the ARB is proposing the adoption of the the U.S. EPA's standards and test procedures with only relatively insignificant changes, the issues of controversy have not focused on the actual test procedure, but on other issues, such as redundant control, legal issues, and safety. These issues are discussed below.

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2. Spitback refers to an expulsion of fuel from the vehicle's fill-pipe during the refueling event as a result of turbulent conditions within the fill-pipe. Spillage refers to a leakage of fuel from the refueling nozzle as it is inserted or removed from the vehicle's fill-pipe during a refueling event.

A. Redundant Control

Owner/operators of gasoline facilities have argued that as soon as ORVR control is fully implemented, requirements for Stage II control should be immediately phased out. However, the full penetration of ORVR will be delayed due to California's 25 year vehicle fleet turnover rate. In that time lapse, Stage II systems can be installed, operated, and retired before ORVR reaches its full effectiveness (based on a 15 year equipment life for Stage II). Also, at the present time there are no plans to include ORVR systems in the medium- and heavy-duty vehicles with a GVWR greater than 8500 pounds, which represent nearly 12 percent of the gasoline consumption. Thus, in addition to the immediate benefits associated with Stage II systems (compared to ORVR), Stage II systems are currently the only means to control refueling emissions from medium- and heavy-duty vehicles.

B. Legal

Most of the legal issues would surface if the ARB does not adopt ORVR regulations. By not adopting ORVR regulations for California, the ARB could inadvertently create a "third vehicle" concept which in the past has been fought vigorously by vehicle manufacturers. Non-adoption of the ORVR regulations would also affect other programs, as explained below.

The requirements of the California pilot test program and centrally fueled fleet provisions in Title II, Part C of the CAA would require the sale of ORVR-equipped low-emission vehicles in California starting with the 1998 model year. If California were not to adopt ORVR standards, it would have to show that its transitional low-emission vehicle standards without ORVR are as protective of the public health and welfare as the clean fuel standards identified in the CAA. The California vehicle would be lacking part of the vehicle's evaporative system. Although California has coverage of refueling emissions through Stage II, it is not a vehicle control and may not be allowed when making the comparison.

Uniformity of ORVR systems throughout the fifty states will prevent complications with the Clean Fuel fleet provisions and California pilot test program. Title II, Part C, section 249 of the CAA requires the production, sale and distribution of 150,000 clean fuel vehicles in California during model years 1996, 1997, and 1998, with the annual number rising to 300,000 starting with the 1999 model year. The clean fuel vehicle requirements are established and administered by the U.S. EPA. The clean fuel vehicle provisions would require that in order for the light-duty vehicles and trucks to qualify for the program, they would have to meet the federal ORVR requirements, unless a protectiveness finding is made. Since the U.S. EPA considers refueling emissions as evaporative emissions, the U.S. EPA would not likely consider a vehicle without ORVR a clean fuel vehicle. Many manufacturers, especially small volume manufacturers, market one model nationwide. In addition, other states have adopted, or are considering adopting California motor vehicle standards to obtain the benefits of more stringent vehicle emission programs. If ORVR is not adopted, the sale of non-ORVR equipped vehicles may not be allowed to other states which may not have the high coverage of Stage II. Those vehicles displaced from California may not be considered as protective as the 49-state vehicles.

In conclusion, non-adoption of ORVR would cause concerns with the vehicle manufacturers, the U.S. EPA, and other states which are dependent on gaining the benefits of more strict California exhaust vehicle standards. Therefore, staff is proposing the adoption of ORVR systems on California vehicles.

C. Safety

Some automobile manufacturers and/or other opponents of ORVR may argue that there are safety concerns related to ORVR systems. These concerns primarily stem from an investigation performed in 1991 by the National Highway Traffic Safety Administration (NHTSA). In their findings, NHTSA expressed concerns over the increased size of the canisters needed to hold refueling vapors, the mechanical complexity of the ORVR system, and the purge strategy needed to manage the large volumes of vapor. However, NHTSA's safety concerns diminished when the U.S. EPA modified its refueling test procedure to promote the usage of integrated evaporative/refueling systems. In addition, new materials and canister purging strategies are being utilized, and other regulatory changes (onboard diagnostics, enhanced evaporative controls, and enhanced inspection and maintenance) were initiated or adopted which also reduced the safety concerns.

VI. WAIVER CONSIDERATIONS

A. Evaporative Waiver

Under section 209 of the CAA (42 U.S.C. 7543), the ARB is required to seek a waiver of federal preemption after it adopts emission standards for new motor vehicles. The waiver request is to be accompanied by the ARB's determination that the California emission standards will be, in the aggregate, at least as protective of the public health and welfare as the applicable federal standards. The U.S. EPA is required to issue the waiver unless the Administrator finds (1) that the ARB's protectiveness determination is arbitrary and capricious, (2) that the state standards and test procedures are not consistent with section 202(a) of the CAA, or (3) that California does not need separate state standards to meet compelling and extraordinary conditions. California filed two waiver requests for the enhanced evaporative test procedures. The first waiver applies to the 1995 model year and has been approved. The second waiver request covers the 1996 and subsequent model year vehicles and that decision is still pending.

The U.S. EPA considers the ORVR standard an evaporative standard which renders it subject to section 209. In evaluating California's waiver applications for the 1996 and subsequent model years, the non-adoption of ORVR would impact the analysis of the 1998 and subsequent model years. The protectiveness determination may be jeopardized since it is unclear whether the U.S. EPA would allow Stage II to be used in the analysis. Under the view which excludes Stage II from the protectiveness determination the reasoning is that since Stage II is not preempted by section 209(a), it would not be allowed in the comparison. Therefore, the failure to adopt ORVR standards may jeopardize the 1996 and subsequent model year evaporative waiver application.

B. Test Differences

The staff has proposed adoption of the U.S. EPA's ORVR standards and test procedures with few modifications. The testing modifications allow the manufacturer the option of certifying to the ORVR standards in line with the U.S. EPA's evaporative test procedure or the California enhanced evaporative test procedure. The vehicle manufacturer certifying in California may follow the same preconditioning and testing procedures throughout the exhaust, evaporative and refueling tests.

VII. REGULATORY ALTERNATIVES

A wide range of regulatory alternatives were considered. These included prohibiting ORVR systems, allowing, but not requiring ORVR systems, and developing a more stringent California-specific requirement. These are discussed in detail below.

No alternative considered by the Executive Officer would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective or less burdensome to affected private persons than the proposed regulation.

A. Prohibition and Non-Adoption of ORVR

The prohibition of ORVR systems on California vehicles could force the vehicle manufacturers to produce a third vehicle, one to meet 49-state exhaust and evaporative requirements with ORVR, one to meet California exhaust and evaporative requirements without the ORVR, and one to meet California exhaust and evaporative emission requirements with ORVR. The U.S. EPA's California Pilot Test Program could have the practical effect of requiring the sale of ORVR-equipped low-emission vehicles in California beginning in the 1998 model year.

The California Pilot Test Program requirements are part of CAA Title II, Part C, "Clean Fuel Vehicles." (CAA sections 241-250.) Section 249 requires the U.S. EPA to establish the California Pilot Test Program to demonstrate the effectiveness of "clean-fuel vehicles" (CFVs) in controlling air pollution in ozone non-attainment areas. The CFV requirements are established and administered by the U.S. EPA. For a vehicle to be considered a CFV, it must at least be as clean as the U.S. EPA standards specify. A vehicle not equipped with ORVR may not be considered as clean for evaporative emissions as the federal version which includes an ORVR system. Therefore, the CFV fleet would likely be required to have ORVR systems causing the vehicle manufacturers to produce a second vehicle for sale in California. Vehicle manufacturers, the U.S. EPA, and other states would likely object to this option.

B. California-Specific Test

California experiences higher ambient and dispensing fuel temperatures than those specified in the U.S. EPA test. Staff investigated the possibility of requiring a more stringent refueling test which would take into account California's higher temperatures. However, the refueling modeling indicated that at extreme conditions (105°F) only two percent vapor capture efficiency is lost. This loss was within the uncertainty of the analysis. Therefore, a California-specific test would be redundant with minimal benefits.

VIII. AIR QUALITY, ENVIRONMENTAL AND ECONOMIC IMPACTS

A. Air Quality and Environmental Impacts

Staff's analysis of the potential impacts of ORVR indicate there will be no additional benefits due to the adoption of ORVR. The control of the fill-pipe emissions will simply be transferred from the Stage II system to the vehicle's ORVR system. In addition, staff does not expect a detriment due to the adoption of ORVR standards and test procedures, pending the Stage II modifications needed to minimize ORVR/Stage II interaction effects. Calculations based on theoretical interaction situations indicated a one ton per day emission increase at the present Stage II equipment set-up. However, future Stage II regulations are expected to address fugitive emission issues and alleviate the potential interaction increase.

B. Cost and Cost-Effectiveness

The U.S. EPA estimates the total cost of ORVR systems to be less than $5 per vehicle for light-duty vehicles and trucks with a GVWR less than 8500 pounds. The cost-effectiveness for the adoption of the U.S. EPA ORVR rule was $0.40 per pound hydrocarbon without the phase-out of Stage II systems.

California's adoption of the U.S. EPA's ORVR standards and test procedures will not impose additional cost to California consumers. Since the U.S. EPA's ORVR rule would apply to all fifty states in the absence of a California waiver, the vehicle manufacturer would have to install ORVR systems even without California ORVR rule adoption. California's rule adoption is mainly to align the ORVR test procedure with the California exhaust and evaporative procedures.

Costs which may eventually be associated with the adoption of this rule are future Stage II equipment changes necessary to address the interactive effect of increasing fugitive emissions. However, fugitive emissions were an issue prior to the introduction of the ORVR rule and were being investigated for possible control options. Fugitive emissions would have to be addressed regardless of the ORVR adoption. Depending on the results of the research contract on fugitive emissions, there may not be any cost directly related to ORVR since the solution to the fugitive emissions problem may also inherently control interactive effects.

If the research indicates that interactive effects are too large to be encompassed by making Stage II systems leak-tight and a vehicle/nozzle mechanism is needed to prevent interactive effects, there may then be costs associated with the introduction of ORVR. For example, an "interfacing" device may be needed to signal a vacuum-assist to terminate its active suction on the vehicle fill-pipe, thereby preventing air from being drawn into the UST. This smart interface would require a Stage II system to recognize an ORVR-equipped vehicle. One possible interfacing device, a bar code reader, would necessitate a bar code on the vehicle filler neck that could be read by the fuel dispenser. The associated vehicle cost would be minimal. The need for a smart interface will be dependent on the quantification of adverse interactive effects in the fugitive emissions research contract and would be considered by ARB as a separate regulatory control measure.

C. Economic Impacts

Section 11346.3 of the Government Code requires that, in proposing to adopt or amend any administrative regulation, state agencies shall assess not only the potential for adverse economic impacts on California business enterprises and individuals, but also the ability of California businesses to compete with businesses in other states. Government Code Section 11346.3 also requires state agencies to assess the potential impact of their regulations on California jobs and on business expansion, elimination, or creation.

The staff does not expect any impact on California businesses as a result of this rulemaking because the ORVR rule has already been adopted federally, applicable to vehicles in all fifty states. California's adoption of the rule will simply align the ORVR test procedure with other California vehicle emission test procedures and provide the vehicle manufacturer more testing flexibility.

Since the rule has already been required nationwide, it is not expected to have any impact on the ability of California businesses to compete with businesses in other states.

Staff expects no change in jobs, business expansions, elimination, or creation because the ORVR rule adoption has no noticeable impact on the profitability of businesses. The vehicle manufacturers will likely produce a universal ORVR system design for all of their vehicles nationwide at a cost of no more than $5 per vehicle.

REFERENCES*

1. United States Environmental Protection Agency. 1991. Technical Guidance-Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities. Technical Report No. EPA-450/3-91-022a,b. Docket A-87-11, Item IV-A-08.

2. United States Environmental Protection Agency. 1994. Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines; Refueling Emission Regulations for Light-Duty Vehicles and Light-Duty Trucks; Final Rule. Federal Register. Vol. 59, No. 66. Docket A-87-11. Washington, D.C.

3. California Air Resources Board. 1994. Regulatory Measures to Control Refueling Emissions Through Vehicle-Based (Onboard) Control, Fill-Pipe, and Nozzle Specifications. Mail-out #94-08. Mobile Source Division. El Monte, California.

* As noted in the text of the staff report.

Appendix A

PROPOSED

Adopt new section 1978, Title 13, California Code of Regulations, to read as follows:

(Note: The entire text of section 1978 set forth below is new language proposed to be added to the California Code of Regulations. The proposed regulation text is shown in normal type.)

1978. Standards and Test Procedures for Vehicle Refueling Emissions.

(a)(1) Vehicle refueling emissions for 1998 and subsequent model gasoline-fueled, alcohol-fueled, diesel-fueled, fuel-flexible, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles with a gross vehicle weight rating less than 8501 pounds, shall not exceed the following standards. Gaseous fueled vehicles are exempt from meeting these refueling standards. The standards apply equally to certification and in-use vehicles.

Hydrocarbons (for gasoline-fueled, diesel-fueled, and hybrid electric vehicles): 0.20 grams per gallon of fuel dispensed.

Organic Material Hydrocarbon Equivalent (for alcohol-fueled, fuel-flexible, and hybrid electric vehicles): 0.20 grams per gallon of fuel dispensed.

(2) Vehicles powered by diesel fuel are not required to conduct testing to demonstrate compliance with the refueling emission standards set forth above, provided that all of the following provisions are met:

(A) The manufacturer can attest to the following evaluation: "Due to the low vapor pressure of diesel fuel and the vehicle tank temperatures, hydrocarbon vapor concentrations are low and the vehicle meets the 0.20 grams/gallon refueling emission standard without a control system."

(B) The certification requirement described in paragraph (A) is provided in writing and applies for the full useful life of the vehicle.

In addition to the above provisions, the ARB reserves the authority to require testing to enforce compliance and to prevent noncompliance with the refueling emission standard.

Vehicles certified to the refueling emission standard under this provision shall not be counted in the phase-in sales percentage compliance determinations.

(3) The manufacturer shall adhere to the following phase-in schedule, with the exception of small volume manufacturers.

ORVR Model Year Phase-In Schedule

Class of Vehicle	40% Fleet	80% Fleet	100% Fleet
Passenger Cars	1998	1999	2000
Light-Duty Trucks	2001	2002	2003
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)	2004	2005	2006

(A) Small volume manufacturers are defined for purposes of this regulation as any vehicle manufacturer with California actual sales less than or equal to 3000 new vehicles per model year based on the average number of vehicles sold by the manufacturer in the previous three consecutive model years.

(B) Small volume manufacturers of passenger cars, as defined in (3)(A), are exempt from the implementation schedule in (3) for model years 1998 and 1999. For small volume manufacturers of passenger cars, the standards of (a)(1), and the associated test procedures, shall not apply until model year 2000, when 100 percent compliance with the standards of this section is required. Small volume manufacturers of light-duty trucks and medium-duty vehicles are not exempt from the implementation schedule in (3).

(b) The test procedures for determining compliance with standards applicable to 1998 and subsequent gasoline, alcohol, diesel, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles are set forth in the "California Refueling Emission Standards and Test Procedures for 1998 and Subsequent Model Motor Vehicles," adopted ________, incorporated herein by reference.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018, 43101, and 43104, of the Health and Safety Code. Reference: Sections 39003, 39500, 39667, 43000, 43013, 32018, 43101, 43102, and 43104 of the Health and Safety Code.

Appendix B

PROPOSED

State of California
AIR RESOURCES BOARD

CALIFORNIA REFUELING EMISSION STANDARDS AND TEST PROCEDURES FOR 1998 AND SUBSEQUENT MODEL MOTOR VEHICLES

ADOPTED: ____________________

Note: The entire text of the test procedures proposed in this rulemaking is new language. The proposed test procedures are shown in normal type.

NOTE: This document incorporates by reference various sections of the Code of Federal Regulations, some with modifications. California provisions which replace specific federal provisions are denoted by the words "DELETE" for the federal language and "REPLACE WITH" for the new California language. The symbols "*****" and "..." mean that the remainder of the federal text for a specific section, which is not shown in these procedures, has been included by reference, with only the printed text changes. Federal regulations which are not listed are not part of the procedures.

CALIFORNIA REFUELING EMISSION STANDARDS AND TEST PROCEDURES FOR 1998 AND SUBSEQUENT MODEL MOTOR VEHICLES

The following provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts A and B, as adopted or amended by the U.S. Environmental Protection Agency on the date listed, and only to the extent they pertain to the testing and compliance of vehicle refueling emissions for light-duty vehicles and light-duty trucks, are adopted and incorporated herein by this reference as the California Refueling Emission Standards and Test Procedures for 1998 and Subsequent Model Motor Vehicles, except as altered or replaced by the provisions set forth below. With respect to subpart A, where a section has been referenced and is not listed in these test procedures, the reference should be considered to refer to that section's most recent counterpart listed herein.

These refueling test procedures are designed to allow the manufacturer to either certify to the refueling standards via the California or Federal certification test procedures. Therefore, subpart B is structured such that the model year 1990 requirements, as modified in these procedures, apply if the manufacturer is certifying via the California certification test procedures. If a manufacturer is certifying via the federal certification test procedures, then the 1996 model year requirements apply. The manufacturer shall follow only one certification test procedure, California or Federal, once that sequence has been initiated. The 1998 model year requirements apply to all manufacturers regardless of which test procedures they are using.

These standards and test procedures are applicable to all new 1998 and subsequent model gasoline, alcohol, diesel, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles with a gross vehicle weight less than 8501 pounds. References to "light-duty trucks" in 40 CFR 86 shall apply both to "light-duty trucks" and "medium-duty vehicles" in these procedures. References to "light-duty vehicles" in 40 CFR 86 shall apply to passenger cars.

In those instances that the testing conditions or parameters are not practical or feasible for such vehicles, the manufacturer shall provide a test plan that provides equal or greater confidence in comparison to these test procedures. The test plan must be approved in advance by the Executive Officer.

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

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

PART 86-CONTROL OF AIR POLLUTION FROM NEW AND IN-USE MOTOR VEHICLES AND NEW AND IN-USE MOTOR VEHICLE ENGINES: CERTIFICATION AND TEST PROCEDURES

86.1 Reference materials. September 21, 1994.

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fuels and Methanol-Fueled Heavy-Duty Vehicles.

86.094-1 General applicability. January 12, 1993.

* * * * *

(e) *Small volume manufacturers*. Special certification procedures are available for any manufacturer whose projected combined California sales of passenger cars, Light-duty trucks, medium-duty vehicles and heavy-duty engines in its product line (including all vehicles and engines imported under the provisions of §§85.1505 and 85.1509 of this chapter) are fewer than 3,000 units for the model year in which the manufacturer seeks certification. To certify its product line under these optional procedures, the small-volume manufacturer must first obtain the Executive Officer's approval. The manufacturer must meet the eligibility criteria specified in §86.092-14(b) before the Executive Officer's approval will be granted. The small-volume manufacturer's certification procedures are described in §86.092-14.

86.082-2 Definitions. November 2, 1982.

86.084-2 Definitions. December 16, 1987.

86.085-2 Definitions. December 16, 1987.

86.088-2 Definitions. March 15, 1985.

86.090-2 Definitions. July 26, 1990.

86.091-2 Definitions. July 26, 1990.

86.092-2 Definitions. February 28, 1990.

86.094-2 Definitions. June 5, 1991.

86.096-2 Definitions. November 1, 1993.

86.098-2 Definitions. April 6, 1994.

ADD:
The definitions in sections 1900 and 2112, Title 13, California Code of Regulations, are hereby incorporated into this test procedure by

reference. For purposes of this test procedure and section 1978 of Title 13, California Code of Regulations, "small volume manufacturer" shall mean any vehicle manufacturer with California sales less than or equal to 3000 new vehicles per model year based on the average number of vehicles sold by the manufacturer in the previous three consecutive model years. ...

* * * * :

"Administrator" means the Executive Officer of the Air Resources Board (ARB).

"Alcohol fuel" means either methanol or ethanol as those terms are defined in these test procedures.

"Battery assisted combustion engine vehicle" means any vehicle which allows power to be delivered to the driven wheels solely by a combustion engine, but which uses a battery pack to store energy which may be derived through remote charging, regenerative braking, and/or a flywheel energy storage system or other means which will be used by an electric motor to assist in vehicle operation.

"Battery pack" means any electrical energy storage device consisting of any number of individual battery modules which is used to propel electric or hybrid electric vehicles.

"Certificate of Conformity" means Executive Order certifying vehicles for sale in California.

"Certification" means certification as defined in Section 39018 of the Health and Safety Code.

"Certification level" means the official exhaust or evaporative emission result from an emission-data vehicle which has been adjusted by the applicable mass deterioration factor and is submitted to the Executive Officer for use in determining compliance with an emission standard for the purpose of certifying a particular engine family.

"Continually regenerating trap oxidizer system" means a trap oxidizer system that does not utilize an automated regeneration mode during normal driving conditions for cleaning the trap.

"Conventional gasoline" means any certification gasoline which meets the specifications of 86.113-90(a), 40 CFR 86, including the specifications of (a)(1)(i) but excluding the specifications of (a)(1)(ii) as amended by these test procedures.

"Dedicated Ethanol Vehicle" means any ethanol-fueled motor vehicle that is engineered and designed to be operated solely on ethanol.

"Dedicated Methanol Vehicle" means any methanol-fueled motor vehicle that is engineered and designed to be operated solely on methanol.

"Defeat Device" means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use, unless (1) such conditions are substantially included in the Federal emission test procedure, (2) the need for the AECD is justified in terms of protecting the vehicle against damage or accident, or (3) the AECD does not go beyond the requirements of engine starting.

"Diesel" DELETE
REPLACE WITH:
"Diesel Engine" means any engine powered with diesel fuel, gaseous fuel, ethanol, or methanol for which diesel engine speed/torque characteristics and vehicle applications are retained.

"Diesel-cycle" means powered by an engine where the primary means of controlling power output is by limiting of the amount of fuel that is injected into the combustion chambers of the engine.

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"Dual-fuel vehicle" means any motor vehicle that is engineered and designed to be capable of operating on gasoline or diesel and on compressed natural gas or liquefied petroleum gas, with separate fuel tanks for each fuel on-board the vehicle.

"Electric vehicle" means any vehicle which operates solely by use of a battery or battery pack. This definition also includes vehicles which are powered mainly through the use of an electric battery or battery pack, but which use a flywheel that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

"Element of Design" means any control system (i.e., computer software, electronic control system, emission control system, computer logic), and/or control system calibrations and/or the results of systems interaction, and/or hardware items on a motor vehicle or motor vehicle engine.

"Ethanol" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure ethanol (CH_3CH_2OH) and gasoline as specified in section 86.113-90 (Fuel Specifications) of these test procedures. The required fuel blend is based on the type of ethanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

"Ethanol vehicle" means any motor vehicle that is engineered and designed to be operated using ethanol as a fuel.

* * * * *

"Flexible fuel vehicle" DELETE
REPLACE WITH:
"Fuel-flexible vehicle (FFV)" means any methanol-fueled or ethanol-fueled motor vehicle that is engineered and designed to be operated using any gasoline-methanol or gasoline-ethanol fuel mixture or blend.

"Fuel fired heater" means a fuel burning device which creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

"Heavy light-duty truck" DELETE

"Hybrid electric vehicle" or "HEV" means any vehicle which is included in the definition of a "series hybrid electric vehicle", a "parallel hybrid electric vehicle", or a "battery assisted combustion engine vehicle".

"Incomplete vehicle" means any vehicle which does not have the primary load carrying device or container attached. In situations where individual marketing relationships makes the status of the vehicle questionable, the Executive Officer shall determine whether a specific model complies with the definition of incomplete vehicle.

* * * * *

"Intermediate Temperature Cold Testing" means testing done pursuant to the driving cycle and testing conditions contained in 40 CFR Part 86 Subpart C, at temperatures between 25 degrees F (-4 degrees C) and 68 degrees F (20 degrees C).

"Intermediate volume manufacturer" is any vehicle manufacturer with California sales between 3,001 and 35,000 new light- and medium-duty vehicles per model year based on the average number of vehicles sold by the manufacturer each year from 1989 to 1993; however, for manufacturers certifying for the first time in California, model-year sales shall be based on projected California sales.

"Light-duty truck 1" DELETE

"Light-duty truck 2" DELETE

"Light-duty truck 3" DELETE

"Light-duty truck 4" DELETE

"Light light-duty truck" DELETE

"Low-emission vehicle" or "LEV" means any vehicle certified to low-emission standards.

"Methane Reactivity Adjustment Factor" means a factor applied to the mass of methane emissions from natural gas fueled vehicles for the purpose of determining the gasoline equivalent ozone-forming potential of the methane emissions.

"Methanol" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH_3OH) and gasoline as specified in section 86.113-90 (Fuel Specifications) of these procedures. The required fuel blend is based on the type of methanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

"Methanol-fueled" DELETE
REPLACE WITH:
"Methanol vehicle" means any motor vehicle that is engineered and designed to be operated using methanol as a fuel.

"Natural gas" means either compressed natural gas or liquefied natural gas.

"Natural gas vehicle" means any motor vehicle that is engineered and designed to be operated using either compressed natural gas or liquefied natural gas.

* * * * *

"Non-methane organic gas" (or "NMOG") means the sum of non-oxygenated and oxygenated hydrocarbons contained in a gas sample as measured in accordance with the "California Non-Methane Organic Gas Test Procedures" as adopted July 12, 1991 and last amended September 22, 1993.

"Non-regeneration emission test" means a complete emission test which does not include a regeneration.

"Organic material non-methane hydrocarbon equivalent" (or "OMNMHCE") for methanol-fueled vehicles means the sum of the carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, and formaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons. For ethanol-fueled vehicles, "organic material non-methane hydrocarbon equivalent" (or "OMNMHCE") means the sum of carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, ethanol, formaldehyde and acetaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons.

"Otto-cycle" DELETE
REPLACE WITH:
"Otto-cycle" means powered by an engine where the primary means of controlling power output is by limiting the amount of air and fuel which can enter the combustion chambers of the engine. Gasoline-fueled engines are otto-cycle engines.

"Ozone deterioration factor" means a factor applied to the mass of NMOG emissions from TLEVs, LEVs, or ULEVs which accounts for changes in the ozone-forming potential of the NMOG emissions from a vehicle as it accumulates mileage.

"Parallel hybrid electric vehicle" means any vehicle which allows power to be delivered to the driven wheels by either a combustion engine and/or by a battery powered electric motor.

"Periodically regenerating trap oxidizer system" means a trap oxidizer system that utilizes, during normal driving conditions for cleaning the trap, an automated regeneration mode which can be easily detected.

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"Regeneration" means the process of oxidizing accumulated particulate matter. It may occur continually or periodically.

"Regeneration emission test" means a complete emission test which includes a regeneration.

"Regeneration interval" means the interval from the start of a regeneration to the start of the next regeneration.

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"Series hybrid electric vehicle" means any vehicle which allows power to be delivered to the driven wheels solely by a battery powered electric motor, but which also incorporates the use of a combustion engine to provide power to the battery and/or electric motor.

"Transitional low-emission vehicle" or "TLEV" means any vehicle certified to transitional low-emission standards.

"Trap oxidizer system" means an emission control system which consists of a trap to collect particulate matter and a mechanism to oxidize the accumulated particulate.

"Type A hybrid electric vehicle" means a hybrid electric vehicle which achieves a minimum range of 60 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit.

"Type B hybrid electric vehicle" means a hybrid electric vehicle which achieves a range of 40 to 59 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit.

"Type C hybrid electric vehicle" means a hybrid electric vehicle which achieves a range of 0 to 39 miles in the All-Electric Range Test, while maintaining minimal speed and time requirements throughout the test and without use of the auxiliary power unit; or which has been designated by the manufacturer as having a range of less than 40 miles without the use of the auxiliary power unit. This definition shall also apply to any hybrid electric vehicle which allows the operator to control the time or mode of operation of the auxiliary power unit either directly or indirectly (with the exception that a mechanism which allows the operator only to shut off the auxiliary power unit is permissible for Type A and Type B HEVs), to any hybrid electric vehicle which can be operated solely through the use of the auxiliary power unit, to any hybrid electric vehicle which utilizes a climate control system that cannot be operated without using the auxiliary power unit, and all other types of hybrid electric vehicles, excluding Type A and Type B hybrid electric vehicles.

"Ultra-low-emission vehicle" or "ULEV" means any vehicle certified to ultra-low emission standards.

"Useful life" DELETE
REPLACE WITH:
"Useful life" shall have the same meaning as provided in section 2112, Title 13, California Code of Regulations. Approval of vehicles which are not exhaust emissions tested using a chassis dynamometer pursuant to section 1960.1, Title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant. The useful life of incomplete medium-duty vehicles certified to the "California Exhaust Emission Standards and Test Procedures for 1987 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles" shall be defined by the useful life of the medium-duty vehicle engine used in such vehicles.

86.078-3 Abbreviations. January 21, 1980.

86.090-3 Abbreviations. July 26, 1990.

86.094-3 Abbreviations. September 21, 1994.

86.098-3 Abbreviations. April 6, 1994.

86.084-4 Section numbering; construction. September 25, 1980.

86.090-5 General standards; increase in emissions; unsafe conditions. April 11, 1989.

86.091-7 Maintenance of records; submitted information; right of entry. July 26, 1990.

86.094-7 Maintenance of records; submitted information; right of entry. July 17, 1992.

86.096-7 Maintenance of records; submitted information; right of entry. June 28, 1993.

86.098-7 Maintenance of records; submitted information; right of entry. April 6, 1994.

86.096-8 Emission standards for 1996 and later model year light-duty vehicles. March 24, 1993.

(a) DELETE
REPLACE WITH:
(a) For guidance see section 1960.1, Title 13, California Code of Regulations.

(b) DELETE
REPLACE WITH:
(b) For guidance see section 1976, Title 13, California Code of Regulations.

* * * * *

(e) - (k) DELETE

86.098-8 Emission standards for 1998 and later model year light-duty vehicles. April 6, 1994.

(a) - (b) DELETE

* * * * *

(e) - (k) DELETE

86.099-8 Emission standards for 1999 and later model year light-duty vehicles. April 6, 1994.

(a) - (b) DELETE

* * * * *

(e) - (k) DELETE

86.001-9 Emission standards for 2001 and later model year light-duty trucks. April 6, 1994.

(a) - (b) DELETE

*   *   *   *   *

(e) - (k) DELETE

86.004-9 Emission standards for 2004 and later model year light-duty trucks. April 4, 1994.

(a) - (b) DELETE

*   *   *   *   *

(e) - (k) DELETE

86.097-9 Emission standards for 1997 and later model year light-duty trucks. November 1, 1993.

(a) DELETE
REPLACE WITH:
(a) For guidance see section 1960.1, Title 13, California Code of Regulations.

(b) DELETE
REPLACE WITH:
(b) For guidance see section 1976, Title 13, California Code of Regulations.

*   *   *   *   *

(e) - (k) DELETE

86.080-12 Alternative certification procedures. April 17, 1980.

86.085-13 Alternative durability program. May 19, 1983.

86.094-14 Small-volume manufacturers certification procedures. January 12, 1993.

*   *   *   *   *

(b)(1) DELETE
REPLACE WITH:
(b)(1) The optional small-volume manufacturers certification procedures apply to light-duty vehicles (passenger cars, light-duty trucks, and medium-duty vehicles), produced by manufacturers with California sales (for the model year in which certification is sought) of fewer than

3,000 units (PC, LDT, and MDV combined). The optional small-volume manufacturers certification procedures shall not apply to hybrid electric vehicles. All hybrid electric vehicle manufacturers shall be subject to the certification requirements established for hybrid electric vehicles.

(b)(2) DELETE

(b)(3) DELETE

(b)(4) DELETE

(b)(5) DELETE

* * * * *

(c)(4) DELETE
REPLACE WITH:
(c)(4) A small-volume manufacturer shall include in its records all of the information that ARB requires in 86.088-21, 86.090-21, 86.091-21, or 86.094-21, including the modifications noted in these test procedures. This information will be considered part of the manufacturer's application for certification and must be submitted to the Executive Officer.

* * * * *

(c)(7)(i)(A) DELETE

* * * * *

(c)(11)(ii)(D)(1) DELETE
REPLACE WITH:
(c)(11)(ii)(D)(1) The following statement signed by the authorized representative of the manufacturer: "The vehicles (or engines) described herein have been tested in accordance with (list of the applicable subparts A or B) of part 86, Title 40, Code of Federal Regulations, and on the basis of those tests are in conformance with that subpart. All of the data and records required by that subpart are on file and are available for inspection by the Executive Officer. We project the total California sales of vehicles (engines) subject to this subpart (including all vehicles and engines imported under the provisions of §§86.1505 and 85.1509 of this chapter to be fewer than 3,000 units."

* * * * *

86.095-14 Small-volume manufacturers certification procedures. January 12, 1993.

* * * * *

(c)(11)(ii)(D)(1) DELETE
REPLACE WITH:
(c)(11)(ii)(D)(1) The following statement signed by the authorized representative of the manufacturer: "The vehicles (or engines) described herein have been tested in accordance with (list of the applicable subparts A or B) of part 86, Title 40, Code of Federal Regulations, and on the basis of those tests are in conformance with that subpart. All of the data and records required by that subpart are on file and are available for inspection by the Executive Officer. We project the total California sales of vehicles (engines) subject to this subpart (including all vehicles and engines imported under the provisions of §§86.1505 and 85.1509 of this chapter to be fewer than 3,000 units."

* * * * *

86.098-14 Small-volume manufacturers certification procedures. April 6, 1994.

86.094-16 Prohibition of defeat devices. July 17, 1992.

(a) DELETE
REPLACE WITH:
(a) No new passenger car, light-duty truck, or medium-duty vehicle shall be equipped with a defeat device.

* * * * *

86.098-17 Emission control diagnostic system for 1998 and later light-duty vehicles and light-duty trucks. April 6, 1994.

DELETE
REPLACE WITH:
The "Malfunction and Diagnostic System Requirements-1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines" in section 1968.1, Title 13, California Code of Regulations, is hereby incorporated into this test procedure by reference. For purposes of this test procedure, all references to evaporative system monitoring, malfunction criteria, and MIL illumination and fault code storage shall also apply to refueling systems.

86.085-20 Incomplete vehicles. January 12, 1983.

86.094-21 Application for certification. February 19, 1993.

* * * * *

(b)(1)(i) DELETE
REPLACE WITH:
(b)(1)(i) Identification and description of the vehicles (or engines) covered by the application and a description (including a list and part numbers of all major emission control system parts and fuel system components) of their engine (vehicles only) emission control system and fuel system components, including if applicable, the turbocharger and intercooler. This shall include a detailed description of each auxiliary emission control device (AECD) to be installed in or on any certification test vehicle (or certification test engine).

* * * * *

(b)(2) DELETE
REPLACE WITH:
(b)(2) For 1992 and subsequent model-year TLEVs, LEVs, and ULEVs not certified exclusively on gasoline, projected California sales data and fuel economy data 19 months prior to January 1 of the calendar year with the same numerical designation as the model year for which the vehicles are certified, and projected California sales data for all vehicles, regardless of operating fuel or vehicle emission category, sufficient to enable the Executive Officer to select a test fleet representative of the vehicles (or engines) for which certification is requested at the time of certification.

* * * * *

(g) DELETE
REPLACE WITH:
(g)(1) For ZEVs and hybrid electric vehicles, the certification application shall include the following:

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

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

(iii) Identification and description of the propulsion system for the vehicle.

(iv) Identification and description of the climate control system used on the vehicle.

(v) Projected number of vehicles produced and delivered for sale in California, and projected California sales.

(vi) For electric and hybrid electric vehicles, identification of the energy usage in kilowatt-hours per mile from the point when electricity is introduced from the electrical outlet and the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test (see section 9.f. of the "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(k), Title 13, California Code of Regulations).

(vii) If the vehicle is equipped with a fuel fired heater, a description of the control system logic of the fuel fired heater, including an evaluation of the conditions under which the fuel fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist. Vehicles which utilize fuel fired heaters which can be operated at ambient temperatures above 40 degrees Fahrenheit or which cannot be demonstrated to have zero evaporative emissions under any and all possible operation modes and conditions shall not be certified as ZEVs.

(viii) All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel, method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

* * * * *

86.096-21 Application for certification. July 1, 1994.

* * * * *

(b)(10)(i) DELETE
REPLACE WITH:
(b)(10)(i) Canister working capacity, according to the procedures specified in §86.132-96(h)(1)(iv); or §86.132-90(b)(4) as modified in these test procedures.

* * * * *

(b)(10)(iii) DELETE
REPLACE WITH:

(b)(10)(iii) Fuel temperature profile for the running loss test, according to the procedures specified in §86.129-94(d), or §86.129-80(d) as modified by these test procedures.

* * * * *

86.098-21 Application for certification. April 6, 1994.

* * * * *

(b)(4)(i) DELETE
REPLACE WITH:
(b)(4)(i) For passenger cars, light-duty trucks, and medium-duty vehicles, with a GVW less than 8501 pounds, a description of the test procedures to be used to establish the evaporative emission and/or refueling emission deterioration factors, as appropriate, required to be determined and supplied in §86.098-23(b)(2).

* * * * *

(b)(10)(i) DELETE
REPLACE WITH:
(b)(10)(i) Canister working capacity, according to the procedures specified in §86.132-96(h)(1)(iv), or §86.132-90(b)(4) as modified in these test procedures.

* * * * *

(b)(10)(iii) DELETE
REPLACE WITH:
(b)(10)(iii) Fuel temperature profile for the running loss test, according to the procedures specified in §86.129-94(d), or §86.129-90(d) as modified in these test procedures.

* * * * *

(j) - (k) DELETE

86.001-21 Application for certification. April 6, 1994.

* * * * *

(b)(4)(i) DELETE
REPLACE WITH:
(b)(4)(i) For passenger cars, light-duty trucks, and medium-duty vehicles, with a GVW less than 8501 pounds, a description of the test procedures to be used to establish the evaporative emission and/or refueling emission deterioration factors, as appropriate, required to be determined and supplied in §86.001-23(b)(2).

*   *   *   *   *

(b)(10)(i) DELETE
REPLACE WITH:
(b)(10)(i) Canister working capacity, according to the procedures specified in §86.132-96(h)(1)(iv), or §86.132-90(b)(4) as modified in these test procedures.

*   *   *   *   *

(b)(10)(iii) DELETE
REPLACE WITH:
(b)(10)(iii) Fuel temperature profile for the running loss test, according to the procedures specified in §86.129-94(d), or §86.129-90(d) as modified in these test procedures.

*   *   *   *   *

(j) - (k) DELETE

86.094-22 Approval of application for certification; test fleet selection, etc. January 12, 1993.

86.098-22 Approval of application for certification; test fleet selections; determination of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy limits, and physically adjustable ranges. April 6, 1994.

86.001-22 Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges. April 6, 1994.

86.095-23 Required data. March 25, 1994.

86.098-23 Required data. April 6, 1994.

86.001-23 Required data. April 6, 1994.

86.096-24 Test vehicles and engines. November 1, 1993.

*   *   *   *   *

(a)(1) ... separate engine family. For 1995 and subsequent model-year vehicles or engines, all engines classified in the same engine family shall be certified to identical exhaust emission standards.

*   *   *   *   *

(b) DELETE
REPLACE WITH:
(b) Emission-data vehicles shall be selected according to the provisions of Appendix II. Selection shall be based on highest sales volume and will require only two emission-data vehicles for certification testing per engine family. (For fifty-state families, the reference in the federal procedures to configuration or sales shall mean California configurations and sales rather than total family configurations and sales.) The Executive Officer will accept data from California (or fifty-state) configuration vehicles or from federal vehicles which meet the requirements of subparagraph (f). Federal vehicles may be reconfigured to California versions and tested to show compliance with California emission standards. The Executive Officer will also allow the manufacturer to reconfigure California vehicles.

(c) *Durability data ...*

* * * * *

(e)(1) DELETE
REPLACE WITH:
(e)(1) Any manufacturer whose projected California annual sales for the model year in which certification is sought is less than a combined total of 3,000 passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines may request a reduction in the number of test vehicles determined in accordance with the foregoing provisions of this paragraph. The Executive Officer may agree to such lesser numbers as he or she determines would meet the objectives of this procedure.

(e)(2) DELETE
REPLACE WITH:
(e)(2)(i) Any manufacturer may request to certify engine families using assigned DFs for a combined total of 3,000 projected annual California sales of passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines per manufacturer regardless of total sales.

(e)(2)(ii) Assigned DFs shall be used only where specific mileage accumulation data do not exist (i.e., if a vehicle manufacturer uses an engine/system combination where DFs derived from exhaust emission testing exist, then the assigned factors cannot be used).

Assigned DFs shall be used in lieu of data from durability vehicle(s) only when a manufacturer demonstrates that it has control over design specifications, can provide development data, has in-house testing capabilities including accelerated aging of components/systems, and has evaluation criteria to ensure emission control system (ECS) durability for the vehicle's useful life. The applying manufacturer must demonstrate engine durability and that the emission control system(s) developed or adapted for the particular engine will be durable and comply with the applicable emission standards for the engine's or vehicle's useful life. In evaluating any information provided, all relevant test data and design factors shall be considered, including but not limited to: vehicle application, engine design, catalyst loading and volume, space velocity in the catalyst, engine exhaust gas concentrations and catalyst temperatures for various operating modes, and the durability of any emission control system components which may have been used in other vehicle applications. The assigned DFs shall be applied only to entire families.

If emission control parts from other certified vehicles are utilized, then parameter comparisons of the above data must also be provided including part numbers where applicable. Emission control durability may include special in-house specifications.

(e)(2)(iii) The criteria for evaluating assigned DFs for evaporative families are the same as those for exhaust families. However, in determining evaporative family DFs the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" require that an evaporative family DF be determined by averaging DFs obtained from durability vehicle testing and from bench testing. Therefore, if a manufacturer meets the criteria as specified above in (e)(2)(i) and (e)(2)(ii), the Executive Officer may grant assigned DFs for either (or both) the durability vehicle DF or the bench DF.

Assigned DFs for bench test requirements do not depend upon the 3,000 maximum sales limit. The assigned bench DF is applicable only to evaporative emission control systems which are similar to those used by the manufacturer for 1980 or later model-year vehicles and where an evaporative vehicle DF was determined. In evaluating a request for an assigned bench DF, all relevant information shall be considered, including but not limited to: fuel tank capacity, fuel tank temperatures, carburetor bowl "capacity," underhood temperatures, canister capacity and location, and any other comparisons to the certified application.

(f) ... has previously been submitted.

ADD:
The durability or emission data submitted may be from vehicles previously certified by ARB. For 1993 through 1996 model-year passenger cars and light-duty trucks and 1995 through 1997 model-year medium-duty vehicles, the manufacturer shall submit durability data from only California (or fifty-state) configuration vehicles unless the durability data was generated from a vehicle certified by EPA or ARB prior to the 1993 model year (1995 for medium-duty vehicles). For 1997 (1998 for medium-duty vehicles) and subsequent model-year vehicles, durability data shall be submitted from only California (or fifty-state) configuration vehicles. For 1993 and (1995 for medium-duty vehicles) subsequent model-year vehicles, the Executive Officer shall

permit the use of federal durability data vehicles if he or she determines that the federal data will adequately represent the durability characteristics of the California configuration. This determination shall be based upon similarity of catalyst location and configuration; similarity of fuel metering system; similarity of major features of emission control system logic and design; and similarity of any other features determined by the Executive Officer to be likely to affect durability. If data from a federal durability data vehicle is used, the requirements of §86.091-28(a)(4)(i)(B) (durability vehicles must meet emission standards) will refer to the federal emissions standards in effect for the model year for which the durability data was generated.

* * * * *

(h)(1)(v) ... has previously been submitted.

ADD:
The durability or emission data submitted may be from vehicles previously certified by ARB. For 1993 through 1996 model-year passenger cars and light-duty trucks and 1995 through 1997 model-year medium-duty vehicles, the manufacturer shall submit durability data from only California (or fifty-state) configuration vehicles unless the durability data was generated from a vehicle certified by EPA or ARB prior to the 1993 model year (1995 for medium-duty vehicles). For 1997 (1998 for medium-duty vehicles) and subsequent model-year vehicles, durability data shall be submitted from only California (or fifty-state) configuration vehicles. For 1993 and (1995 for medium-duty vehicles) subsequent model-year vehicles, the Executive Officer shall permit the use of federal durability data vehicles if he or she determines that the federal data will adequately represent the durability characteristics of the California configuration. This determination shall be based upon similarity of catalyst location and configuration; similarity of fuel metering system; similarity of major features of emission control system logic and design; and similarity of any other features determined by the Executive Officer to be likely to affect durability. If data from a federal durability data vehicle is used, the requirements of §86.091-28(a)(4)(i)(B) (durability vehicles must meet emission standards) will refer to the federal emissions standards in effect for the model year for which the durability data was generated.

* * * * *

86.098-24 Test vehicles and engines. April 6, 1994.

86.001-24 Test vehicles and engines. April 6, 1994.

86.085-25 Maintenance. July 7, 1986.

(a) DELETE
REPLACE WITH:
(a) Light-duty vehicles. Paragraph (a) of this section applies to passenger cars, light-duty trucks, and medium-duty vehicles.

(a)(1) DELETE
REPLACE WITH:
(a)(1) Scheduled maintenance on the engine, emission control system, and fuel system of durability vehicles shall, unless otherwise provided pursuant to paragraph (a)(5)(iii), be restricted as set forth in the following provisions. If a manufacturer must revise the maintenance schedule, prior approval by the Executive Officer is required. Unscheduled maintenance must not render a durability vehicle nonrepresentative of the production vehicles. The unscheduled maintenance must not be likely to be required in the normal use of the vehicle. Unauthorized or unjustifiable unscheduled maintenance may be cause for disqualification of a durability vehicle.

Manufacturers must submit durability maintenance logs to the Executive Officer. The maintenance logs shall include the mileage where maintenance occurred, the nature of the maintenance, and the name and part numbers of all fuel system and emission control parts involved with the maintenance. Manufacturers of series hybrid electric vehicles and parallel hybrid electric vehicles shall be required to incorporate into the vehicles a separate odometer or other device subject to the approval of the Executive Officer which can accurately gauge the mileage accumulation on the engines which are used in these vehicles.

* * * * *

(i)(A) DELETE
REPLACE WITH:
(i)(A) For otto-cycle vehicles and hybrid electric vehicles which use otto-cycle engines, maintenance shall be restricted to the inspection, replacement, cleaning, adjustment, and/or service of the following items at intervals no more frequent than indicated:

(1) Drive belts on engine accessories (tension adjustment only); (30,000 miles of engine operation).

(2) Valve lash (15,000 miles of engine operation).

(3) Spark plugs (30,000 miles of engine operation).

(4) Air filter (30,000 miles of engine operation).

(5) Exhaust gas sensor (30,000 miles of engine operation). Provided that:

(a) the manufacturer shall equip the vehicle with a maintenance indicator consisting of a light or flag, which shall be preset to activate automatically by illuminating in the case of a light or by covering the odometer in the case of a flag the first time the minimum maintenance interval established during certification testing is reached and which shall remain activated until reset. After resetting, the maintenance indicator shall activate automatically when the minimum maintenance interval, when added to the vehicle mileage at the time of resetting, is again reached and shall again remain activated until reset. When the maintenance indicator consists of a light, it shall also activate automatically in the engine-run key position before engine cranking to indicate that it is functioning. The maintenance indicator shall be located in the instrument panel and shall, when activated, display the words "oxygen sensor" or may display such other words determined by the Executive Officer to be likely to cause the vehicle owner to seek oxygen sensor replacement. The maintenance indicator shall be separate from the malfunction indicator light required by Section 1968, Title 13, California Code of Regulations;

(b) the manufacturer shall provide free replacement of the oxygen sensor, including both parts and labor, and shall reset the maintenance indicator without any charge, the first time the maintenance interval established during certification testing is reached for vehicles certified with scheduled sensor maintenance before 50,000 miles. If the oxygen sensor is replaced pursuant to the warranty provisions of Section 2037, Title 13, California Code of Regulations, before the first maintenance interval is reached, the manufacturer shall also replace the oxygen sensor and reset the maintenance indicator at the mileage point determined by adding the maintenance interval to the vehicle's mileage at the time of the warranty replacement. If the calculated mileage point for a second oxygen sensor replacement would exceed 50,000 miles, no free second replacement shall be required;

(c) The maintenance indicator shall be resettable. The maintenance instructions required by §86.085-38 of these procedures shall provide instructions for the resetting of the maintenance indicator, and shall specify that the maintenance indicator shall be reset each time the oxygen sensor is replaced; and

(d) Notwithstanding the provisions of Section 2037(c), Title 13, California Code of Regulations; the oxygen sensor, including any replacement required pursuant to this section, shall be warranted for the applicable warranty period of the vehicle or engine in accordance with Section 2037(a), Title 13, California Code of Regulations. If such oxygen sensor fails during this period, it shall be replaced by the manufacturer in accordance with Section 2037(d), Title 13, California Code of Regulations.

(6) Choke (cleaning or lubrication only); (30,000 miles of engine operation).

(7) Positive crankcase ventilation valve (50,000 miles of engine operation).

(8) Ignition wires (50,000 miles of engine operation).

(9) In addition, adjustment of the engine idle speed (curb idle and fast idle), valve lash, and engine bolt torque may be performed once during the first 5,000 miles of scheduled driving, provided the manufacturer makes a satisfactory showing that the maintenance will be performed on vehicles in use. For hybrid electric vehicles, these adjustments may only be performed once during the first 5,000 miles of engine operation.

(10) Hybrid electric vehicle battery system (manufacturer's established performance limits). Provided that:

(a) The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light which shall activate automatically by illuminating the first time the minimum performance level is observed for all battery system components. Possible battery system components requiring monitoring are:

i. battery water level
ii. temperature control
iii. pressure control
iv. other parameters critical for determining battery condition

(b) The manufacturer shall equip the vehicle with a useful life indicator for the battery system consisting of a light which shall illuminate the first time the battery system is unable to achieve an all-electric operating range (starting from a full state-of-charge) which is at least 75% of the range determined for the vehicle in the All-Electric Range Test (see section 9.f. of the "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 §1960.1(k) of Title 13, California Code of Regulations) and submitted in the certification application.

(11) Evaporative and/or refueling emission canister(s) (100,000 miles of engine operation).

(12) Mechanical fillpipe seal (100,000 miles of engine operation).

(i)(B) DELETE
REPLACE WITH:
(i)(B) For diesel vehicles and hybrid electric vehicles which use diesel engines, maintenance shall be restricted to the following items at intervals no more frequently than every 12,500 miles of engine operation, provided that no maintenance may be performed within 5,000 miles of the final test point:

(1) Adjust low idle speed.

(2) Adjust valve lash if required.

(3) Adjust injector timing.

(4) Adjust governor.

(5) Clean and service injector tips.

(6) Adjust drive belt tension on engine accessories.

(7) Check engine bolt torque and tighten as required.

(ii) DELETE
REPLACE WITH:
(ii) Change of engine and transmission oil, change or service of oil filter and, for diesel vehicles only, change or service of fuel filter and air filter, will be allowed at the mileage intervals specified in the manufacturer's maintenance instructions.

(iii) DELETE
REPLACE WITH:
(iii) Maintenance shall be conducted in a manner consistent with service instructions and specifications provided by the manufacturer for use by customer service personnel.

*   *   *   *   *

(a)(3) DELETE

(a)(4) DELETE

(a)(5)(iii) ... maintenance will be performed on vehicles in use.

ADD:
(a)(5)(iv) When a part has to be replaced while conducting unscheduled maintenance, a similarly aged part shall be used for those parts that affect emissions, unless it is impractical and unnecessary to age a part and prior approval has been obtained from the Executive Officer

for use of the part without aging. In either case, an engineering report on the nature of the problem with the probable cause and corrective action shall be supplied to the Executive Officer.

* * * * *

(b) DELETE

86.094-26 Mileage and service accumulation; emission measurements. January 12, 1993.

(a)(1) DELETE
REPLACE WITH:
(a)(1) Paragraph (a) of this section applies to light-duty vehicles, except ZEVs, which shall be exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

(a)(2) DELETE
REPLACE WITH:
(a)(2) The procedure for mileage accumulation shall be the Durability Driving Schedule as specified in Appendix IV to Part 86 of the Code of Federal Regulations. A modified procedure may also be used if approved in advance by the Executive Officer. All passenger cars, light-duty trucks, pre-1995 model year medium-duty vehicles, and 1995 Model- year vehicles certified to 1994 model-year emission standards shall accumulate mileage at a measured curb weight which is within 100 pounds of the estimated curb weight. All 1995 and subsequent model-year medium-duty vehicles (except those certified to 1994 model-year emission standards) and all 1992 and subsequent medium-duty LEVs and ULEVs shall accumulate mileage at a loaded weight that is within 100 pounds of the average of the vehicle's curb weight and gross vehicle weight. If the vehicle weight is within 100 pounds of being included in the next higher inertia weight class, the manufacturer may elect to conduct the respective emission tests at the higher weight. All mileage accumulation of hybrid electric vehicles shall be conducted with the battery pack at the manufacturer's indicated lowest state-of-charge at the beginning of the test cycle. At no time throughout mileage accumulation shall the battery pack be charged using any off-board charging source.

* * * * *

(a)(3)(i)(A) ...

ADD:
The Executive Officer will accept the manufacturer's determination of the mileage at which the engine-system combination is stabilized for emission data testing if (prior to testing) a manufacturer determines that the interval chosen yields emissions performance which is stable

and representative of design intent. Sufficient mileage should be accumulated to reduce the possible effects of any emissions variability that is the result of insufficient vehicle operation. Of primary importance in making this determination is the behavior of the catalyst, EGR valve, trap oxidizer or any other part of the ECS which may have non-linear aging characteristics. In the alternative, the manufacturer may elect to accumulate 4,000 mile +/- 250 mile on each test vehicle within an engine family without making a determination.

* * * * *

(a)(3)(ii)(A) ...

ADD:
The Executive Officer will accept the manufacturer's determination of the mileage at which the engine-system combination is stabilized for emission data testing if (prior to testing) a manufacturer determines that the interval chosen yields emissions performance which is stable and representative of design intent. Sufficient mileage should be accumulated to reduce the possible effects of any emissions variability that is the result of insufficient vehicle operation. Of primary importance in making this determination is the behavior of the catalyst, EGR valve, trap oxidizer or any other part of the ECS which may have non-linear aging characteristics. In the alternative, the manufacturer may elect to accumulate 4,000 mile +/- 250 mile on each test vehicle within an engine family without making a determination.

* * * * *

(a)(4)(i)(A) DELETE
REPLACE WITH:
(a)(4)(i)(A) For otto-cycle and diesel vehicles and battery assisted combustion engine vehicles which use otto-cycle or diesel engines:

(1) Passenger cars, light-duty trucks and medium-duty vehicles certifying to exhaust emissions standards only on a 50,000 mile durability basis and selected by the Executive Officer or elected by the manufacturer under 86.085-24(c)(1), 86.090-24(c)(1), 86.092-24(c)(1), 86.094-24(c)(1), or 86.095-24(c)(1) shall be driven, with all emission control systems installed and operating, for 50,000 miles or such lesser distance as the Executive Officer may agree to as meeting the objective of this procedure.

(2) Prior to initiation of mileage accumulation in a durability-data vehicle, manufacturers must establish the mileage test interval for durability-data vehicle testing of the engine family. Once testing has begun on a durability-data vehicle, the durability test interval for that family may not be changed. At a minimum, multiple tests must be performed at 5,000 miles, 50,000 miles, and the final mileage point as long as they meet the requirements of

Appendix III. The Executive Officer will accept durability test interval schedules determined by the manufacturer. The testing must provide a DF confidence level equal to or better than the confidence level using the former fixed mileage test and scheduled maintenance intervals. The procedure for making this determination is also given in Appendix III. The mileage intervals between test points must be approximately of equal length. The +/-250 mile test point tolerance and the requirement that tests be conducted before and after scheduled maintenance is still mandatory. Emission control systems for otto-cycle engines which have step function changes designed into the control system must use the 5,000 mile test interval schedule.

(3) Testing before and after scheduled (or unscheduled) maintenance points must be conducted, and these data are to be included in the deterioration factor calculation.

The number of tests before and after scheduled maintenance and the mileage intervals between test points should be approximately equal. Durability test interval schedules with multiple testing at test points within 10,000 miles of or at the 50,000 mile and the final mileage test point must be submitted for approval. Multiple testing at maintenance mileage tests points within 10,000 miles of the 50,000 mile and the final mileage test points may be approved if it can be demonstrated by previously generated data that the emission effects of the maintenance are insignificant.

(4) For engine families which are to be certified to the full useful life emission standards, each exhaust emission durability-data vehicle shall be driven with all emission control systems installed and operating, for the full useful life or such lesser distance as the Executive Officer may agree to as meeting the objective of this procedure. Durability tests shall be at every 5,000 miles, from 5,000 miles to the full useful life, however, the above procedures may be used to determine alternate test intervals subject to the following.

For engine families which are to be certified to the full useful life emission standards, durability vehicles may accumulate less than the full useful life if the manufacturer submits other data or information sufficient to demonstrate that the vehicle is capable of meeting the applicable emission standards for the full useful life. At a minimum, 75% of the full useful life shall be accumulated. For the purpose of conducting mileage accumulation on light-duty hybrid electric vehicles, the full useful life of the auxiliary power unit shall be defined as 50,000 miles for a Type A hybrid electric vehicle, 75,000 miles for a Type B hybrid electric vehicle, and 100,000 miles for a Type C hybrid electric vehicle. For medium-duty hybrid electric vehicles, the full useful life of the auxiliary power unit shall be defined as 60,000 miles for a Type A hybrid electric vehicle, 90,000 miles for a Type B hybrid electric vehicle, and 120,000 miles for a Type C hybrid electric vehicle. Alternative durability plans may also be used if the manufacturer provides a demonstration that the alternative plan provides equal or greater confidence that the vehicles will comply in-use with the emission standards. The demonstration shall include, but not be limited to, bench test data and engineering data. A manufacturer's in-use emission data may also be used. All alternative durability plans, including the use of durability vehicles which accumulate less than the full useful life are subject to approval in advance by the Executive Officer.

(B) For diesel vehicles equipped with periodically regenerating trap oxidizer systems, at least four regeneration emission tests (see 86.106 through 86.145) shall be made. With the advance approval of the Executive Officer, the manufacturer may install (1) a manual override switch capable of preventing (i.e., delaying until the switch is turned off) the start of the regeneration process and (2) a light which indicates when the system would initiate regeneration if it had no override switch. Upon activation of the override switch the vehicle will be operated on a dynamometer to precondition it for the regeneration emission test in accordance with §§86.132-82, or 86.132-90, 86.129-80, or 86.129.94 of these procedures. The Urban Dynamometer Driving Schedule (UDDS) which is in progress at the time when the light comes on shall be completed and the vehicle shall proceed to the prescribed soak period followed by testing. With the advance approval of the Executive Officer, the manual override switch will be turned off at some predetermined point in the testing sequence permitting the regeneration process to proceed without further manual interaction. The mileage intervals between test points shall be approximately equal. The first regeneration emission test shall be made at the 5,000 mile point. The regeneration emission tests must provide a deterioration factor confidence level equal to or better than the confidence level achieved by performing regeneration emission tests at the following mileage point: 5,000; 20,000; 35,000; and 50,000. The procedure for making this determination is shown in Appendix IV.

(C) For gasoline-, gaseous-, and alcohol-fueled vehicles, the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles," as incorporated in Title 13, California Code of Regulations, Section 1976, specify evaporative durability testing at 5,000, 10,000, 20,000, 30,000, 40,000 and 50,000 mile test points. These requirements are also applicable to hybrid electric vehicles. With the exception of fuel-flexible vehicles, a manufacturer may conduct evaporative testing at test points used for exhaust emission durability testing provided that the same deterioration confidence level for the evaporative emission DF determination is retained (see Appendix III).

(D) For 1993 and 1994 fuel-flexible vehicles which are not certified to TLEV, LEV, or ULEV standards, the test schedule must include exhaust emission tests at 5,000, 10,000, and every 10,000 miles thereafter to the final mileage point using M85 or E85 for methanol and ethanol fuel-flexible vehicles, respectively. Exhaust emission tests shall also be conducted at 5,000 miles, 50,000 miles, and the final mileage point with certification gasoline. For all 1995 and subsequent fuel-flexible vehicles and all 1992 and subsequent fuel-flexible vehicles certifying to TLEV, LEV, or ULEV standards, the test schedule shall include exhaust emission tests at 5,000 miles, 10,000 miles, and every 10,000 miles thereafter to the final mileage point using M85 or E85 and certification gasoline. For all fuel-flexible vehicles, if evaporative emission testing is conducted, exhaust and evaporative emission tests shall also be conducted using M35 or E10, or another approved fuel, at the mileage points where M85 or E85 testing is conducted. The results of these exhaust and evaporative emission tests will be used by the Executive Officer to evaluate the vehicle's emission control deterioration with various fuels (M85, M35, and unleaded gasoline; See Fuel Specifications, §86.113-94 of these procedures). Only the M85 or E85 and certification gasoline exhaust emission results and the M35 or E10 evaporative emission results will be used to determine applicable exhaust and evaporative emission deterioration factors, respectively, as required in §86.091-28 (Compliance with Emission Standards) of these procedures.

(E) The Executive Officer may determine under 86.085-24(f), 86.090-24(f), 86.092-24(f), 86.094-24(f), or 86.095-24(f), or 86.096-24(f), or 86.098-24(f) that no testing is required.

* * * * *

(a)(5)(i) ...

ADD:
In addition, the emission tests performed on emission-data vehicles and durability-data vehicles shall be non-regeneration emission tests for diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems. For any of these vehicles equipped with continually regenerating trap oxidizer systems, manufacturers may use the provisions applicable to periodically regenerating trap oxidizer systems as an option.

If such an option is elected, all references in these procedures to vehicles equipped with periodically regenerating trap oxidizer systems shall be applicable to the vehicles equipped with continually regenerating trap oxidizer systems.

* * * * *

(a)(8) DELETE
REPLACE WITH:
(a)(8) Once a manufacturer submits the information required in paragraphs (a)(7) of this section for a durability-data vehicle, the manufacturer shall continue to run the vehicle to 50,000 miles if the family is certified to 50,000 mile emission standards or to the full useful life if it is certified to emission standards beyond 50,000 miles (or to a lesser distance which the Executive Officer may have previously agreed to), and the data from the vehicle will be used in the calculations under 86.088-28, 86.090-28, and 86.091-28. Discontinuation of a durability-data vehicle shall be allowed only with the consent of the Executive Officer.

*   *   *   *   *

(b) DELETE

*   *   *   *   *

86.95-26 Mileage and service accumulation; emission measurements. January 12, 1993.

*   *   *   *   *

(b) DELETE

*   *   *   *   *

86.096-26 Mileage and service accumulation; emission measurements. March 24, 1993.

*   *   *   *   *

(b) DELETE

*   *   *   *   *

86.098-26 Mileage and service accumulation; emission measurements. April 6, 1994.

*   *   *   *   *

(a)(3)(i)(A) ...

ADD:
The Executive Officer will accept the manufacturer's determination of the mileage at which the engine-system combination is stabilized for emission data testing if (prior to testing) a manufacturer determines that the interval chosen yields emissions performance which is stable and representative of design intent. Sufficient mileage should be

accumulated to reduce the possible effects of any emissions variability that is the result of insufficient vehicle operation. Of primary importance in making this determination is the behavior of the catalyst, EGR valve, trap oxidizer or any other part of the ECS which may have non-linear aging characteristics. In the alternative, the manufacturer may elect to accumulate 4,000 mile +/- 250 mile on each test vehicle within an engine family without making a determination.

*   *   *   *   *

(b) DELETE

*   *   *   *   *

86.001-26 Mileage and service accumulation; emission measurements. April 6, 1994.

*   *   *   *   *

(b) DELETE

*   *   *   *   *

86.090-27 Special test procedures. April 11, 1989.

86.094-28 Compliance with emission standards. January 12, 1993.

(a)(1) DELETE
REPLACE WITH:
(a)(1) Paragraph (a) of this section applies to passenger cars, light-duty trucks and medium-duty vehicles, except ZEVs.

*   *   *   *   *

(a)(3) DELETE
REPLACE WITH:
(a)(3) Since it is expected that emission control efficiency will change with mileage accumulation on a vehicle, the emission level of a vehicle which has accumulated 50,000 miles will be used as the basis for determining compliance with the 50,000 mile emission standards.

*   *   *   *   *

(a)(4)(i) DELETE
REPLACE WITH:
(a)(4)(i) Separate emission deterioration factors shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs,

LEVs, or ULEVs), exhaust NMOG (all TLEVs, LEVs, and ULEVs), exhaust formaldehyde (alcohol vehicles, TLEVs, LEVs, and ULEVs), exhaust CO, exhaust NOx, and exhaust particulate (diesel vehicles only) for each engine-system combination. A separate evaporative emission deterioration factor shall be determined for each evaporative emission family-evaporative emission control system combination from the testing conducted by the manufacturer (gasoline- and alcohol-fueled vehicles only).

Separate emission correction factors (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs, LEVs, or ULEVs), exhaust NMOG (TLEVs, LEVs, and ULEVs), exhaust CO, exhaust NOx, and exhaust particulate for each engine-system combination.

(A) ...

* * * * *

(a)(4)(i)(A)(4) DELETE
REPLACE WITH:
(a)(4)(i)(A)(4) The manufacturer must use the California outlier identification procedure entitled "Calculation of t-Statistic for Deterioration Data Outlier Test," dated December 17, 1976 and set forth in Appendix VII, to test for irregular data from a durability-data set. If any data point is identified as a statistical outlier, the Executive Officer shall determine, on the basis of an engineering analysis of the causes of the outlier submitted by the manufacturer, whether the outlier is to be rejected. The outlier shall be rejected only if the Executive Officer determines that the outlier does not reflect representative characteristics of the emission control system i.e., the outlier is a result of an emission control system anomaly, test procedure error, or an extraordinary circumstance not expected to recur. Only the identified outlier shall be eliminated; other data at that test point (i.e., data for other pollutants) shall not be eliminated unless the Executive Officer determines, based on the engineering analysis, that they also do not reflect representative characteristics of the emission control system. Where the manufacturer chooses to apply both the outlier procedure and averaging (as allowed under 86.084-26(b)(6)(i) and 86.090-26(a)(6)(1)) to the same data set, the outlier procedure shall be completed prior to applying the averaging procedure. All durability test data, including any outliers and the manufacturer's engineering analysis, shall be submitted with the final application.

(a)(4)(i)(B) DELETE
REPLACE WITH:

(a)(4)(i)(B) All applicable exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The emission data will be acceptable for use in the calculation of the deterioration factor only if the interpolated 4,000-mile, 50,000-mile, and full useful life points on this line are within the emission standards given in section 1960.1, Title 13, California Code of Regulations or within the federal emission standards if a federal durability data vehicle is approved in accordance with subparagraph §86.094-24(f), as applicable. For hybrid electric vehicles, the emission data will be acceptable for use in the calculation of the deterioration factor only if the engine mileage points corresponding to the interpolated 4,000 mile, 50,000 mile, and full useful life points of the vehicle on this line are within the emission standards given in section 1960.1, Title 13, California Code of Regulations or within the federal emission standards if a federal durability data vehicle is approved in accordance with subparagraph §86.094-24(f), as applicable. The engine mileage points shall be determined based on the test schedule submitted to the Executive Officer as required in paragraphs 86.084-26 and 86.090-26. As an exception, the Executive Officer will review the data on a case-by-case basis and may approve its use in those instances where the best fit straight line crosses an applicable standard but no data point exceeds the standard or when the best fit straight line crosses the applicable standard at the 4,000-mile point but the 5,000-mile actual test point and the 50,000 mile and full useful life interpolated points are both below the standards. A multiplicative exhaust emission deterioration factor shall be calculated for each engine system combination as follows:

(1) For engine families certified to 50,000 mile emissions standards:

Factor = Exhaust emissions interpolated to 50,000 miles divided by exhaust emissions interpolated to 4,000 miles.

(2) For engine families certified to full useful life emissions standards beyond 50,000 miles:

Factor = Exhaust emissions interpolated to the full useful life divided by exhaust emissions interpolated to 4,000 miles.

* * * * *

(a)(4)(i)(D) The regeneration exhaust emission data (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) from the tests required under 86.084-26(a)(4) or 86.090-26(a)(4) shall be used to determine the regeneration exhaust emissions interpolated to the

50,000-mile point. The regeneration exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The interpolated 50,000-mile point of this line shall be used to calculate the multiplicative exhaust emission correction factor for each engine-system combination as follows:

$$\text{Factor} = 1 + \frac{R-1}{4505} \quad n$$

where, R = the ratio of the regeneration exhaust emissions interpolated to 50,000 miles to the non-regeneration exhaust emissions interpolated to 50,000 miles.

n = the number of complete regenerations which occur during the durability test.

These interpolated values shall be carried out to a minimum of four places to the right of the decimal point before dividing one by the other to determine the correction factor. The results shall be rounded to three places to the right of the decimal point in accordance with ASTM E29-67. For applicability to gaseous emission standards under the 100,000 mile option, R will be determined based upon projected 100,000 mile emissions.

(a)(4)(ii)(A) DELETE
REPLACE WITH:
(a)(4)(ii)(A) The official exhaust emission test results for each emission-data vehicle at the 4,000 mile test point shall be multiplied by the appropriate deterioration factor, and correction factor (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only): Provided: that if a deterioration factor as computed in paragraph (a)(4)(i)(B) of this section or a correction factor as computed in paragraph (a)(4)(i)(D) of this section is less than one, that deterioration factor or correction factor shall be one for the purposes of this paragraph.

*   *   *   *   *

(a)(4)(iii) DELETE
REPLACE WITH:
(a)(4)(iii) The emissions to compare with the standard (or the family particulate emission limit, as appropriate) shall be the adjusted emissions of paragraphs (a)(4)(ii)(A) and (B) of this section for each emission-data vehicle. Before any emission value is compared with the standard (or the family particulate limit, as appropriate), it shall be rounded, in accordance with ASTM E29-67 to one significant figure beyond the number of significant figures contained in the standard (or

the family particulate emission limit, as appropriate). The rounded emission values may not exceed the standard (or the family particulate emission limit, as appropriate). Fleet average NMOG value calculations shall be rounded, in accordance with ASTM E29-67, to four significant figures before comparing with fleet average NMOG requirements.

* * * * *

(b)(1) DELETE
REPLACE WITH:
(b)(1) Paragraph (b) of this section applies to light-duty and medium-duty vehicles, except ZEVs.

* * * * *

(b)(3) DELETE
REPLACE WITH:
(b)(3) Since it is expected that emission control efficiency will change with mileage accumulation on a vehicle, the emission level of a vehicle which has accumulated 50,000 miles will be used as the basis for determining compliance with the 50,000 mile emission standards.

* * * * *

(b)(4)(i) DELETE
REPLACE WITH:
(b)(4)(i) The applicable procedure for the determination of deterioration factors for light-duty trucks and medium-duty vehicles is the same as that described in paragraph (a)(4) of this section for passenger cars.

(b)(4)(ii) DELETE

(b)(4)(iii) DELETE

(b)(4)(iv) DELETE

* * * * *

86.098-28 Compliance with emission standards. April 6, 1994.

(a)(1) DELETE
REPLACE WITH:
(a)(1) Paragraph (a) of this section applies to passenger cars, except ZEVs.

* * * * *

(a)(4)(i) DELETE
REPLACE WITH:
(a)(4)(i) Separate emission deterioration factors shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs, LEVs, or ULEVs), exhaust NMOG (all TLEVs, LEVs, and ULEVs), exhaust formaldehyde (alcohol vehicles, TLEVs, LEVs, and ULEVs), exhaust CO, exhaust NOx, and exhaust particulate (diesel vehicles only) for each engine-system combination. A separate evaporative and/or refueling emission deterioration factor shall be determined for each evaporative/refueling emission family-evaporative emission control system combination from the testing conducted by the manufacturer (gasoline- and alcohol-fueled vehicles only). Separate refueling emission deterioration factors shall be determined for each evaporative/refueling emission family-emission control system combination from the testing conducted by the manufacturer (petroleum-fueled diesel cycle vehicles not certified under the provisions of paragraph (g) of this section only).

Separate emission correction factors (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC (non-alcohol vehicles, non-TLEVs, non-LEVs, and non-ULEVs), exhaust OMHCE or OMNMHCE (alcohol vehicles that are not TLEVs, LEVs, or ULEVs), exhaust NMOG (TLEVs, LEVs, and ULEVs), exhaust CO, exhaust NOx, and exhaust particulate for each engine-system combination.

* * * * *

(a)(4)(i)(E) The regeneration exhaust emission data (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only) from the tests required under 86.084-26(a)(4) or 86.090-26(a)(4) shall be used to determine the regeneration exhaust emissions interpolated to the 50,000-mile point. The regeneration exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The interpolated 50,000-mile point of this line shall be used to calculate the multiplicative exhaust emission correction factor for each engine-system combination as follows:

$$\text{Factor} = 1 + \frac{R-1}{4505} \quad n$$

where, R = the ratio of the regeneration exhaust emissions interpolated to 50,000 miles to the non-regeneration exhaust emissions interpolated to 50,000 miles.

n = the number of complete regenerations which occur during the durability test.

These interpolated values shall be carried out to a minimum of four places to the right of the decimal point before dividing one by the other to determine the correction factor. The results shall be rounded to three places to the right of the decimal point in accordance with ASTM E29-67. For applicability to gaseous emission standards under the 100,000 mile option, R will be determined based upon projected 100,000 mile emissions.

* * * * *

(a)(4)(iii) DELETE
REPLACE WITH:
(a)(4)(iii) The emissions to compare with the standard (or the family particulate emission limit, as appropriate) shall be the adjusted emissions of paragraphs (a)(4)(ii)(B) and (C) of this section and 86.094-28 (a)(4)(ii)(A) for each emission-data vehicle. Before any emission value is compared with the standard (or the family particulate limit, as appropriate), it shall be rounded, in accordance with ASTM E29-67 to one significant figure beyond the number of significant figures contained in the standard (or the family particulate emission limit, as appropriate). The rounded emission values may not exceed the standard (or the family particulate emission limit, as appropriate). Fleet average NMOG value calculations shall be rounded, in accordance with ASTM E29-67, to four significant figures before comparing with fleet average NMOG requirements.

* * * * *

(b) DELETE

* * * * *

(g)(1)(i) DELETE
REPLACE WITH:
(g)(1)(i) This provision is only available for petroleum diesel fuel.

86.001-28 Compliance with emission standards. April 6, 1994.

* * * * *

(b) DELETE

* * * * *

(g)(1)(i) DELETE
REPLACE WITH:
(g)(1)(i) This provision is only available for petroleum diesel fuel.

86.004-28 Compliance with emission standards. April 6, 1994.

* * * * *

(b) DELETE

* * * * *

(g)(1)(i) DELETE
REPLACE WITH:
(g)(1)(i) This provision is only available for petroleum diesel fuel.

86.091-29 Testing by the Administrator. March 24, 1993.

86.001-30 Certification. April 6, 1994.

86.004-30 Certification. April 6, 1994.

86.094-30 Certification. February 19, 1993.

86.095-30 Certification. February 19, 1993.

86.096-30 Certification. June 28, 1993.

86.098-30 Certification. April 6, 1994.

86.079-31 Separate certification. September 8, 1977.

86.079-32 Addition of a vehicle or engine after certification. September 8, 1977.

86.079-33 Changes to a vehicle or engine covered by certification. September 8, 1977.

86.082-34 Alternative procedures for notification of addition and changes. November 2, 1982.

(a) ...

ADD:
A manufacturer must notify the Executive Officer within 10 working days of making an addition of a vehicle to a certified engine family or a change in a vehicle previously covered by certification.

The manufacturer shall also submit, upon request of the Executive Officer, the following items:

(1) service bulletin.
(2) driveability statement.
(3) test log.
(4) maintenance log.

All running changes and field fixes which do not adversely affect the system durability are deemed approved unless disapproved by the Executive Officer within 30 days of the receipt of the running change or field fix request. A change not specifically identified in the manufacturer's application must also be reported to the Executive Officer if the change may adversely affect engine or emission control system durability. Examples of such changes include any change that could affect durability, thermal characteristics, deposit formation, or exhaust product composition, i.e., combustion chamber design, cylinder head material, camshaft profile, computer modifications, turbocharger, intercooler wastegate characteristics, and transmission or torque converter specifications. Running changes and field fixes meeting the definitions contained in Appendix VI shall be automatically deemed approved by the Executive Officer, as long as the conditions set forth in Appendix VI are satisfied.

The manufacturer is required to update and submit to the Executive Officer the "supplemental data sheet" for all running changes and field fixes implemented with the change notification. The manufacturer shall submit, on a monthly basis, by engine family, a list of running changes/field fixes giving the document number date submitted and a brief description of the change.

* * * * *

86.001-35 Labeling. April 6, 1994.

86.092-35 Labeling. July 26, 1990.

86.094-35 Labeling. July 17, 1992.

86.095-35 Labeling. July 28, 1993.

86.096-35 Labeling. March 24, 1993.

86.098-35 Labeling. April 6, 1994.

86.079-36 Submission of vehicle identification numbers. November 14, 1978.

86.085-37 Production vehicles and engines. January 12, 1983.

86.085-38 Maintenance instructions. November 16, 1983.

(a) DELETE
REPLACE WITH:
(a) The manufacturer shall furnish or cause to be furnished to the purchaser of each new motor vehicle subject to the standards prescribed in §§86.098-8, 86.099-8, 86.001-9, or 86.004-9 of these procedures, written instructions for the maintenance and use of the vehicle by the purchaser as may be reasonable and necessary to assure the proper functioning of emission control systems in normal use. Such instructions shall be consistent with and not require maintenance in excess of the restrictions imposed under subparagraph 86.085-25(a)(1) as amended above, except that the instructions may, subject to approval by the Executive Officer, require additional maintenance for vehicles operated under extreme conditions. In addition, subject to approval by the Executive Officer, the instructions may require inspections necessary to insure safe operation of the vehicle in use.

In addition to any maintenance which may be required pursuant to the preceding paragraph, the instructions may also recommend such inspections, maintenance, and repair as may be reasonable and necessary for the proper functioning of the vehicle and its emission control systems. If the instructions recommend maintenance in addition to that which may be required pursuant to the preceding paragraph, they shall distinguish clearly between required and recommended maintenance.

* * * * *

(c)(1) DELETE
REPLACE WITH:
(c)(1) Such instructions shall specify the performance of all scheduled maintenance performed by the manufacturer under subparagraph 86.085-25(a)(1).

* * * * *

(d)(1) DELETE
REPLACE WITH:
(d)(1) Such instructions shall specify the performance of all scheduled maintenance performed by the manufacturer under subparagraph 86.085-25(a)(1).

* * * * *

86.079-39 Submission of maintenance instructions. September 8, 1977.

(a) DELETE
REPLACE WITH:
(a) The manufacturer shall provide to the Executive Officer, no later than the time of the submission required by paragraph 86.088-23,

86.091-23, or 86.094-23, a copy of the maintenance instructions which the manufacturer proposes to supply to the ultimate purchaser in accordance with subparagraph 86.085-38(a). The Executive Officer will review such instructions to determine whether they are consistent with California requirements, and to determine whether the instructions for required maintenance are consistent with the restrictions imposed under subparagraph 86.085-25(a)(1). The Executive Officer will notify the manufacturer of his or her determinations.

* * * * *

Subpart B - Emission Regulations for 1977 and Later Model year New Light-Duty Vehicles and New Light-Duty Trucks; Test Procedures.

86.101 General applicability. April 6, 1994.

86.102 Definitions. March 5, 1980.

DELETE
REPLACE WITH:
The definitions in subpart A, as modified in these procedures, apply to this subpart.

86.103 Abbreviations. March 5, 1980.

86.104 Section numbering, construction. April 11, 1989.

86.105 Introduction; structure of subpart. April 6, 1994.

86.106-96 Equipment required; overview. March 24, 1993.

86.107-90 Sampling and analytical system, evaporative emissions. April 11, 1989.

(a) ...

(a)(1) DELETE
REPLACE WITH:
(a)(1) *Evaporative emission measurement enclosure.*

(i) Diurnal Evaporative Emissions Measurement Enclosure

(A) The diurnal evaporative emissions measurement enclosure shall be equipped with an internal blower or blowers coupled with an air temperature management system (typically air to water heat exchangers and associated programmable temperature controls) to provide for air mixing and temperature control. For 1993 through 1995 model hybrid electric vehicles and 1995 model motor vehicles, the blower(s) shall be sized to provide a nominal total flow rate within a range of 0.3 to 0.6 ft^3/min per ft^3 of the nominal enclosure volume (V_n). For 1996 and subsequent model motor vehicles, the blower(s) shall provide a nominal total flow rate of 0.8 ± 0.2 ft^3/min per ft^3 of the V_n. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The air circulation blower(s), plus any additional fans if needed, shall also maintain a minimum wind speed of 5 mph under the fuel tank of the test vehicle. The Executive Officer may adjust fan speed and location to ensure sufficient air circulation around the fuel tank. The wind speed requirement may be satisfied by consistently using a fan configuration that has been demonstrated to meet a broad 5-mph air flow in the vicinity of the vehicle's fuel tank, subject to verification by the Executive Officer.

The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall and with a thermocouple located underneath the vehicle where it would provide a temperature measurement representative of the temperature of the air under the fuel tank. The temperature conditioning system shall be capable of controlling the internal enclosure air temperature to follow the prescribed temperature versus time cycle as specified in 40 CFR 86.133-90 as modified by these test procedures within an instantaneous tolerance of ± 3.0°F and an average tolerance of ± 2.0°F as measured by the vehicle underbody thermocouples, and within an instantaneous tolerance of + 5.0°F as measured by the side walls thermocouples. The control system shall be tuned to provide a smooth temperature pattern which has a minimum of overshoot, hunting, and instability about the desired long term temperature profile.

(B) The enclosure shall be of sufficient size to contain the test vehicle with personnel access space. It shall use materials on its interior surfaces which do not adsorb or desorb hydrocarbons or alcohol (if the enclosure is used for alcohol-fueled vehicles). The enclosure shall be insulated to enable the test temperature profile to be achieved with a heating/cooling system which has minimum surface temperatures in the enclosure no less than 25.0°F below the minimum diurnal temperature specification. The enclosure shall be equipped with a pressure transducer with an accuracy and precision of ± 0.1 inches H_2O. The enclosure shall be constructed with a minimum number of seams and joints which provide potential leakage paths. Particular attention shall be given to sealing and gasketing of such seams and joints to prevent leakage.

(C) The enclosure shall be equipped with features which provide for the effective enclosure volume to expand and contract in response to both the temperature changes of the air mass in the enclosure, and any fluctuations in the ambient barometric pressure during the duration of the test. Either a variable volume enclosure or a fixed volume enclosure may be used for diurnal emission testing.

I. The variable volume enclosure shall have the capability of latching or otherwise constraining the enclosed volume to a known, fixed value which shall be termed the nominal enclosure volume (V_n). The nominal enclosure volume shall be determined by measuring all pertinent dimensions of the enclosure in its latched configuration, including internal fixtures, based on a temperature of 84°F, to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. In addition, the enclosure volume shall be measured based on a temperature of 65°F and 105°F. The latching system shall provide a fixed volume with an accuracy and repeatability of $0.005xV_n$. Two potential means of providing the volume accommodation capabilities are a moveable ceiling which is joined to the enclosure walls with a flexure; or a flexible bag or bags of Tedlar or other suitable materials which are installed in the enclosure and provided with flowpaths which communicate with the ambient air outside the enclosure. By moving air into and out of the bag(s), the contained volume can be adjusted dynamically. The total enclosure volume accommodation shall be sufficient to balance the volume changes produced by the difference between the extreme enclosure temperatures and the ambient laboratory temperature with the addition of a superimposed barometric pressure change of 0.8 in. Hg. A minimum total volume accommodation range of $\pm 0.07xV_n$ shall be used. The action of the enclosure volume accommodation system shall limit the differential between the enclosure internal pressure and the external ambient barometric pressure to a maximum value of ± 2.0 inches H_2O.

II. The fixed volume enclosure shall be constructed with rigid panels that maintain a fixed enclosure volume, which shall be referred to as the nominal enclosure volume (V_n). V_n shall be determined by measuring all pertinent dimensions of the enclosure including internal fixtures to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. The enclosure shall be equipped with an outlet flow stream that withdraws air at a low, constant rate and provides makeup air as needed, or by reversing the flow of air into and out of the enclosure in response to rising or falling temperatures. If inlet air is added continuously throughout the test, it must be filtered with activated carbon to provide a relatively constant hydrocarbon and alcohol level. Any method of volume accommodation shall maintain the differential between the enclosure internal pressure and the barometric pressure to a maximum value of ±2.0 inches of water. The equipment shall be capable of measuring the mass of hydrocarbon and alcohol (if the enclosure is used for alcohol-fueled vehicles) in the inlet and outlet flow streams with a resolution of 0.01 gram. A bag sampling system may be used to collect a proportional sample of the air withdrawn from and admitted to the enclosure. Alternatively, the inlet and outlet flow streams may be continuously analyzed using an on-line Flame Ionization Detector (FID) analyzer and integrated with the flow measurements to provide a continuous record of the mass hydrocarbon and alcohol removal.

(D) An online computer system or stripchart recorder shall be used to record the following parameters during the diurnal evaporative emissions test sequence:

-Enclosure internal air temperature

-Diurnal ambient air temperature specified profile as defined in §86.133-90 as modified in these test procedures

-Vehicle fuel tank liquid temperature

-Enclosure internal pressure

-Enclosure temperature control system surface temperature(s)

-FID output voltage recording the following parameters for each sample analysis:

-zero gas and span gas adjustments

-zero gas reading

-Enclosure sample reading

-zero gas and span gas readings

The data recording system shall have a time resolution of 30 seconds and shall provide a permanent record in either magnetic, electronic or paper media of the above parameters for the duration of the test.

(E) Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternative equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

(ii) Running Loss Measurement Facility

(A) For all types of running loss measurement test facilities, the following shall apply:

I. The measurement of vehicle running loss fuel vapor emissions shall be conducted in a test facility which is maintained at a nominal ambient temperature of 105.0°F. Manufacturers have the option to perform running loss testing in either an enclosure incorporating atmospheric sampling equipment, or in a cell utilizing point source sampling equipment. Confirmatory testing or in-use compliance testing may be conducted by the Executive Officer using either sampling procedure. The test facility shall have space for personnel access to all sides of the vehicle and shall be equipped with the following test equipment:

- A chassis dynamometer which meets the requirements of 40 CFR 86.108-79.

- A fuel tank temperature management system which meets the requirements specified in ii.A.III. of this paragraph.

- A running loss fuel vapor hydrocarbon analyzer which meets the requirements specified in §86.107-90(a)(2)(i) and a running loss fuel vapor alcohol analyzer which meets the requirements specified in §86.107-90(a)(2)(ii).

- A running loss test data recording system which meets the requirements specified in ii.A.IV. of this paragraph.

II. All types of running loss test facilities shall be configured to provide an internal ambient temperature of 105°F ± 5°F maximum and ± 2°F on average throughout the running loss test sequence. This shall be accomplished by any one or combination of the following techniques:

- Using the test facility without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.

- Adding insulation to the test facility walls.

- Using the test facility artificial cooling system (if so equipped) with the setpoint of the cooling system adjusted to a value not lower than 105.0°F, where the cooling system setpoint refers to the internal test facility air temperature.

- Using a full range test facility temperature management system with heating and cooling capabilities.

III. Cell/enclosure temperature management shall be measured at the inlet of the vehicle cooling fan. The vehicle cooling fan shall be a road speed modulated fan which is controlled to a discharge velocity which matches the dynamometer roll speed at least up to 30 mph throughout the driving cycle. The fan outlet may discharge airflow to both the vehicle radiator air inlet(s) and the vehicle underbody. An additional fan, not to exceed 8,000 cfm, may be used to discharge airflow from the front of the vehicle directly to the vehicle underbody to control fuel temperatures.

The fuel tank temperature management system shall be configured and operated to control the fuel tank temperature profile of the test vehicle during the running loss test sequence. The use of a discrete fuel tank temperature management system is not required provided that the existing temperature and airflow conditions in the test facility are sufficient to match the on-road fuel tank liquid (T_{liq}) temperature profile of the test vehicle within a tolerance of ± 3.0°F throughout the running loss driving cycle, and, if applicable, the fuel tank vapor (T_{vap}) temperature profile of the test vehicle within a tolerance of ± 5.0°F throughout the running loss driving cycle and +3.0°F during the final 120 second idle period of the test, if applicable. The system shall provide a ducted air flow directed at the vehicle fuel tank which can be adjusted in flow rate and/or temperature of the discharge air to manage the fuel tank temperature. The system shall monitor the vehicle fuel tank temperature sensors located in the tank according to the specifications in §86.129-80(d)(1) during the running loss drive cycle. The measured temperature shall be compared to a reference on-road profile for the same platform/powertrain/fuel tank combination developed according to the procedures in §86.129-80(c). The system shall adjust the discharge flow and/or temperature of the outlet duct to maintain the tank liquid temperature profile within ± 3.0°F of the reference on-road liquid temperature profile throughout the test. If applicable, the vapor temperature shall match the reference on-road vapor temperature profile within ±5.0°F throughout the test and +3.0°F during the final 120 second idle period. The system shall be designed to avoid heating or cooling of the fuel tank vapor space in a way that would cause vapor temperature behavior to be unrepresentative of the vehicle's on-road vapor profile. The system shall provide a discharge airflow up to 4,000 cfm. With Executive Officer approval, the system may provide a discharge airflow with a maximum of 6,000 cfm.

For 1996 and subsequent model motor vehicles, blowers or fans shall be used to mix the enclosure contents during evaporative emission testing. The blowers or fans shall have a total capacity of at least 1.0 ft^3/min per ft^3 of the nominal enclosure volume. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification.

The temperature of the air supplied to the outlet duct shall be within a range of 90°F to 160°F for systems which utilize artificial heating and/or cooling of the air supply to the outlet duct. This requirement does not apply to systems which recirculate air from inside the test cell without temperature conditioning the airflow. The control system shall be tuned and operated to provide a smooth and continuous fuel tank temperature profile which is representative of the on-road temperature profile.

Direct fuel heating may be used to control fuel temperatures for vehicles under exceptional circumstances in which airflow alone is insufficient to control fuel temperatures. The heating system must not cause hot spots on the tank wetted surface that could cause local overheating of the fuel. Heat must not be applied to the vapor in the tank above the liquid fuel, nor near the liquid-vapor interface.

IV. An on-line computer system or strip-chart recorder shall be used to record the following parameters during the running loss test sequence:

-Cell/enclosure ambient temperature

-Vehicle fuel tank liquid (T_{liq}) and, if applicable, vapor space (T_{vap}) temperatures

-Vehicle coolant temperature

-Vehicle fuel tank headspace pressure

-Reference on-road fuel tank temperature profile developed according to §86.129-80(d)

-Dynamometer rear roll speed (if applicable)

-FID output voltage recording the following parameters for each sample analysis:

- -zero gas and span gas adjustments
- -zero gas reading
- -dilute sample bag reading (if applicable)

-dilution air sample bag reading (if applicable)

-zero gas and span gas readings

-methanol sampling equipment data:

-the volumes of deionized water introduced into each impinger

-the rate and time of sample collection

-the volumes of each sample introduced into the gas chromatograph

-the flow rate of carrier gas through the column

-the column temperature

-the chromatogram of the analyzed sample

(B) If an enclosure, or atmospheric sampling, running loss facility is used, the following requirements (in addition to those in subparagraph A. above) shall also be applicable:

I. The enclosure shall be readily sealable and rectangular in shape. When sealed, the enclosure shall be gas tight in accordance with 40 CFR 86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbons and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface should be of flexible, impermeable, and non-reactive material to allow for minor volume changes, resulting from temperature changes.

II. In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F.

III. For 1996 and subsequent model motor vehicles, the enclosure shall be equipped to supply air to the vehicle, at a temperature of 105 ± 5°F, from sources outside of the running loss enclosure directly into the operating engine's air intake system. Supplemental air requirements shall be supplied by drawing air from the engine intake source.

(C) If a point source running loss measurement facility (cell) is used, the following requirements (in addition to those in subparagraph A. above) shall also be applicable:

I. The running loss vapor collection system shall be configured to collect all running loss emissions from each of the discrete emissions sources, which include vehicle fuel system vapor vents , and transport the collected vapor emissions to a CFV or PDP based dilution and measurement system. The collection system shall consist of a collector at each discrete vehicle emissions source, lengths of heated sample line connecting each collector to the inlet of the heated sample pump, and lengths of heated sample line connecting the outlet of the heated sample pump to the inlet of the running loss fuel vapor sampling system. Up to 3 feet of unheated line connecting each of the vapor collectors to the heated sample lines shall be allowed. Each heated sample pump and its associated sample lines shall be maintained at a temperature between 175.0°F and 200.0°F to prevent condensation of fuel vapor in the sample lines. The heated sample pump(s) and its associated flow controls shall be configured and operated to draw a flow of ambient air into each collector at a flow rate of at least 40 standard cubic feet per hour (SCFH). The flow controls on each heated sampling system shall include an indicating flow meter which provides an alarm output to the data recording system if the flow rate drops below 40 SCFH by more than 5 percent. The collector inlet for each discrete emissions source shall be placed in proximity to the source as necessary to capture any fuel vapor emissions without significantly affecting flow or pressure of the normal action of the source. The collector inlets shall be designed to interface with the configuration and orientation of each specific source. For vapor vents which terminate in a tube or hose barb, a short length of tubing of an inside diameter larger throughout its length than the inside diameter of the vent outlet, may be used to extend the vent into the mouth of the collector as illustrated in Figure 1. For those vapor vent designs which are not compatible with such collector configurations and other emissions sources, the vehicle manufacturer shall supply a collector which is configured to interface with the vapor vent design or the specific emissions source design, and which terminates in a fitting approved by the Executive Officer. The Executive Officer shall approve the fitting if the manufacturer demonstrates that it is capable of capturing all vapor emitted from the source.

II. The running loss fuel vapor sampling system shall be a CFV or PDP based dilution and measurement system which further dilutes the running loss fuel vapors collected by the vapor collection system(s) with ambient air, collects continuously proportional samples of the diluted running loss vapors and dilution air in sample bags, and measures the total dilute flow through the sampling system over each test interval. In practice, the system shall be configured and operated in a manner which is directly analogous to an exhaust emissions constant volume sampling system, except that the input flow to the system is the flow from the running loss vapor collection system(s) instead of vehicle exhaust flow. The system shall be configured and operated to meet the following requirements:

(1) The running loss fuel vapor sampling system shall be designed to measure the true mass of fuel vapor emissions collected by the running loss vapor collection system from the specified discrete emissions source. The total volume of the mixture of running loss emissions and dilution air shall be measured, and a continuously proportionated sample of volume shall be collected for analysis. Mass emissions shall be determined from the sample concentration and total flow over the test period.

(2) The PDP-CVS shall consist of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling system, and associated valves, pressure and temperature sensors. The PDP-CVS shall conform to the following requirements:

The gas mixture temperature, measured at a point immediately ahead of the positive displacement pump, shall be within ± 10°F of the designed operating temperature at the start of the test. The gas mixture temperature variation from its value at the start of the test shall be limited to ± 10°F during the entire test. The temperature measuring system shall have an accuracy and precision of ± 2°F.

The pressure gauges shall have an accuracy and precision of ± 1.6 inches of water (± 0.4 kPa).

The flow capacity of the CVS shall not exceed 350 CFM (0.165 m^3/s).

Sample collection bags for dilution air and running loss fuel vapor samples shall be sufficient size so as not to impede sample flow.

(3) The CFV sample system shall consist of a dilution air filter and mixing assembly, a sampling venturi, a critical flow venturi, a sampling system and assorted valves, and pressure and temperature sensors. The CFV sample system shall conform to the following requirements:

-The temperature measuring system shall have an accuracy and precision of ± 2°F and a response time of 0.100 seconds of 62.5 percent of a temperature change (as measured in hot silicone oil).

-The pressure measuring system shall have an accuracy and precision of ± 1.6 inches of water (0.4 kPa).

-The flow capacity of the CVS shall not exceed 350 CFM ($0.165\ m^3/s$).

-Sample collection bags for dilution air and running loss fuel vapor samples shall be of sufficient size so as not to impede sample flow.

III. The on-line computer system or strip-chart recorder specified in ii.A.IV. of this paragraph shall be used to record the following additional parameters during the running loss test sequence, if applicable:

-CFV (if used) inlet temperature and pressure

-PDP (if used) inlet temperature and pressure and differential pressure

-Running loss vapor collection system low flow alarm events

(D) Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternate equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

(iii)Hot Soak Evaporative Emissions Measurement Enclosure

The enclosure shall be readily sealable, rectangular in shape, with space for personnel access to all sides of the vehicle. When sealed, the enclosure shall be gas tight in accordance with §86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbon and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface shall be of flexible, impermeable and non-reactive material to allow for minor volume changes, resulting from temperature changes. The enclosure shall be configured to provide an internal enclosure ambient temperature of $105^oF \pm 5^oF$ maximum and $\pm 2^oF$ on average during the test time interval from 5 minutes after the enclosure is closed and sealed until the end of the one hour hot soak interval. For the first 5 minutes, the ambient temperature shall be maintained at $105^oF \pm 10^oF$. For 1996 and subsequent model motor vehicles, the enclosure shall be equipped with an internal air circulation blower(s). The blower(s) shall be sized to provide a nominal total flow rate within a range of $0.8 \pm 0.2\ ft^3/min$ per ft^3 of the nominal enclosure volume. The inlets and outlets of the blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall. This shall be accomplished by any one or combination of the following techniques:

-Using the enclosure without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.

-Adding insulation to the enclosure walls.

-Using the enclosure artificial cooling system (if so equipped) with the setpoint of the cooling system adjusted to a value not lower than 105.0°F, where the cooling system setpoint refers to the internal enclosure air temperature.

-Using a full range enclosure temperature management system with heating and cooling capabilities.

In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F.

(a)(2)

* * * * *

(a)(4) DELETE

86.107-96 Sampling and analytical system; evaporative emissions. March 24, 1993.

86.107-98 Sampling and analytical system; evaporative emissions. April 6, 1994.

* * * * *

(a)(1) - (a)(3) DELETE
REPLACE WITH
(a)(1) - (a)(3) The enclosure specifications for the refueling test shall either conform to the guidelines contained in 40 CFR 86.107-96(a)(1) - (a)(3), or 86.107-90 (a)(1) - (a)(3) as modified above.

(b) - (d) DELETE
REPLACE WITH
(b) - (d) The analyzing, data recording, and fuel temperature control system specifications for the refueling test shall conform to the guidelines contained in either sections 86.107-96 (b) - (d), or sections 86.107-90 (a)(1)(ii)(A)(III), (a)(2) and (a)(3).

(e) *Temperature recording system.*

(e)(1) DELETE
REPLACE WITH

(e)(1)*For all emission testing*. A strip chart potentiometric recorder, an on-line computer system, or other suitable means shall be used to record enclosure ambient temperature during all evaporative emission test segments, as well as vehicle fuel tank temperature during the running loss test. The recording system shall record each temperature at least once every minute. The recording system shall be capable of resolving time to ±15s and capable of resolving temperature to ±0.75°F(±0.42°C). The recorder (data processor) shall have a time accuracy of ±15s and a precision of ±15s. Two ambient temperature sensors, connected to provide one average output, shall be located 3 feet above the floor at the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall. Manufacturers shall arrange that vehicles furnished for testing at Federal certification facilities be equipped with iron-constantan Type J thermocouples for measurement of fuel tank temperature. Vehicles shall be equipped with 2 temperature sensors installed to provide an average liquid fuel temperature. The temperature sensors shall be placed to measure the temperature at the mid-volume of the liquid fuel at a full level of 40 percent of nominal tank capacity. In-tank temperature sensors are not required for the supplemental two-diurnal test sequence specified in section 86.130-78, or §86.130-96, or for the refueling test specified in §86.151-98.

The manufacturer may elect to use the recording systems specified in sections 107-90 (a)(1)(i)(D), (a)(1)(ii)(A)(iv), (a)(1)(ii)(C)(III), and (a)(1)(iii)

(e)(2) ...

(f) - (h)(3) DELETE
REPLACE WITH
(f) - (h)(3) The pressure recording, purge blower, and mixing blower system specifications shall either conform to the guidelines contained in 40 CFR 86.107-96(f) - (h)(3), or the instrumentation guidelines for enclosures set forth in section 107-90(a)(1).

(h)(4) ...

* * * * *

(i) DELETE
REPLACE WITH
(i) The specifications for the point-source running loss measurement facility shall conform to the guidelines contained in 40 CFR 86.107-96(i), or the instrumentation guidelines for enclosures set forth in section 107-90(a)(1)(ii)(C).

(j) ...

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86.108-79 Dynamometer. September 12, 1977.

86.109-94 Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emission measurements. June 5, 1991.

86.110-90 Exhaust gas sampling system; diesel vehicles. April 11, 1989.

86.110-94 Exhaust gas sampling system; diesel-cycle vehicles, and Otto-cycle vehicles requiring particulate emissions measurements. June 5, 1991.

86.111-90 Exhaust gas analytical-system. April 11, 1989.

86.111-94 Exhaust gas analytical-system. June 16, 1993.

86.112-91 Weighing chamber (or room) and microgram balance specifications. June 5, 1991.

86.113-90 Fuel Specifications. April 11, 1989.

86.113-94 Fuel specifications. March 24, 1993.

(a) *Otto-cycle test fuel.* (1) ...

ADD:
(a)(1)(i) For 1992-1994 model-year Otto-cycle vehicles, gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in subparagraph (a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

Research Octane, minimum	93
Sensitivity, minimum	7.5
Lead (organic), maximum, g/US gal	0.050
Distillation Range	
IBP, degrees F	75-100
10 pct. point, degrees F	120-140
50 pct. point, degrees F	200-230
90 pct. point, degrees F	300-325
EP, maximum, degrees F	415
Sulfur, maximum weight pct.	0.03
Phosphorous, maximum, g/US gal	0.005
RVP, psi	7.5-8.0

Hydrocarbon composition	
Olefins, maximum pct.	10
Aromatics, maximum pct.	35
Saturates	remainder

(a)(1)(ii) For 1993-1994 model-year Otto-cycle TLEVs, LEVs, and ULEVs and for all 1995 and subsequent model-year Otto-cycle vehicles, gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in subparagraph (a)(1), except in the case of refueling testing (when certifying to the refueling standards, the manufacturer must use gasoline having the specifications listed in subparagraph (a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

Fuel Property a/	Limit	Test Method b/
Octane, (R+M)/2 (min)	91	D 2699-88, D 2700-88
Sensitivity (min)	7.5	D 2699-88, D 2700-88
Lead, g/gal (max) (No lead added)	0-0.01	Title 13 CCR 2253.4(c)
Distillation Range, degrees F		Title 13 CCR 2263 c/
10 pct. point,	130-150	
50 pct. point,	200-210 d/	
90 pct. point,	290-300 e/	
EP, maximum	390	
Residue, vol% (max)	2.0	
Sulfur, ppm by wt.	30-40	Title 13 CCR 2263
Phosphorous, g/gal (max)	0.005	Title 13 CCR 2253.4(c)
RVP, psi	6.7-7.0	Title 13 CCR 2263
Olefins, vol %	4.0-6.0	Title 13 CCR 2263
Total Aromatic Hydrocarbons, vol %	22-25	Title 13 CCR 2263
Benzene, vol %	0.8-1.0 f/	Title 13 CCR 2263
Multi-Substituted Alkyl Aromatic Hydrocarbons, vol %	12-14	g/
MTBE, vol %	10.8-11.2	Title 13 CCR 2263
Additives	Sufficient to meet requirements of Title 13, Section 2257, of California Code of Regulations	
Copper Corrosion	No. 1	D 130-88
Gum, Washed, mg/100 ml (max)	3.0	D 381-86
Oxidation Stability, minutes (min)	1000	D 525-88
Specific Gravity	Report h/	
Heat of Combustion	Report h/	
Carbon, wt%	Report h/	
Hydrogen, wt%	Report h/	

a/ The gasoline must be blended from typical refinery feedstocks.

b/ ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

c/ Although Title 13 CCR Section 2263 refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

d/ The range for interlaboratory testing is 195-215 degrees Fahrenheit.

e/ The range for interlaboratory testing is 285-305 degrees Fahrenheit.

f/ The range for interlaboratory testing is 0.7-1.1 percent by volume.

g/ "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

h/ The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

(a)(2) ...

* * * * *

(a)(3) DELETE

(a)(4) DELETE

(a)(5) DELETE
REPLACE WITH:
(a)(5) The specification range of the fuels to be used under paragraph (a)(2) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

(b) *Diesel test fuel.* (1) ...

(b)(2) DELETE
REPLACE WITH:
(b)(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 86.113-90(b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel shall be used. For 1993 and subsequent model-year diesel vehicles, petroleum fuel meeting the specifications of 86.113-94(b)(2) may be used in exhaust emission testing as an option to the specifications in 86.113-90(b)(2). For 1995 and subsequent model-year diesel-fueled vehicles, the petroleum fuel used in exhaust emission testing may meet the specifications of

the general reference fuel in Section 2256(g)(3), Title 13, California Code of Regulations, or substantially equivalent specifications approved by the Executive Officer as an option to the specifications in 86.113-90(b)(2) or 86.113-94(b)(2).

(b)(3) DELETE
REPLACE WITH:
(b)(3) Except as noted below, petroleum fuel for diesel vehicles meeting the following specifications, or substantially equivalent specifications approved by the Executive Officer shall be used in service accumulation. The grade of diesel fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel fuel, shall be used. For 1993 and subsequent model-year diesel-fueled vehicles, petroleum fuel meeting the specifications of 86.113-94(b)(3) may be used in service accumulation. For 1995 and subsequent model-year diesel- fueled vehicles, diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

* * * * *

(b)(4) DELETE

(b)(5) DELETE

(b)(6) DELETE
REPLACE WITH:
(b)(6) The specification range of the fuels to be used under paragraphs (b)(2) and (b)(3) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

(c) ...

(d) DELETE

ADD:
(e) Alcohol-Gasoline Fuel Specifications for 1994 and Subsequent Model-Year Vehicles.

Various alcohol-gasoline fuel blends will be used according to the type of alcohol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted, as specified below.

Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

(1) Otto-cycle alcohol vehicles and hybrid electric vehicles which use otto-cycle alcohol engines

Mileage-accumulation fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle methanol or ethanol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as applicable.

Emission-testing fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle methanol or ethanol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as modified by the following:

The fuel specification for Title 13, CCR, Section 2292.1 shall be modified to: a) require methanol content at 98.0 +/- 0.5 volume percent; b) require ethanol content at 1.0 +/- 0.1 volume percent; c) require certification gasoline conforming with specifications noted in paragraph (a) at 1.0 +/- 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.3 shall be modified to: a) require ethanol content at 98.0 +/- 0.5 volume percent; b) require methanol content at 1.0 +/- 0.1 volume percent; c) require certification gasoline conforming with specifications noted in paragraph (a) at 1.0 +/- 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.2 and 2292.4 shall be modified to require certification gasoline conforming with specifications noted in paragraph (a) as the hydrocarbon fraction. The vapor pressure specification for the emission-testing fuel shall be adjusted to 8.0 - 8.5 psi., using common blending components from the gasoline stream.

(2) Alcohol-fueled diesel vehicles and hybrid electric vehicles which use alcohol-fueled diesel engines

Mileage-accumulation fuel: For methanol, ethanol and hybrid electric vehicles which use alcohol-fueled diesel engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as applicable.

Emission-testing fuel: For methanol, ethanol and hybrid electric vehicles which use otto-cycle alcohol engines, fuel which meets the specifications listed in Title 13, CCR, Section 2292.1, 2292.2, 2292.3 or 2292.4, as modified by the following:

The fuel specification for Title 13, CCR, Section 2292.1 shall be modified to: a) require methanol content at 98.0 +/- 0.5 volume percent; b) require ethanol content at 1.0 +/- 0.1 volume percent; c) require certification gasoline as noted in paragraph (a) at 1.0 +/- 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.3 shall be modified to require ethanol content at 98.0 +/- 0.5 volume percent and require certification gasoline conforming with specifications noted in paragraph (a) at 1.0 +/- 0.1 volume percent.

The fuel specification for Title 13, CCR, Section 2292.2 and 2292.4 shall be modified to require certification gasoline conforming with specifications noted in paragraph (a) as the hydrocarbon fraction. The vapor pressure specification for the emission-testing fuel shall be adjusted to 8.0 - 8.5 psi., using common blending components from the gasoline stream.

(3) Fuel-flexible vehicles

Mileage-accumulation fuel: For both durability-data vehicles and emission-data vehicles, mileage accumulation shall be conducted with one fuel. For vehicles designed to operate on methanol, a fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 shall be used. For vehicles designed to operate on ethanol, a fuel that meets the specifications listed in Title 13, CCR, Section 2292.4 shall be used. Alternative mileage accumulation fuels and procedures may be used if demonstrated to result in equivalent or more severe deterioration of the vehicle's emission control system, subject to the prior approval of the Executive Officer.

Emission-test fuel: Case (1) For exhaust only emission testing of emission-data vehicles, fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 or 2292.4. For evaporative emission testing, a blend of fuel that meets the specifications listed in Title 13, CCR, Section 2292.2 or 2292.4 and gasoline meeting the specifications of paragraph (a) such that the final blend is composed of either 35 volume percent methanol (plus or minus 1 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (plus or minus 1 volume percent of total blend) for ethanol-fueled vehicles shall be used.

Case (2) For the testing required under 86.090(a)(4)(i)(D) of these procedures (durability-data vehicles), exhaust emission tests (exhaust OMHCE or OMNMHCE for non-TLEVs, non-LEVs, and non-ULEVs, exhaust NMOG for TLEVs, LEVs, and ULEVs, exhaust formaldehyde, exhaust CO, and exhaust NOx) and evaporative emission tests (evaporative OMHCE) shall be conducted at the specified mileage intervals using: (i) emission testing fuel that meets the specifications listed in subparagraph (e)(1) of this section and (ii) a blend of fuel produced by combining emission-testing fuel that meets the specifications in subparagraph (e)(1) of this section and certification gasoline described in paragraph (a) such that the final fuel is either 35 volume percent methanol (plus or minus 1 volume percent of total blend) and 65 volume percent certification gasoline for methanol-fueled vehicles or 10 volume percent ethanol (plus or minus 1 volume percent of total blend) and 90 volume percent certification gasoline for ethanol-fueled vehicles.

For both Case (1) and (2), alternative alcohol-gasoline blends may be used in place of M35 or E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to the prior approval of the Executive Officer.

(4) The specification of the fuels to be used under paragraphs (e)(1), (e)(2), (e)(3) and (e)(4) of this section shall be reported in accordance with 86.090-21(b)(3) or 86.091-21(b)(3).

ADD:

(f) Gaseous Fuel Specifications for 1994 and Subsequent Model Year Vehicles.

(1) Dedicated gaseous- and dual-fueled vehicles and hybrid electric vehicles which use liquefied petroleum gas

Mileage accumulation fuel: Liquefied petroleum gas meeting the specifications listed in Title 13, CCR, Section 2292.6 shall be used in service accumulation.

Emission-test fuel: Liquefied petroleum gas meeting the specifications listed in Title 13, CCR, Section 2292.6 shall be used for exhaust and evaporative emission testing with the following exceptions: a) propane content limited to 93.5 +/- 1.0 volume percent; b) propene content limited to 3.8 +/- 0.5 volume percent; c) butane and heavier components limited to 1.9 +/- 0.3 volume percent.

(2) Dedicated gaseous- and dual-fueled vehicles and hybrid electric vehicles which use natural gas

Mileage accumulation fuel: Natural gas meeting the specifications listed in Title 13, CCR, Section 2292.5 shall be used in service accumulation.

Emission-test fuel: Natural gas meeting the specifications listed in Title 13, CCR, Section 2292.5 as modified by the following: a) methane content limited to 90.0 +/- 1.0 mole percent; b) ethane content limited to 4.0 +/- 0.5 mole percent; c) C and higher hydrocarbon content at 2.0 +/- 0.3 mole percent; d) oxygen content at 0.5 maximum mole percent; e) inert gases (sum of CO and N) content at 3.5 +/- 0.5 mole percent.

86.114-94 Analytical gases. June 5, 1991.

86.115-78 EPA urban dynamometer driving schedules. April 6, 1994.

86.116-94 Calibrations, frequency and overview. July 1, 1994.

86.117-90 Evaporative emission enclosure calibrations. April 11, 1989.

* * * * *

(e)(1) Diurnal evaporative emission enclosure. The diurnal evaporative emission measurement enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic hydrocarbon (HC) and methanol retention check and calibration. Calibration for HC and methanol may be conducted in the same test run or in sequential test runs.

(i) The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0°F throughout the four hour period. Variable volume enclosures may be operated in either the latched volume configuration, or with the variable volume feature active. Fixed volume enclosures shall be operated with inlet and outlet flow streams closed. The allowable enclosure background emissions of HC and/or methanol as calculated according to §86.117-90(a)(7) shall not be greater than 0.05 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading (C_{HCi}) and the initial methanol concentration reading (C_{CH3OHi}) is taken and the four hour background measurement period begins.

(ii) The initial determination of enclosure internal volume shall be performed according to the procedures specified in §86.107-90(a)(1)(i)(C). If the enclosure will be used for hot soak determination, the determination of enclosure internal volume shall also be performed based on 105°F.

(iii) The HC and methanol measurement and retention check shall evaluate the accuracy of enclosure HC and methanol mass measurements and the ability of the enclosure to retain trapped HC and methanol. A separate retention check for hydrocarbon and alcohol shall be conducted. The following references to propane are applicable for methanol. The check shall be conducted over a 24 hour period with all of the normally functioning subsystems of the enclosure active. A known mass of propane and/or methanol shall be injected into the enclosure and an initial enclosure mass measurement(s) shall be made. The enclosure shall be subjected to the temperature cycling specified in §86.133-90(1) for a 24 hour period. A final enclosure mass measurement(s) shall be made. The following procedure shall be performed prior to the introduction of the enclosure into service and following any modifications or repairs to the enclosure that may impact the integrity of this enclosure; otherwise, the following procedure shall be performed on a monthly basis. (If six consecutive monthly retention checks are successfully completed without corrective action, the following procedure may be determined quarterly thereafter as long as no corrective action is required.):

(A) Zero and span the HC analyzer.

(B) Purge the enclosure until a stable enclosure HC level is attained.

(C) Turn on the enclosure air mixing and temperature control system and adjust it for an initial temperature of 105.0°F and a programmed temperature profile covering one diurnal cycle over a 24 hour period according to the profile specified in §86.133-90. Close the enclosure door. On variable volume enclosures, latch the enclosure to the enclosure volume measured at 105°F. On fixed volume enclosures, close the outlet and inlet flow streams.

(D) When the enclosure temperature stabilizes at 105.0°F ± 3.0°F seal the enclosure; measure the enclosure background HC concentration (C_{HCe1}), and/or background methanol concentration (C_{CH3OH1}), the temperature (T_1), and pressure (P_1) in the enclosure.

(E) Inject into the enclosure a known quantity of propane between 2 to 6 grams and/or a known quantity of methanol in gaseous form between 2 to 6 grams. The injection method shall use a critical flow orifice to meter the propane and/or methanol at a measured temperature and pressure for a measured time period. Techniques which provide an accuracy and precision of ± 0.5 percent of the injected mass are also acceptable. Allow the enclosure internal HC and/or methanol concentration to mix and stabilize for up to 300 seconds. Measure the enclosure HC concentration (C_{HCe2}), or the enclosure methanol concentration (C_{CH3OH2}). For fixed volume enclosures, measure the temperature (T_2) and pressure in the enclosure (P_2), if applicable (i.e. fixed volume enclosure). On variable volume enclosures, unlatch the enclosure. On fixed volume enclosures, open the outlet and inlet flow streams. Start the temperature cycling function of the enclosure air mixing and temperature control system. These steps shall be completed within 900 seconds of sealing the enclosure.

(F) For fixed volume enclosures, calculate the initial recovered HC mass (M_{HCe1}) according to the following formula:

$$M_{HCe1} = (3.05 x V x 10^{-4} x [P_2(C_{HCe2} - rC_{CH3OH2})/T_2 - P_1(C_{HCe1} - rC_{CH3OH1})/T_1])$$

where:

V is the enclosure volume at 105°F (ft^3)

P_1 is the enclosure initial pressure (inches Hg absolute)

P_2 is the enclosure final pressure (inches Hg absolute)

C_{HCen} is the enclosure HC concentration at event n (ppm C)

C_{CH3OHn} is the enclosure methanol concentration calculated according to §86.117-90 (d)(2)(iii) at event n (ppm C)

r is the FID response factor to methanol

T_1 is the enclosure initial temperature (^oR)

T_2 is the enclosure final temperature (^oR)

For variable volume enclosures, calculate the initial recovered HC mass and initial recovered methanol mass according to the equations used above except that P_2 and T_2 shall equal P_1 and T_1.

Calculate the initial recovered methanol mass (M_{CH3OH1}) according to §86.117-96(d)(1), as amended March 24, 1993.

If the recovered HC mass agrees with the injected mass within 2.0 percent and/or the recovered methanol mass agrees with the injected mass within 6.0 percent, continue the test for the 24 hour temperature cycling period. If the recovered mass differs from the injected mass by greater than the acceptable percentage(s) for HC and/or methanol, repeat the enclosure concentration measurement in step (E) and recalculate the initial recovered HC mass (M_{HCe1}) and/or methanol mass (M_{CH3OH1}). If the recovered mass based on the latest concentration measurement agrees within the acceptable percentage(s) of the injected mass, continue the test for the 24 hour temperature cycling period and substitute this second enclosure concentration measurement for C_{HCe2} and/or C_{CH3OH2} in all subsequent calculations. In order to be a valid calibration, the final measurement of C_{HCe2} and C_{CH3OH2} shall be completed within the 900 second time limit outlined above. If the discrepancy persists, the test shall be terminated and the cause of the difference determined, followed by the correction of the problems(s) and the restart of the test.

(G) At the completion of the 24 hour temperature cycling period, measure the final enclosure HC concentration (C_{HCe3}) and/or the final enclosure methanol concentration (C_{CH3OH3}). For fixed-volume enclosures, measure the final pressure (P_3), and final temperature (T_3) in the enclosure.

For fixed volume enclosures, calculate the final recovered HC mass (M_{HCe2}) as follows:

$$M_{HCe2} = [3.05 \times V \times 10^{-4} \times (P_3(C_{HCe3} - rC_{CH3OH3})/T_3 - P_1(C_{HCe1} - rC_{CH3OH1})/T_1] + M_{HC,out} - M_{HC,in}$$

where:

V is the enclosure volume at $105^{o}F$ (ft^3)

P_1 is the enclosure initial pressure (inches Hg absolute)

P_3 is the enclosure final pressure (inches Hg absolute)

C_{HCe3} is the enclosure HC concentration at the end of the 24 hour temperature cycling period (ppm C)

C_{CH3OH3} is the enclosure methanol concentration at the end of the 24 hour temperature cycling period, calculated according to §86.117-90 (d)(2)(iii) (ppm carbon)

r is the FID response factor to methanol

T_1 is the enclosure initial temperature (^{o}R)

T_3 is the enclosure final temperature (^{o}R)

$M_{HC,out}$ is mass of HC exiting the enclosure (grams)

$M_{HC,in}$ is mass of HC entering the enclosure (grams)

For variable volume enclosures, calculate the final recovered HC mass and final recovered methanol mass according to the equations used above except that P_3 and T_3 shall equal P_1 and T_1, and $M_{HC,out}$ and $M_{HC,in}$ shall equal zero.

Calculate the final recovered methanol mass (M_{CH3OH2}) according to §86.117-96(d)(1), as amended March 24, 1993.

(H) If the calculated final recovered HC mass for the enclosures is not within 3 percent of the initial enclosure mass or the calculated final recovered methanol mass for the enclosure is not within 6 percent of the initial enclosure mass, then action shall be required to correct the error to the acceptable level.

(e)(2) The running loss equipment shall be calibrated as follows:

(i) The chassis dynamometer shall be calibrated according to the requirements of 40 CFR 86.118-78. The calibration shall be conducted at a typical ambient temperature of $75^{o}F \pm 5^{o}F$.

(ii) The running loss HC analyzer shall be calibrated according to the requirements of 40 CFR 86.121-90.

(iii) If a point source facility is used, the running loss fuel vapor sampling system shall be calibrated according to the requirements of 40 CFR 86.119-90, with the additional requirement that the CVS System Verification in 40 CFR

86.119-90(c) be conducted by injecting the known quantity of propane into the inlet of the most frequently used fuel vapor collector configured to collect vapors from the source of the evaporative emission vapor storage canister. This procedure shall be conducted in the running loss test cell with the collector installed in a vehicle in the normal test configuration, except that the vent hose from the vehicle evaporative emission canister shall be routed to a ventilation outlet to avoid unrepresentative background HC concentration levels. The propane injection shall be conducted by injecting approximately 4 grams of propane into the collector while the vehicle is operated over one Urban Dynamometer Driving Schedule (UDDS) test procedure, as described in 40 CFR 86.115-78 and 40 CFR Appendix I. The propane injection shall be conducted at a typical ambient temperature of 75°F ± 5°F.

(iv) In the event the running loss test is conducted using the atmospheric sampling measurement technique, the following procedure shall be used for the enclosure calibration:

(A) The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0°F throughout the four hour period. The allowable enclosure background emissions as calculated according to §86.117-90 (a)(7) shall not be greater than 0.2 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading is taken.

(B) The initial determination of enclosure internal volume shall be performed according to the procedures specified in §86.117-90 (b).

(C) The enclosure shall meet the calibration and retention requirements of §86.117-90(c). The propane injection recovery test shall be conducted with a test vehicle being driven over one UDDS cycle in the enclosure during the propane injection test. The vehicle used shall be configured and operated under conditions which ensure that its own running loss contribution is negligible, by using fuel of the lowest available volatility (7.0 psi RVP), maintaining the tank temperature at low levels (<100°F), and routing the canister vent to the outside of the enclosure.

(v) Hot soak enclosure. The hot soak enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic HC and methanol retention check and calibration. The hot soak enclosure calibration shall be conducted according to the method specified in subparagraph (e)(1) with a retention check of 4 hours at 105°F or the method specified in subparagraph (e)(2)(iv).

(vi) Diurnal and hot soak enclosure HC analyzer. The HC analyzers used for measuring the diurnal and hot soak samples shall be calibrated according to the requirements of §86.121-90.

(vii) Other equipment. Other test equipment including temperature and pressure sensors and the associated amplifiers and recorders, flow measurement devices, and other instruments shall be calibrated and operated according to the manufacturer's specifications and recommendations, and good engineering practice.

86.117-96 Evaporative emission enclosure calibrations. March 24, 1993.

When certifying to the refueling standards set forth in Sections 86.098-8, 86.099-8, 86.001-9, and 86.004-9, the manufacturer shall follow the evaporative emission enclosure calibrations specified in the following sections, or section 86.117-90 as modified above.

*   *   *   *   *

86.118-78 Dynamometer calibration. January 7, 1988.

86.119-90 CVS calibration. April 11, 1989.

86.120-82 Gas meter of flow instrumentation calibration, particulate measurement. March 5, 1980.

86.121-90 Hydrocarbon analyzer calibration. April 11, 1989.

86.122-78 Carbon monoxide analyzer calibration. June 28, 1977.

86.123-78 Oxides of nitrogen analyzer calibration. September 12, 1977.

86.124-78 Carbon dioxide analyzer calibration. June 28, 1977.

86.125-94 Methane analyzer calibration. June 5, 1991.

86.126-90 Calibration of other equipment. April 11, 1989.

86.127-90 Test procedures; overview. April 11, 1989.

86.127-94 Test procedures; overview. June 5, 1991.

86.127-96 Test procedures; overview. March 24, 1993.

86.128.79 Transmission. March 24, 1993.

86.129-80 Road load power test weight and inertia weight class determination. November 14, 1978.

(a) ...

*   *   *   *   *

ADD:
ROAD LOAD POWER TEST WEIGHT AND INERTIA WEIGHT CLASS DETERMINATION

ROAD LOAD POWER AT 50 mi/hr-LIGHT DUTY TRUCKS	LOADED WEIGHT (POUNDS)	EQUIVALENT TEST WEIGHT (POUNDS)	INERTIA WEIGHT CLASS (POUNDS)
	10001 to 10250	10000	10000
	10251 to 10750	10500	10500
	10751 to 11250	11000	11000
	11251 to 11750	11500	11500
	11751 to 12250	12000	12000
	12251 to 12750	12500	12500
	12751 to 13250	13000	13000
	13251 to 13750	13500	13500
	13751 to 14000	14000	14000

For 1995 and subsequent medium-duty vehicles, "Loaded Weight" shall be the average of the vehicle's curb weight and gross vehicle weight.

*   *   *   *   *

(d) Determination of running loss test fuel tank temperature profile

The manufacturer shall establish for each combination of vehicle platform/powertrain/fuel tank submitted for certification a representative profile of fuel tank liquid and vapor temperature versus time to be used as the target temperature profile for the running loss evaporative emissions test drive cycle. If a vehicle has more than one fuel tank, a profile shall be established for each tank. For 1996 and subsequent model motor vehicles, if manufacturers use a vehicle model to develop a profile to represent multiple vehicle models, the vehicle model selected must have the greatest expected fuel liquid temperature and fuel vapor temperature increase during driving of all of the vehicle models it will represent. For 1996 and subsequent model motor vehicles, manufacturers must select test vehicles with any available vehicle options that could increase fuel temperature during driving, such as any feature that limits underbody air flow. The profile shall be established by driving the vehicle on-road over the same driving schedule as is used for the running loss evaporative emissions test according to the following sequence:

(1) The vehicle to be used for the fuel tank temperature profile determination shall be equipped with at least 2 thermocouples installed so as to provide a representative bulk liquid average fuel temperature. The specific placement of the thermocouples shall take into account the tank configuration and orientation and shall be along the major axis of the tank. The thermocouples shall not be placed within internal reservoirs or other locations which are thermally isolated from the bulk volume of the fuel. The thermocouples shall be placed at a vertical depth equivalent to the mid-volume of the liquid fuel at a fill level of 40 percent of nominal tank capacity. A third thermocouple shall be installed in the approximate center of the vapor space of the fuel tank. A pressure transducer with a minimum precision and accuracy of ± 1.0 inches H_2O shall be connected to the vapor space of the fuel tank. A means of conveniently draining the fuel tank shall be provided. The vehicle shall be equipped with a driver's aid which shall be configured to provide the test driver with the desired UDDS vehicle speed versus time trace as defined in 40 CFR Part 86, Appendix I of the CFR and with the desired NYCC vehicle speed versus time trace as defined in Part 86, Appendix I of the CFR, amended as of March 24, 1993, and the actual vehicle speed. Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). A computer, data logger, or strip chart data recorder shall record the following parameters during the test run:

-Desired speed

-Actual speed

-Average liquid fuel temperature (T_{liq})

-Vapor space temperature (T_{vap})

-Vapor space pressure

The data recording system shall provide a time resolution of 1 second, and an accuracy of ± 1 MPH, ± 2.0°F, and ± 1.0 inches H_2O. The temperature and pressure signals may be recorded at intervals of up to 30 seconds.

(2) The temperature profile determination shall be conducted during ambient conditions which include:

-ambient temperature above 95°F and increasing or stable (± 2°F)

-sunny or mostly sunny with a maximum cloud cover of 25 percent

-wind conditions calm to light with maximum sustained wind speeds of 15 mph: temporary gusts of wind between 15 and 25 mph may occur up to 5 percent of the total driving time

-road surface temperature (T_{sur}) at least 20°F above ambient temperature (T_{amb}) or at least 135°F, whichever is less for 1996 and subsequent model motor vehicles

The track surface temperature shall be measured with an embedded sensor, a portable temperature probe, or an infrared pyrometer which can provide an accuracy of ± 2.0°F. Temperatures must be measured on a surface representative of the surface where the vehicle is driven. The test shall be conducted on a track or other restricted access facility so that the speed versus time schedule can be maintained without undue safety risks.

Prior to the start of the profile generation, the fuel tank may be artificially heated to the ambient temperature to a maximum of 105°F. The vehicle may be soaked in a temperature-controlled enclosure. Fans blowing ambient air may be used to help control fuel temperatures. Engine idling may not be used to control fuel temperatures. If the fuel tank is artificially heated, the liquid fuel temperature and the vapor temperature must be stabilized for at least one hour at the ambient temperature within ± 2°F to a maximum of of 105°F before the profile generation begins.

Tank pressure shall not exceed 10 inches of water 30 seconds after the start of the engine until the end of engine operation during the temperature profile determination unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel cap was removed at the end of the running loss fuel tank temperature profile determination.

(3) The vehicle fuel tank shall be drained and filled to 40 percent of the nominal tank capacity with fuel meeting the requirements of §86.113. The vehicle shall be moved to the location where the driving cycle is to be conducted. It may be driven a maximum distance of 5.0 miles; longer distances shall require that the vehicle be transported by other means. The vehicle shall be parked for a minimum of 12 hours in an open area on a surface that is representative of the test road. The orientation of the front of the vehicle during parking (N, SW, etc.) shall be documented. Once the 12 hour minimum parking time has been achieved and the ambient temperature and weather conditions and track surface temperature are within the allowable ranges the vehicle engine shall be started. The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F. The vehicle may be operated at minimum throttle for periods up to 60 seconds prior to beginning the first UDDS cycle in order to move from the parking location onto the road surface. The driver's aid shall be started and the vehicle operated over three sequential UDDS cycles with the transmission operated in the same manner as specified in 40 CFR

86.128-79. For 1996 and subsequent model motor vehicles, the vehicles shall be operated over one UDDS cycle, then two NYCCs, and another UDDS cycle instead of over three UDDS cycles. The end of each UDDS cycle and the end of the two NYCCs, if applicable shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in §86.128-79 except for the following:

Revise section (c) to include: Idle modes may be run with automatic transmission in "Neutral" and shall be placed in "Drive" with the wheels braked at least 5 seconds before the end of the idle mode. Manual transmission may be in "Neutral" with the clutch engaged and shall be placed in gear with the clutch disengaged at least 5 seconds before the end of the idle mode.

The data recording system shall provide a record of the required parameters over the entire sequence from the initiation of the first UDDS cycle to the end of the third 120 second idle period. Following the completion of the test, the data recording system and driver's aid shall be turned off.

(4) In addition to the vehicle data recording, the following parameters shall be documented for the running loss test fuel tank temperature determination:

-Date and time of vehicle fueling

-Odometer reading at vehicle fueling

-Date and time vehicle was parked and parking location and orientation

-Odometer reading at parking

-Time and temperature of fuel tank heating, if applicable

-Date and time engine was started

-Time of initiation of first UDDS cycle

-Time of completion of third 120 second idle period

-Ambient temperature and track surface temperature at initiation of first UDDS cycle (T_{amb1} and T_{sur1})

-Ambient temperature and track surface temperature at completion of third 120 second idle period (T_{amb2} and T_{sur2})

(5) The three UDDS cycle driving traces and the two UDDS and two NYCC driving traces shall be verified to meet the speed tolerance requirements of 40 CFR 86.115-78 (b).

The following temperature conditions shall be verified:

$(T_{amb1}) \geq 95.0^{o}F$

$(T_{amb2}) \geq (T_{amb1} - 2.0^{o}F)$

For 1993 to 1995 model hybrid vehicles and 1995 model motor vehicles:

$(T_{sur1} - T_{amb1}) \geq 20.0^{o}F$

$(T_{sur2} - T_{amb2}) \geq 20.0^{o}F$

For 1996 and subsequent model motor vehicles:

$(T_{sur(n)} - T_{amb(n)}) \geq 30.0^{o}F$

where n is the incremental measurements in time.

or $T_{sur} > 135^{o}F$

Failure to comply with any of these requirements shall result in a void test, and require that the entire test procedure be repeated beginning with the fuel drain specified in (d)(3) of this subparagraph. If all of these requirements are met, the following calculations shall be performed:

$T_{corr} = T_{(i)} - T_{o}$

where: $T_{(i)}$ is the liquid fuel temperature or vapor fuel temperature during the drive (^{o}F) where i is the incremental measurements in time

T_{o} is the corresponding liquid fuel temperature or vapor fuel temperature observed at the start of the specified driving schedule (^{o}F)

The individual tank liquid (T_{liq}) and vapor space (T_{vap}) temperatures recorded during the test run shall be adjusted by arithmetically adding the corresponding temperature correction (T_{corr}) adjustment calculated above to $105^{o}F$. If T_{o} is higher than the corresponding ambient temperature by $2^{o}F$, the temperature correction shall be determined by the above equation plus the difference in T_{o} and the corresponding ambient temperature.

(6) Other methodologies for developing corrected liquid and vapor space temperature profiles are acceptable if approved in advance by the Executive Officer. The Executive Officer shall approve an alternate method if the manufacturer demonstrates equivalence to data collected at $105^{o}F$.

86.129-94 Road load power test weight and inertia weight class determination. March 24, 1993.

* * * * *

(a) ...

ADD:
ROAD LOAD POWER TEST WEIGHT AND INERTIA WEIGHT CLASS DETERMINATION

ROAD LOAD POWER AT 50 mi/hr-LIGHT DUTY TRUCKS	LOADED WEIGHT (POUNDS)	EQUIVALENT TEST WEIGHT (POUNDS)	INERTIA WEIGHT CLASS (POUNDS)
	10001 to 10250	10000	10000
	10251 to 10750	10500	10500
	10751 to 11250	11000	11000
	11251 to 11750	11500	11500
	11751 to 12250	12000	12000
	12251 to 12750	12500	12500
	12751 to 13250	13000	13000
	13251 to 13750	13500	13500
	13751 to 14000	14000	14000

For 1995 and subsequent medium-duty vehicles, "Loaded Weight" shall be the average of the vehicle's curb weight and gross vehicle weight.

* * * * *

(d) Power absorption unit adjustment- medium-duty vehicles.

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 mph true speed. The dynamometer power absorption shall take into account the dynamometer friction, as discussed in paragraph 86.118-78.

(2) The dynamometer road load setting is determined from the loaded test weight, the reference frontal area, vehicle protuberances, and an aerodynamic drag coefficient as determined appropriate by the Executive Officer. The vehicle manufacturer shall submit the procedure by which the aerodynamic drag coefficient was determined in the test vehicle information section in the certification application. The dynamometer road load setting shall be determined by the following equation.

(i) For medium-duty vehicles to be tested on twin or single, large roll dynamometers.

$$Hp = (0.00182)V((0.015)(W)+(0.0375)(Cd)(A)(V^2)/(32.2ft/s^2))+P$$

where:

Hp=the dynamometer power absorber setting at 50 mph (horsepower).
0.00182=conversion factor to horsepower.
V=velocity in feet/sec.
0.015=coefficient of rolling resistance.
W=loaded vehicle weight in pounds.
0.0375=air density in lbm/cubic ft.
Cd=aerodynamic drag coefficient
A=reference frontal area in square ft.
32.2 ft/s =gravitational acceleration
P=protuberance power (horsepower)

(ii) The protuberance power, P shall be determined per subparagraph 86.129-80 (c)(2)(i).

(iii) The dynamometer power absorber setting for medium-duty vehicles shall be rounded to the nearest 0.1 horsepower.

(3) The road load power calculated above shall be used or the vehicle manufacturer may determine the road load power by an alternate procedure requested by the manufacturer and approved in advance by the Executive Officer.

(4) Where it is expected that more than 33 percent of a vehicle line within an engine-system combination will be equipped with air conditioning, per subparagraph 86.090-24(g)(2), 86.092-24(g)(2), 86.094-24(g)(2), or 86.095-24(g)(2), the road load power as determined in paragraph (d) (2) or (3) of this section shall be increased by 10 percent up to a maximum increment of 1.4 horsepower, for testing all test vehicles of that vehicle line within that engine-system combination if those vehicles are intended to be offered with air conditioning in production. This power increment shall be added to the indicated dynamometer power absorption setting prior to rounding off this value.

(5) For electric and hybrid electric vehicle lines where it is expected that more than 33 percent of a vehicle line will be equipped with air conditioning, per subparagraph 86.090-24(g)(2), 86.092-24(g)(2), 86.094-24(g)(2), or 86.095-24(g)(2), which derives power from the battery pack, the road load shall be increased by the incremental horsepower required to operate the air conditioning unit. The incremental increase shall be determined by recording the difference in energy required for a hybrid electric vehicle under all-electric power to complete the running loss test fuel tank temperature profile test sequence without air conditioning and the same vehicle tested over the running loss test fuel tank temperature profile test sequence with the air conditioning set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed over the time period needed to perform the test sequence, and converting this value into units of horsepower.

Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72 degrees Fahrenheit. The running loss test fuel tank temperature profile test sequence is found in the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR.

(e) Determination of running loss test fuel tank temperature profile

The manufacturer shall establish for each combination of vehicle platform/powertrain/fuel tank submitted for certification a representative profile of fuel tank liquid and vapor temperature versus time to be used as the target temperature profile for the running loss evaporative emissions test drive cycle. If a vehicle has more than one fuel tank, a profile shall be established for each tank. For 1996 and subsequent model motor vehicles, if manufacturers use a vehicle model to develop a profile to represent multiple vehicle models, the vehicle model selected must have the greatest expected fuel liquid temperature and fuel vapor temperature increase during driving of all of the vehicle models it will represent. For 1996 and subsequent model motor vehicles, manufacturers must select test vehicles with any available vehicle options that could increase fuel temperature during driving, such as any feature that limits underbody air flow. The profile shall be established by driving the vehicle on-road over the same driving schedule as is used for the running loss evaporative emissions test according to the following sequence:

(1) The vehicle to be used for the fuel tank temperature profile determination shall be equipped with at least 2 thermocouples installed so as to provide a representative bulk liquid average fuel temperature. The specific placement of the thermocouples shall take into account the tank configuration and orientation and shall be along the major axis of the tank. The thermocouples shall not be placed within internal reservoirs or other locations which are thermally isolated from the bulk volume of the fuel. The thermocouples shall be placed at a vertical depth equivalent to the mid-volume of the liquid fuel at a fill level of 40 percent of nominal tank capacity. A third thermocouple shall be installed in the approximate center of the vapor space of the fuel tank. A pressure transducer with a minimum precision and accuracy of $\pm$ 1.0 inches H_2O shall be connected to the vapor space of the fuel tank. A means of conveniently draining the fuel tank shall be provided. The vehicle shall be equipped with a driver's aid which shall be configured to provide the test driver with the desired UDDS vehicle speed versus time trace as defined in 40 CFR Part 86, Appendix I of the CFR and with the desired NYCC vehicle speed versus time trace as defined in Part 86, Appendix I of the CFR, amended as of March 24, 1993, and the actual vehicle speed. Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). A computer, data logger, or strip

chart data recorder shall record the following parameters during the test run:

-Desired speed

-Actual speed

-Average liquid fuel temperature (T_{liq})

-Vapor space temperature (T_{vap})

-Vapor space pressure

The data recording system shall provide a time resolution of 1 second, and an accuracy of ± 1 MPH, ± 2.0°F, and ± 1.0 inches H_2O. The temperature and pressure signals may be recorded at intervals of up to 30 seconds.

(2) The temperature profile determination shall be conducted during ambient conditions which include:

-ambient temperature above 95°F and increasing or stable (± 2°F)

-sunny or mostly sunny with a maximum cloud cover of 25 percent

-wind conditions calm to light with maximum sustained wind speeds of 15 mph: temporary gusts of wind between 15 and 25 mph may occur up to 5 percent of the total driving time

-road surface temperature (T_{sur}) at least 20°F above ambient temperature (T_{amb}) or at least 135°F, whichever is less for 1996 and subsequent model motor vehicles

The track surface temperature shall be measured with an embedded sensor, a portable temperature probe, or an infrared pyrometer which can provide an accuracy of ± 2.0°F. Temperatures must be measured on a surface representative of the surface where the vehicle is driven. The test shall be conducted on a track or other restricted access facility so that the speed versus time schedule can be maintained without undue safety risks.

Prior to the start of the profile generation, the fuel tank may be artificially heated to the ambient temperature to a maximum of 105°F. The vehicle may be soaked in a temperature-controlled enclosure. Fans blowing ambient air may be used to help control fuel temperatures. Engine idling may not be used to control fuel temperatures. If the fuel tank is artificially heated, the liquid fuel temperature and the vapor temperature must be stabilized for at least one hour at the ambient temperature within ± 2°F to a maximum of of 105°F before the profile generation begins.

Tank pressure shall not exceed 10 inches of water 30 seconds after the start of the engine until the end of engine operation during the temperature profile determination unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel cap was removed at the end of the running loss fuel tank temperature profile determination.

(3) The vehicle fuel tank shall be drained and filled to 40 percent of the nominal tank capacity with fuel meeting the requirements of §86.113. The vehicle shall be moved to the location where the driving cycle is to be conducted. It may be driven a maximum distance of 5.0 miles; longer distances shall require that the vehicle be transported by other means. The vehicle shall be parked for a minimum of 12 hours in an open area on a surface that is representative of the test road. The orientation of the front of the vehicle during parking (N, SW, etc.) shall be documented. Once the 12 hour minimum parking time has been achieved and the ambient temperature and weather conditions and track surface temperature are within the allowable ranges the vehicle engine shall be started. The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F. The vehicle may be operated at minimum throttle for periods up to 60 seconds prior to beginning the first UDDS cycle in order to move from the parking location onto the road surface. The driver's aid shall be started and the vehicle operated over three sequential UDDS cycles with the transmission operated in the same manner as specified in 40 CFR 86.128-79. For 1996 and subsequent model motor-vehicles, the vehicles shall be operated over one UDDS cycle, then two NYCCs, and another UDDS cycle instead of over three UDDS cycles. The end of each UDDS cycle and the end of the two NYCCs, if applicable shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in §86.128-79 except for the following:

Revise section (c) to include: Idle modes may be run with automatic transmission in "Neutral" and shall be placed in "Drive" with the wheels braked at least 5 seconds before the end of the idle mode. Manual transmission may be in "Neutral" with the clutch engaged and shall be placed in gear with the clutch disengaged at least 5 seconds before the end of the idle mode.

The data recording system shall provide a record of the required parameters over the entire sequence from the initiation of the first UDDS cycle to the end of the third 120 second idle period. Following the completion of the test, the data recording system and driver's aid shall be turned off.

(4) In addition to the vehicle data recording, the following parameters shall be documented for the running loss test fuel tank temperature determination:

-Date and time of vehicle fueling

-Odometer reading at vehicle fueling

-Date and time vehicle was parked and parking location and orientation

-Odometer reading at parking

-Time and temperature of fuel tank heating, if applicable

-Date and time engine was started

-Time of initiation of first UDDS cycle

-Time of completion of third 120 second idle period

-Ambient temperature and track surface temperature at initiation of first UDDS cycle (T_{amb1} and T_{sur1})

-Ambient temperature and track surface temperature at completion of third 120 second idle period (T_{amb2} and T_{sur2})

(5) The three UDDS cycle driving traces and the two UDDS and two NYCC driving traces shall be verified to meet the speed tolerance requirements of 40 CFR 86.115-78 (b).

The following temperature conditions shall be verified:

$(T_{amb1}) \geq 95.0^{o}F$

$(T_{amb2}) \geq (T_{amb1} - 2.0^{o}F)$

For 1993 to 1995 model hybrid vehicles and 1995 model motor vehicles:

$(T_{sur1} - T_{amb1}) \geq 20.0^{o}F$

$(T_{sur2} - T_{amb2}) \geq 20.0^{o}F$

For 1996 and subsequent model motor vehicles:

$(T_{sur(n)} - T_{amb(n)}) \geq 30.0^{o}F$

where n is the incremental measurements in time.

or $T_{sur} > 135^{o}F$

Failure to comply with any of these requirements shall result in a void test, and require that the entire test procedure be repeated beginning with the fuel drain specified in (d)(3) of this subparagraph. If all of these requirements are met, the following calculations shall be performed:

$$T_{corr} = T_{(i)} - T_o$$

where: $T_{(i)}$ is the liquid fuel temperature or vapor fuel temperature during the drive (^oF) where i is the incremental measurements in time

T_o is the corresponding liquid fuel temperature or vapor fuel temperature observed at the start of the specified driving schedule (^oF)

The individual tank liquid (T_{liq}) and vapor space (T_{vap}) temperatures recorded during the test run shall be adjusted by arithmetically adding the corresponding temperature correction (T_{corr}) adjustment calculated above to 105^oF. If T_o is higher than the corresponding ambient temperature by 2^oF, the temperature correction shall be determined by the above equation plus the difference in T_o and the corresponding ambient temperature.

(6) Other methodologies for developing corrected liquid and vapor space temperature profiles are acceptable if approved in advance by the Executive Officer. The Executive Officer shall approve an alternate method if the manufacturer demonstrates equivalence to data collected at 105^oF.

86.130-78 Test sequence; general requirements. June 28, 1977.

DELETE
REPLACE WITH:
For all hybrid electric vehicles and all 1995 and subsequent model-year vehicles certifying to running loss and useful life evaporative emission standards, the test sequence shown in Figure 2 (Figure 3 for hybrid electric vehicles) describes the steps encountered as the vehicle undergoes the three-day diurnal sequence to determine conformity with the standards set forth.

(a) For 1996 and subsequent model motor vehicles, the test sequence shown in Figure 4 (Figure 5 for hybrid electric vehicles) describes the steps encountered as the vehicle undergoes the three-day diurnal sequence and the supplemental two-day diurnal sequence to determine conformity with the standards set forth. Methanol measurements may be omitted when methanol-fueled vehicles will not be tested in the evaporative enclosure. Ambient temperature levels encountered by the test vehicle throughout the entire duration of this test sequence shall not be less than 68^oF nor more than 86^oF, unless otherwise specified. The temperatures monitored during testing shall be representative of those experienced by the test vehicle. The test vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution. The temperature tolerance of a soak period may be waived for up to 10 minutes to allow purging of the enclosure or transporting the vehicle into the enclosure.

If tests are invalidated after collection of emission data from previous test segments, the test may be repeated to collect only those data points needed to complete emission measurements. Compliance with emission standards may be determined by combining emission measurements from different test runs. If any emission measurements are repeated, the new measurements supersede previous values.

The three-day diurnal test sequence shown in Figure 2 (and Figure 3 for hybrid electric vehicles) is briefly described as follows:

1. The fuel tank shall be drained and filled to the prescribed tank fuel volume, as specified in 40 CFR 86.082-2, in preparation for the vehicle preconditioning.

2. The vehicle preconditioning drive shall be performed in accordance with 40 CFR 86.132-90, except that following the vehicle fueling step at §86.132-90(a)(1) a minimum soak period of 6 hours shall be provided to allow the vehicle to stabilize to ambient temperature prior to the preconditioning drive. Vehicles performing consecutive tests at a test point with the same fuel specification and while remaining under laboratory ambient temperature conditions for at least 6 hours, may eliminate the initial fuel drain and fill and vehicle soak. In such cases, each subsequent test shall begin with the preconditioning drive. For hybrid electric vehicles only, the manufacturer may elect to perform the All-Electric Range Test pursuant to §9.f. of the "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 §1960.1(k) of Title 13, California Code of Regulations prior to vehicle preconditioning.

3. Following the vehicle preconditioning drive, the fuel tank shall be drained and then filled to 40 percent capacity.

4. The vehicle shall be allowed to soak for 12 to 36 hours prior to the exhaust emissions test.

5. During the 12 to 36 hour soak specified in subparagraph 4. above, the vehicle's canister shall be purged with a volume of air equivalent to 300 canister charcoal bed volumes at a flow rate of 48 SCFH (22.7 slpm). For hybrid electric vehicles, the battery pack shall be discharged to the state of charge that satisfies one of the following two conditions: (1) the state of charge is at the lowest level allowed by the control unit of the auxiliary power unit, or (2) the state of charge is set such that auxiliary

power unit operation will be at its maximum power level at the beginning and through the emission test.

6. The canister shall then be loaded using a butane-nitrogen mixture.

7. Perform exhaust emission tests in accordance with procedures as provided in section 1960.1(k), Title 13, California Code of Regulations, and these procedures.

8. Upon completion of the hot start test, the vehicle shall be parked in a temperature controlled area between one to six hours to stabilize the fuel temperature at 105°F for one hour. Artificial cooling or heating of the fuel tank may be induced to achieve a fuel temperature of 105°F. The initial fuel and, if applicable, vapor temperatures for the running loss test may be less than 105°F with advance Executive Order approval if the manufacturer is able to provide data demonstrating initial temperatures at least 3°F lower than the required 105°F starting temperature.

9. A running loss test shall be performed after the fuel tank is stabilized at 105°F. The fuel tank temperature shall be controlled using a specified tank temperature profile for that vehicle during the test. The temperature profile shall be achieved either using temperature controllers or by an air management system that would simulate airflow conditions under the vehicle during driving.

10. The hot soak enclosure test shall then be performed at an enclosure ambient temperature of 105°F.

11. Upon completion of the hot soak enclosure test, the vehicle shall be soaked for no less than 6 hours nor more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65°F.

12. A three-day diurnal test shall be performed in a variable temperature enclosure.

The supplemental two-day diurnal sequence in Figure 4 (and Figure 5 for hybrid electric vehicles) shall be conducted according to the steps described in (1) through (4), (6), (7), followed by (10) through (12) of this paragraph except that the ambient temperature of the hot soak test is conducted at an ambient temperature between 68°F and 86°F at all times and that the diurnal test will consist of a two-day test.

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

86.130-96 Test sequence; general requirements. March 24, 1993.

86.131-90 Vehicle preparation. April 11, 1989.

(a) DELETE
REPLACE WITH:
(a) Prepare the fuel tank(s) for recording the temperature(s) of the prescribed test fuel liquid and, if applicable, fuel vapor according to the requirements of paragraph §86.129-80(d)(1). Measurement of the fuel vapor temperature is optional. If vapor temperature is not measured, the measurement of the fuel tank pressure is not required.

(b) DELETE
REPLACE WITH:
(b) If applicable, the vehicle shall be equipped with a pressure transducer to monitor the fuel tank headspace pressure during the test. The transducer shall have an accuracy and precision of ± 1.0 inches water.

(c) Provide additional fittings and adapters, as required, to accommodate a fuel drain at the lowest point possible in the fuel tank(s) as installed on the vehicle.

(d) Provide valving or other means to allow purging and loading of the evaporative emission canister(s). Special care shall be taken during this step not to alter normal functions of the fuel vapor system components.

(e) For vehicles to be tested for running loss emissions, prepare the exhaust system by sealing and/or plugging all detectable sources of exhaust gas leaks. The exhaust system shall be tested or inspected to ensure that detectable exhaust hydrocarbons are not emitted into the running loss enclosure during the running loss test.

86.131-96 Vehicle preparation. March 24, 1993.

86.132-90 Vehicle preconditioning. April 11, 1989.

For all vehicles certified to the running loss and useful life standards which are subjected to exhaust emissions testing only, the canister loading procedure as set forth in paragraph (b)(4) shall be used.

* * * * *

(a)(2)(i) For hybrid electric vehicles, the battery pack shall be discharged to or just below the state-of-charge at which operation of the auxiliary power unit will be initiated by the vehicle's control strategy. One UDDS shall be used for preconditioning. If the auxiliary power unit is capable of being manually activated (which would cause the vehicle to be classified as a Type C HEV), the auxiliary power unit shall be activated at the beginning and throughout the emission test.

* * * * *

(a)(4) The Executive Officer may also choose to conduct or require the performance of optional or additional preconditioning to ensure that the evaporative emission control system is subjected to conditions typical of normal driving. The optional preconditioning shall consist of no less than 20 and no more than 50 miles of on-road mileage accumulation under typical driving conditions.

(a)(4)(i) *Gasoline-fueled and methanol-fueled vehicles.* ...

* * * * *

(b) DELETE
REPLACE WITH:
(b)

(1) Within five minutes of completion of preconditioning, the vehicle shall be driven off the dynamometer to a work area.

(2) The fuel tank(s) of the prepared vehicle shall be drained and refilled with the applicable test fuel, as specified in §86.113-94 of these procedures, to the prescribed tank fuel volume, defined in §86.082-2. The vehicle shall be refueled within 1 hour of completion of the preconditioning drive.

(3) Following the fuel drain and fill described in subparagraph (2) above, the test vehicle shall be allowed to soak for a period of not less than 12 or more than 36 hours prior to the exhaust emissions test. During the soak period, the canister shall be connected to a pump or compressor and loaded with butane as described in (4) below for the three-day diurnal sequence and in (5) below for the supplemental two-day diurnal sequence. For all vehicles certified to the running loss and useful life standards which are subjected to exhaust emissions testing only, the canister loading procedure as set forth in paragraph (4) shall be used.

For vehicles designed to use fuel consisting of at least 80 percent methanol by volume, canister preconditioning shall be performed with a fuel vapor composition representative of the composition of the vapor space in the vehicle's fuel tank under in-use conditions. Manufacturers shall develop a procedure to precondition the canister, if the vehicle is so equipped for the different fuel. The procedure shall represent a canister loading equivalent to that specified in (4) below and shall be approved in advance by the Executive Officer.

(4) For the three-day diurnal sequence, the evaporative emissions storage canister(s) shall be preloaded with an amount of butane equivalent to 1.5 times the nominal working capacity. For vehicles with multiple canisters in a series configuration, the

set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister shall be preconditioned separately. In addition, for 1998 and later model year vehicles equipped with refueling canisters, these canisters shall be preconditioned for the three-day diurnal test sequence according to the procedure in paragraph (5)(i) below. If a vehicle is designed to actively control evaporative or refueling emissions without a canister, the manufacturer shall devise an appropriate preconditioning procedure subject to the approval of the Executive Officer. If canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning. The nominal working capacity of a carbon canister shall be established by determining the mass of butane required to load a stabilized canister to a two gram breakthrough. The 2 gram breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams. The determination of nominal capacity shall be based on the average capacity of no less than five canisters which are in a stabilized condition. For stabilization, each canister must be cycled no less than 10 times and no more than 100 times to a two gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ± 2 grams butane per hour. Each canister loading step must be preceded by canister purging with 300 canister bed volume exchanges at 48 SCFH. The following procedure shall be used to preload the canister:

(i) Prepare the evaporative emission canister(s) for the canister purging and loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step so that the normal functions of the fuel system components or the normal pressure relationships in the system are not disturbed. The canister purge shall be performed with ambient air of controlled humidity to 50 ± 25 grains per pound of dry air. This may be accomplished by purging the canister in a room which is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal flow rate of 48 SCFH (22.7 slpm), and the duration shall be determined to provide a total purge volume flow through the canister equivalent to 300 canister charcoal bed volume exchanges.

(ii) The evaporative emission canister(s) shall then be loaded with an amount of commercial grade butane vapors equivalent to 1.5 times the nominal working capacity. Canister loading shall not be less than 1.5 times the nominal canister capacity. The canister shall be loaded with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. The butane shall be loaded into the canister at a rate of 15 ± 2 grams of butane per hour. If the canister loading at this rate takes longer than 12 hours, a manufacturer may determine a new rate, based on completing the canister loading in no less than 12 hours. Either a Critical Flow Orifice (CFO) butane injection device, a gravimetric method, or electronic mass flow controllers shall be used to fulfill the requirements of this step. The time of completion of the canister(s) loading activity shall be recorded. Manufacturers shall disclose to the Executive Officer their canister loading procedure. The protocol may not allow for the replacement of components. In addition, the Executive Officer may require that the manufacturer demonstrate that the procedure does not unduly disturb the components of the evaporative system.

(iii) Reconnect the evaporative/refueling emission canister(s), if applicable.

(5) For the supplemental two-day diurnal sequence, the evaporative emission storage canister(s) shall be loaded to the point of breakthrough using either (i) or (ii) below. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister shall be preconditioned separately. In addition, for model year 1998 and later vehicles equipped with refueling canisters, these canisters shall be preconditioned for the supplemental two-diurnal test sequence according to the procedure in (i) below. Breakthrough may be determined by emission measurement in an enclosure or by measuring the weight gain of an auxiliary evaporative canister connected downstream of the vehicle's canister, in which case, the following references to the enclosure can be ignored. The auxiliary canister shall be well purged with ambient air of humidity controlled to 50±25 grains per pound of dry air prior to loading. Breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams.

(i) The following procedure provides for loading of the canister to breakthrough with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. If the canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning.

(A) Prepare the evaporative/refueling emission canister(s) for the canister loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the canister loading procedure. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. Place the vehicle in the sealed enclosure and measure emissions with the FID.

(B) Load the canister with a mixture composed of 50/50 mixture by volume of butane and nitrogen at a rate of 40 $\pm$ 2 grams butane per hour. As soon as the canister reaches breakthrough, the vapor source shall be shut off.

(C) Reconnect the evaporative/refueling emission canister, if applicable.

(ii) The following procedure provides for loading the canister with repeated diurnal heat builds to breakthrough.

(A) The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the diurnal heat builds. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. The average temperature of the dispensed fuel shall be 60 $\pm 12^{\circ}$F. Within one hour of being refueled, the vehicle shall be placed, with the engine shut off, in the evaporative emission enclosure. The fuel tank temperature sensor shall be connected to the temperature recording system. A heat source, specified in §86.107-90(a)(4), shall be properly positioned with respect to the fuel tank(s) and connected to the temperature controller.

(B) The fuel may be artificially heated or cooled to the starting diurnal temperature of 65°F. Turn off purge blower (if not already off); close and seal enclosure doors; and initiate measurement of the hydrocarbon level in the enclosure. When the fuel temperature reaches 65°F, start the diurnal heat build. The diurnal heat build should conform to the following function to within $\pm$ 4°F:

$$F = T_o \pm 0.4t$$

F is the fuel temperature, $^{\circ}$F
T_o is the initial temperature, $^{\circ}$F
t is the time since beginning of test, minutes

(C) As soon as breakthrough occurs or when the fuel temperature reaches 105°F, whichever occurs first, the heat source shall be turned off, the enclosure doors shall be unsealed and opened. If breakthrough has not occurred by the time the fuel temperature reaches 105°F, the heat source shall be removed from the vehicle, the vehicle shall be removed (with the engine still off) from the evaporative emission enclosure and the entire procedure outlined above shall be repeated until breakthrough occurs.

(D) After breakthrough occurs, the fuel tank(s) of the prepared vehicle shall be drained and filled with test fuel, as specified in 86.113-94 of these procedures, to the "tank fuel volume" defined in §86.082-2. The fuel shall be stabilized to a temperature within ± 3°F of the lab ambient before beginning the driving cycle for the exhaust emission test.

86.132-96 Vehicle preconditioning. April 6, 1994.

When certifying to the refueling standards set forth in Sections 86.098-8, 86.099-8, 86.001-9, and 86.004-9, the manufacturer shall follow the vehicle preconditioning sequence specified in the following sections, or section 86.132-90 as modified above.

* * * * *

(c) ... appendix I of this part. The UDDS performed prior to a non-regeneration emission test shall not contain a regeneration (diesel passenger cars, light-duty trucks, and medium-duty vehicles equipped with periodically regenerating trap oxidizer systems only). The test vehicle may not be used to set dynamometer horsepower.

(1) For hybrid electric vehicles, the battery pack shall be discharged to or just below the state-of-charge at which operation of the auxiliary power unit will be initiated by the vehicle's control strategy. One UDDS shall be used for preconditioning. If the auxiliary power unit is capable of being manually activated (which would cause the vehicle to be classified as a Type C HEV), the auxiliary power unit shall be activated at the beginning and throughout the emission test.

* * * * *

86.133-96 Diurnal emission test. March 24, 1993.

86.134-96 Running loss test. March 24, 1993.

86.135-90 Dynamometer procedure. April 11, 1989.

86.135-94 Dynamometer procedure. June 5, 1991.

86.136-90 Engine starting and restarting. March 24, 1993.

* * * * *

(c) DELETE
REPLACE WITH:
(c) If the vehicle does not start after the manufacturer's recommended cranking time (or 10 continuous seconds in the absence of a manufacturer's recommendation), cranking shall cease for the period recommended by the manufacturer (or 10 seconds in the absence of a manufacturer's recommendation). This may be repeated for up to three start attempts. If the vehicle does not start after three attempts, the reason for failure to start shall be determined. The gas flow measuring device on the CVS (usually a revolution counter) or CFV shall be turned off and the sampler selector valves, including the alcohol sampler, placed in the "standby" position during this diagnostic period. In addition, either the CVS should be turned off, or the exhaust tube disconnected from the tailpipe during the diagnostic period. If failure to start is an operational error, the vehicle shall be rescheduled for testing from a cold start.

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86.137-90 Dynamometer test run, gaseous and particulate emissions. April 11, 1989.

86.137-94 Dynamometer test run, gaseous and particulate emissions. June 5, 1991.

86.137-96 Dynamometer test run, gaseous and particulate emissions. March 24, 1993.

86.138-96 Hot soak test. March 24, 1993.

86.139-90 Diesel particulate filter handling and weighing. April 11, 1989.

86.140-94 Exhaust sample analysis. June 5, 1991.

86.142-90 Records required. April 11, 1989.

86.143-90 Calculations; evaporative emissions. April 11, 1989.

(a) The calculation of the net hydrocarbon plus methanol mass change in the enclosure is used to determine the diurnal, hot soak, and running loss mass emissions. If the emissions also include ethanol and other alcohol components, the manufacturer shall determine an appropriate calculation(s) which reflect characteristics of the alcohol component similar to the equations below, subject to the Executive Officer approval. The mass changes are calculated from initial and final hydrocarbon and methanol concentrations in ppm carbon, initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the following equations:

(a)(1) DELETE
REPLACE WITH:
(a)(1) Methanol calculations shall be conducted according to §86.143-96 (b)(1)(i).

(a)(2) DELETE
REPLACE WITH:
(a)(2) For hydrocarbons:

(i) Hot soak HC mass. For fixed volume enclosures, the hot soak enclosure mass is determined as:

$$M_{HChs} = [2.97 x (V_n - 50) x 10^{-4} x \{P_f(C_{HCe2} - rC_{CH3OHe2})/T_f - P_i(C_{HCe1} - rC_{CH3OHe1})/T_i\}]$$

where: M_{HChs} is the hot soak HC mass emissions (grams)

V_n is the enclosure nominal volume if the running loss enclosure is used or the enclosure volume at 105°F if the diurnal enclosure is used. (ft^3)

P_i is the initial barometric pressure (inches Hg)

P_f is the final barometric pressure (inches Hg)

C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

$C_{CH3OHe2}$ is the final methanol concentration calculated according to §86.143-90 (a)(2)(iii) (ppm C equivalent)

$C_{CH3OHe1}$ is the initial methanol concentration calculated according to §86.143-90 (a)(2)(iii) (ppm C equivalent)

r is the FID response factor to methanol

T_i is the initial enclosure temperature (°R)

T_f is the final enclosure temperature (°R)

For variable volume enclosures, calculate the hot soak enclosure mass (M_{HChs}) according to the equation used above except that P_f and T_f shall be equal to P_i and T_i.

(ii) Running loss HC mass. The running loss HC mass per distance traveled is defined as:

$$M_{HCrlt} = (M_{HCrl(1)} + M_{HCrl(2)} + M_{HCrl(3)})/(D_{rl(1)} + D_{rl(2)} + D_{rl(3)})$$

where: M_{HCrlt} is the total running loss HC mass per distance traveled (grams HC per mile)

$M_{HCrl(n)}$ is the running loss HC mass for phase n of the test (grams HC)

$D_{rl(n)}$ is the actual distance traveled over the driving cycle for phase n of the test (miles)

For the point-source method:

Hydrocarbon emissions:

$$M_{HCrl(n)} = (C_{HCs(n)} - C_{HCa(n)}) \times 16.88 \times V_{mix} \times 10^{-6}$$

where: $C_{HCs(n)}$ is the sample bag HC concentration for phase n of the test (ppm C)

$C_{HCa(n)}$ is the background bag concentration for phase n of the test (ppm C)

16.88 is the density of pure vapor at 68°F (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per §86.144-90

Methanol emissions:

$$M_{CH3OHrl(n)} = (C_{CH3OHs(n)} - C_{CH3OHa(n)}) \times 37.74 \times V_{mix}$$

where: $C_{CH3OHs(n)}$ is the sample bag methanol concentration for phase n of the test (ppm C equivalent)

$C_{CH3OHa(n)}$ is the background bag concentration for phase n of the test (ppm C equivalent)

37.71 is the density of pure vapor at 68°F (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per §86.144-90

For the enclosure method:

$M_{HCrl(n)}$ shall be determined by the same method as the hot soak hydrocarbon mass emissions determination specified in subparagraph (a)(2)(i) above.

(iii) Diurnal mass. For fixed volume enclosures, the HC mass for each of the three diurnals is defined for an enclosure as:

$$M_{HCd} = [2.97x(V - 50)x10^{-4}x\{P_f(C_{HCe2} - rC_{CH3OHe2})/T_f - P_i(C_{HCe1} - rC_{CH3OHe1})/T_i\}/T_i] + M_{HC,out} - M_{HC,in}$$

where: M_{HCd} is the diurnal HC mass emissions (grams)

V is the enclosure volume at 65^oF (ft^3)

P_i is the initial barometric pressure (inches Hg)

P_f is the final barometric pressure (inches Hg)

C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

$C_{CH3OHe2}$ is the final methanol concentration calculated according to §86.143-90 (a)(2)(iii)

$C_{CH3OHe1}$ is the initial methanol concentration calculated according to §86.143-90 (a)(2)(iii)

r is the FID response factor to methanol

T_i is the initial enclosure temperature (^oR)

T_f is the final enclosure temperature (^oR)

$M_{HC,out}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle (grams)

$M_{HC,in}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle (grams)

For variable volume enclosures, calculate the HC mass for each of the three diurnals (M_{HCd}) according to the equation used above except that P_f and T_f shall equal P_i and T_i and $M_{HC,out}$ and $M_{HC,in}$ shall equal zero.

(a)(3) The total mass emissions shall be adjusted as follows:

(1) $M_{hs} = M_{HChs} + (14.2284/32.042) \times 10^{-6} M_{CH3OH}$

(2) $M_{di} = M_{HCd} + (14.3594/32.042) \times 10^{-6} M_{CH3OH}$

(3) $M_{rl} = M_{HCrlt} + (14.2284/32.042) \times 10^{-6} M_{CH3OH}$

(b) DELETE
REPLACE WITH:
(b) The final evaporative emission test results reported shall be computed by summing the adjusted evaporative emission result determined for the hot soak test (M_{hs}) and the highest 24-hour result determined for the diurnal breathing loss test (M_{di}). The final reported result for the running loss test shall be the adjusted emission result (M_{rl}), expressed on a grams per mile basis.

86.143-96 Calculations; evaporative emissions. March 24, 1993.

86.144-94 Calculations; exhaust emissions. June 5, 1991.

86.145-82 Calculations; particulate emissions. November 2, 1982.

86.146-96 Fuel dispensing spitback procedure. March 24, 1993.

86.150-98 Overview; refueling test. April 6, 1994.

86.151-98 General requirements; refueling test. April 6, 1994.

86.152-98 Vehicle preparation; refueling test. April 6, 1994.

86.153-98 Vehicle and canister preconditioning; refueling test. April 6, 1994.

(a) DELETE
REPLACE WITH
(a) Vehicle and canister preconditioning. Vehicles and vapor storage canisters shall be preconditioned in accordance with the preconditioning procedures for the supplemental two-diurnal evaporative emissions test specified in §86.132-96 (a) through (j), or §86.132-90 (b). For vehicles equipped with non-integrated refueling emission control systems, the canister must be loaded using the method involving butane loading to breakthrough (see §86.132-96(j)(1) or 86.132-90(b)(5) of these test procedures. If the refueling test procedure is started within 24 hours of the completion of an evaporative emission test on the same vehicle at the same ambient conditions, the fuel tank drain and fill and minimum soak period requirement described in paragraphs (b) and (c) of §86.132-96, and subparagraphs (b)(2) and (b)(3) of §86.132-90 may be omitted from the refueling test procedure.

* * * * *

(b)(1) DELETE
REPLACE WITH
(b)(1) *Without the exhaust emission test.* The Executive Officer may conduct the canister preconditioning by purging the canister(s) with at least 1200 canister bed volumes of ambient air (with humidity controlled to 50±25 grains of water vapor per pound of dry air) maintained at a nominal flow rate of 0.8 cfm directly following the

preconditioning drive described in §86.132-96(c) through (e), or §86.130-78(a)(2) of this subpart. In this case, the canister loading procedures and the vehicle driving procedures described in §86.132-96(f) through (j), or §86.132-90(b), and in paragraphs (c) through (d) of this section shall be omitted, and the 10 minute and 60 minute time requirements of paragraph (e) of this section shall apply to time after completion of the bench purge. In the case of multiple refueling canisters, each canister shall be purged separately.

* * * * *

(c)(1) DELETE
REPLACE WITH
(c)(1) Vehicles to be tested for exhaust emissions only shall be processed according to §§86.135-94 through 86.137-96, or §§86.135-90 through 86.137-90 as modified in these test procedures. Vehicles to be tested for refueling emissions shall be processed in accordance with the procedures in §§86.135-94 through 86.137-96, or §§86.135-90 through 86.137-96 as modified by these test procedures, followed by the procedures outlined in paragraph (c)(2) of this section.

* * * * *

86.154-98 Measurement procedure; refueling test. April 6, 1994.

ADD:
For purposes of this section, all references to methanol shall also be applicable to alcohol.

* * * * *

(e)(5)(i) DELETE
REPLACE WITH
(e)(5)(i) Within 10 minutes of closing and sealing the doors, analyze enclosure atmosphere for hydrocarbons and record. This is the initial (time=0 minutes) hydrocarbon concentration, C_{HCi}, required in §86.143-96, or C_{HCe1}, required in §86.143-90.

* * * * *

(e)(8)(i) DELETE
REPLACE WITH
(e)(8)(i) The final reading of the evaporative enclosure FID analyzer shall be taken 60±5 seconds following the final shut-off of fuel flow. This is the final hydrocarbon concentration, C_{HCf}, required in §86.143-96, or C_{HCe2}, required in §86.143-90. The elapsed time, in minutes, between the initial and final FID (or HFID) readings shall be recorded.

* * * * *

86.155-98 Records required; refueling test. April 6, 1994.

86.156-98 Calculations;

(a) DELETE
REPLACE WITH
(a) The calculation of the net hydrocarbon mass change and methanol mass change (if applicable) in the enclosure is used to determine refueling mass emissions. The mass is calculated from initial and final hydrocarbon and methanol (if applicable) concentrations in ppm carbon initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the equations of §86.143-96, or §86.143-90. For vehicles with multiple tanks, the results for each tank shall be calculated and then summed to determine overall refueling emissions.

* * * * *

Title 40, Part 86, Appendix I (Urban Dynamometer Schedules).
March 24, 1993.

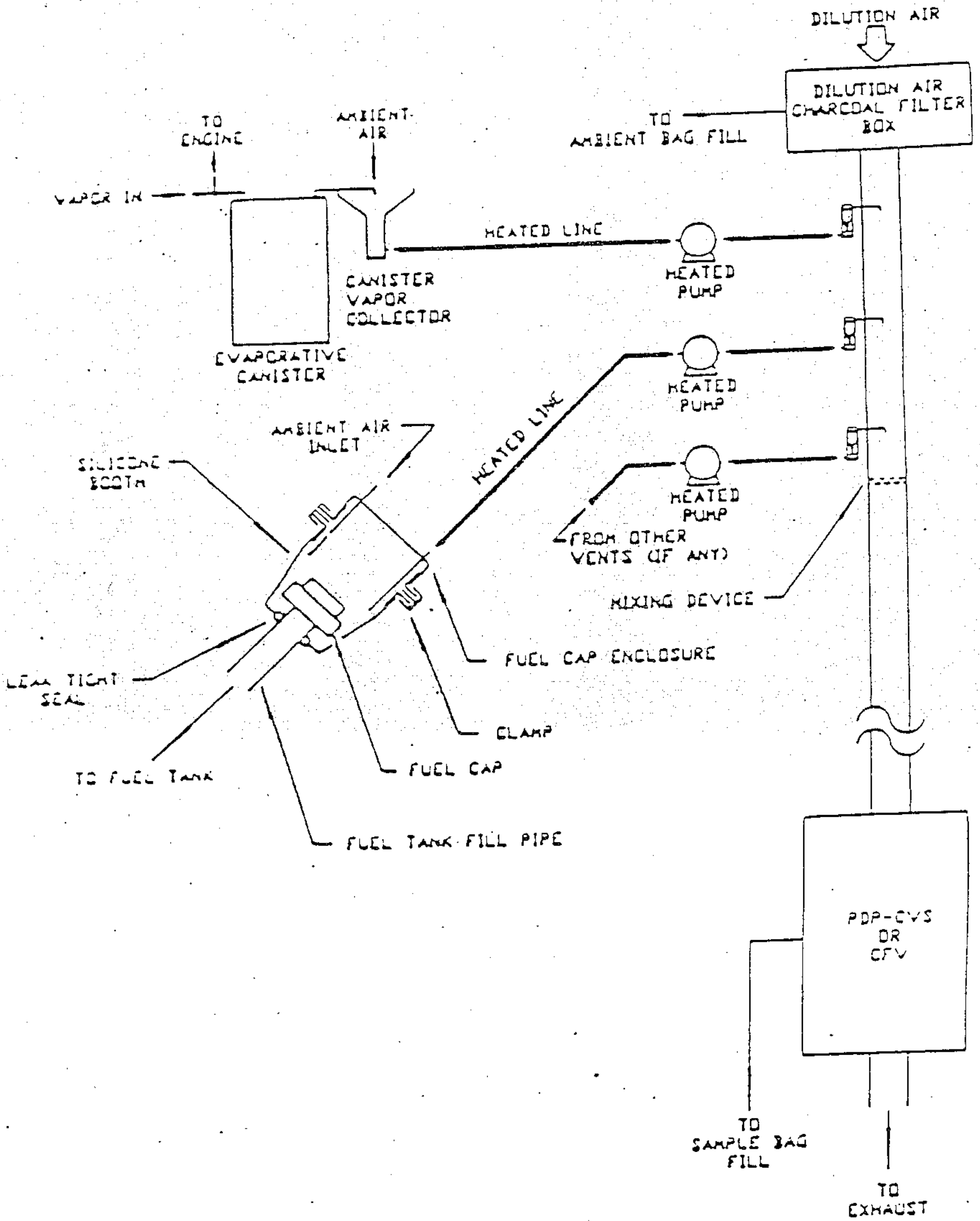

Figure 1. Running Loss Vapor Vent Collection System

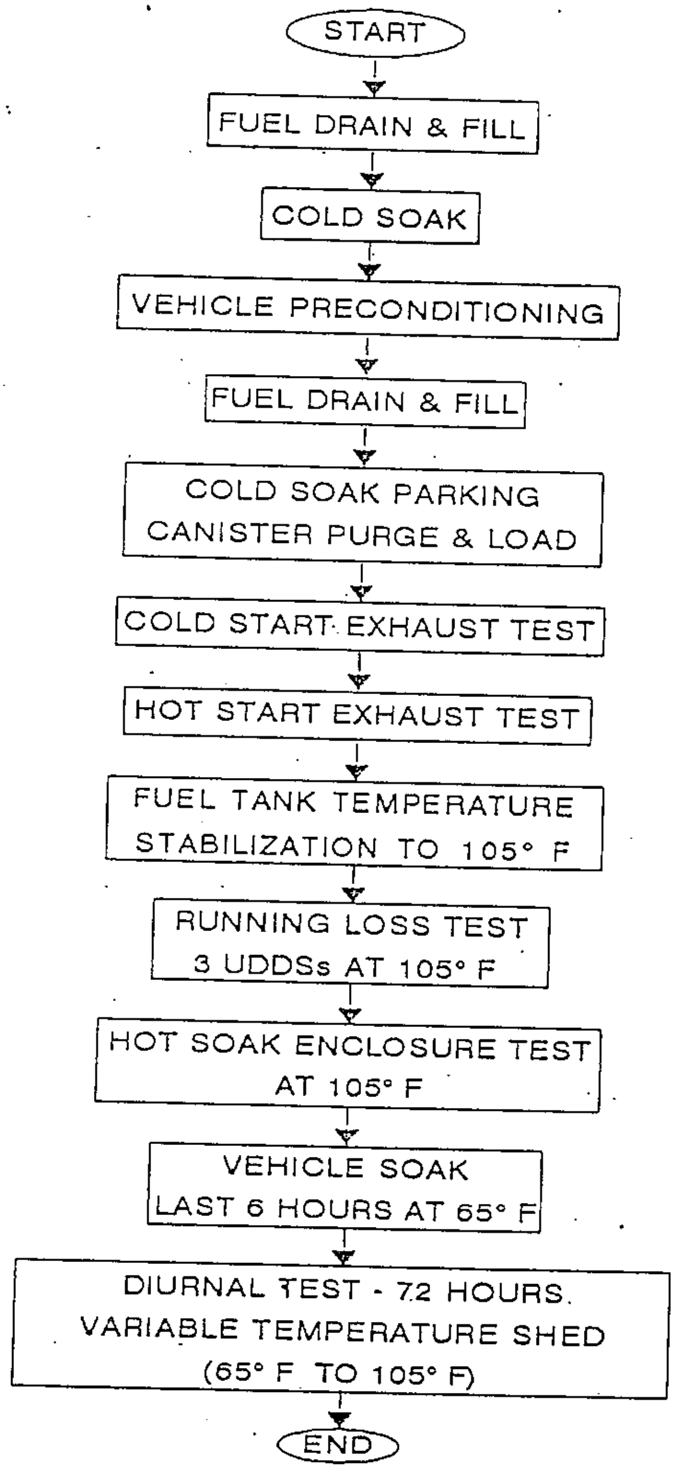

FIGURE 2. TEST PROCEDURES FOR 1995 MODEL MOTOR VEHICLES

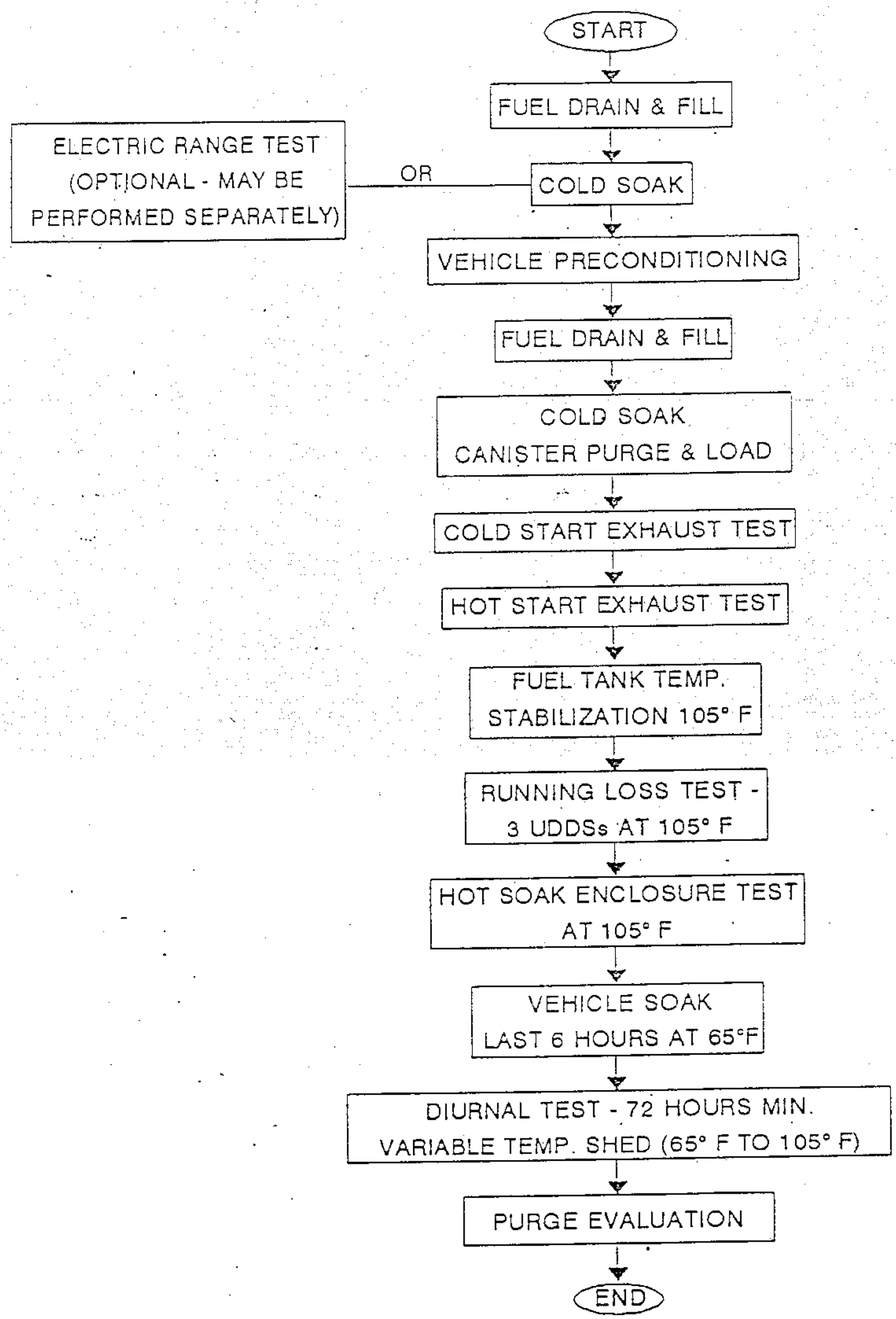

FIGURE 3. TEST PROCEDURES FOR 1993 TO 1995 MODEL HYBRID ELECTRIC VEHICLES

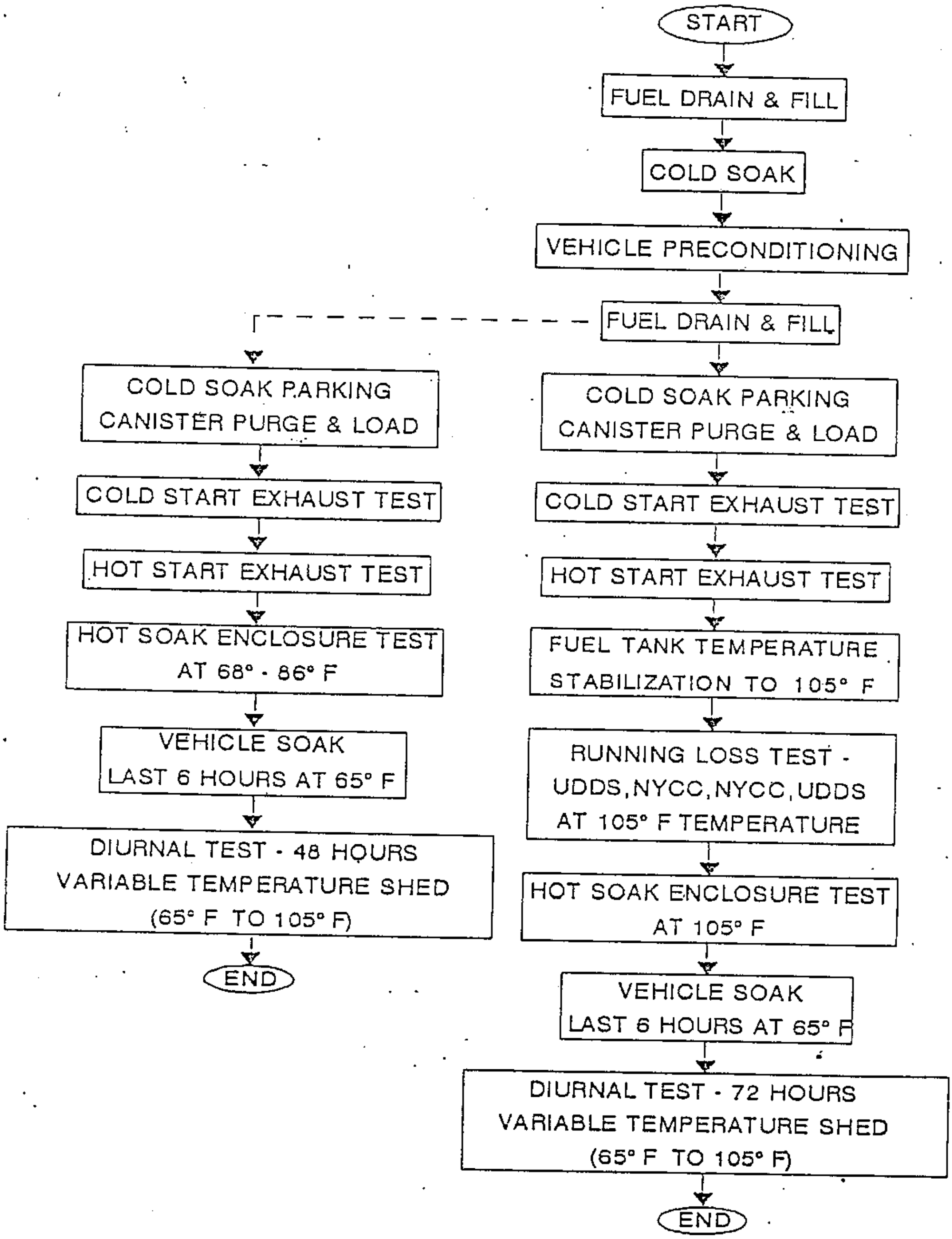

FIGURE 4. TEST PROCEDURES FOR 1996 AND SUBSEQUENT MODEL MOTOR VEHICLES

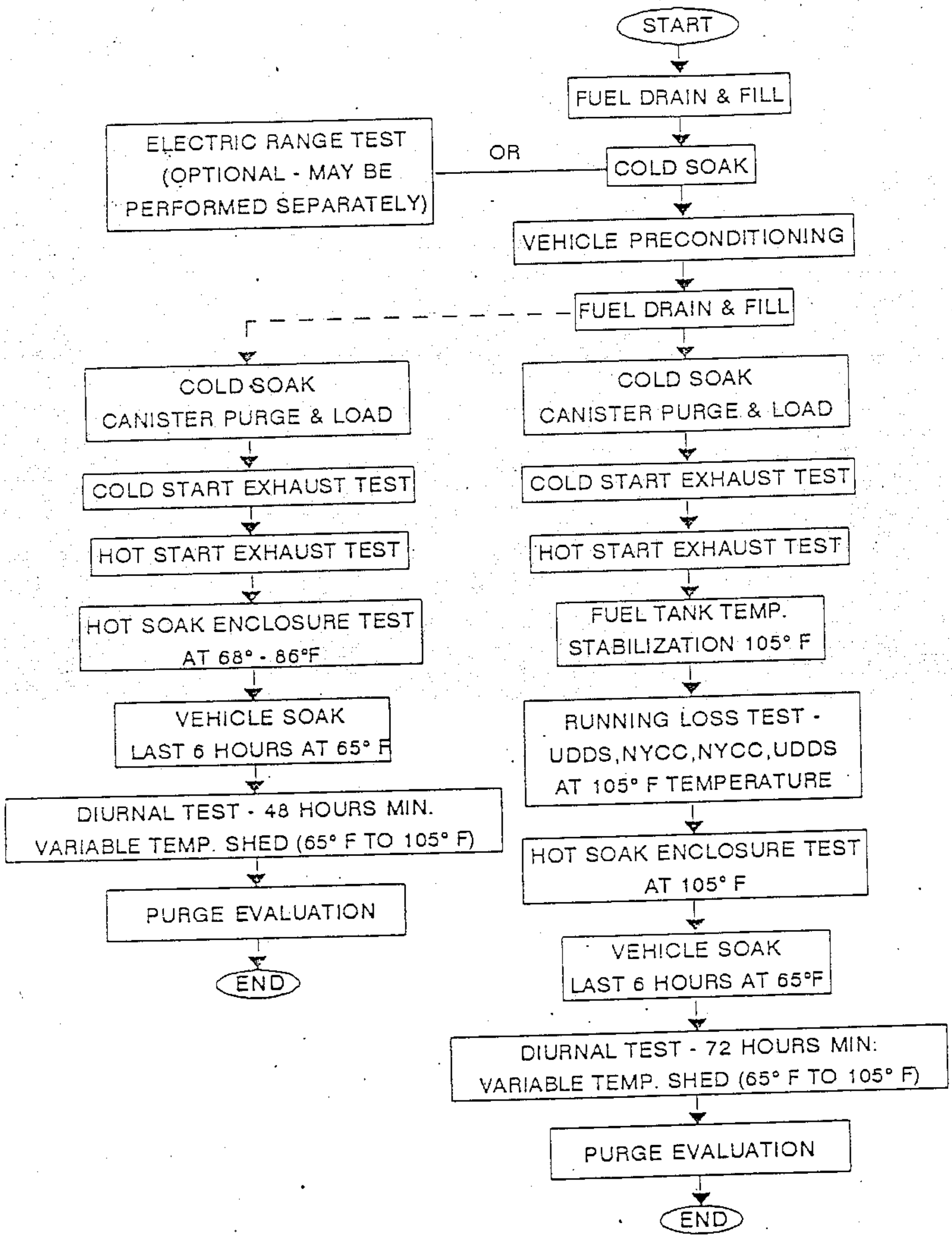

FIGURE 5. TEST PROCEDURES FOR 1996 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES

Appendix C

PROPOSED

Except as otherwise indicated, the text of the proposed amendments is shown below in underline to indicate additions and ~~strikeout~~ to show deletions.

Amend Title 13, California Code of Regulations, section 1976, to read as follows:

1976. Standards and Test Procedures for Motor Vehicle Fuel Evaporative Emissions.

(a) Fuel evaporative emissions from 1970 through 1977 model passenger cars and light-duty trucks are set forth in Title 40, Code of Federal Regulations, Part 86, Subparts A and C, as it existed on June 20, 1973. These standards are enforced in California pursuant to section 43008 of the Health and Safety Code.

(b)(1) Evaporative emissions for 1978 and subsequent model gasoline-fueled, 1983 and subsequent model liquefied petroleum gas-fueled, and 1993 and subsequent model alcohol-fueled motor vehicles and hybrid electric vehicles subject to exhaust emission standards under this article, except petroleum-fueled diesel vehicles, compressed natural gas-fueled vehicles, hybrid electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions, and motorcycles, shall not exceed: the following standards.

(A) For vehicles identified below, tested in accordance with the test procedure based on the Sealed Housing for Evaporative Determination as set forth in Title 40, Code of Federal Regulations, sections 86.130-78 through 86.143-90 as they existed July 1, 1989, the evaporative emission standards are:

Vehicle Type	Model Year	Hydrocarbons (1) Diurnal + Hot Soak (grams/test) 50K miles
Passenger cars	1978 and 1979	6.0
Light-duty trucks		6.0
Medium-duty vehicles		6.0
Heavy-duty vehicles		6.0
Passenger cars	1980 - 1994 (2)	2.0
Light-duty trucks		2.0
Medium-duty vehicles		2.0
Heavy-duty vehicles		2.0

(1) Organic Material Hydrocarbon Equivalent, for alcohol-fueled vehicles.

(2) Other than hybrid electric vehicles.

(B) For the vehicles identified below, tested in accordance with the test procedure which includes the running loss test, the hot soak test, and the 72 hour diurnal test, the evaporative emission standards are:

Vehicle Type	Model Year	Hydrocarbons (1) Three-Day Diurnal + Hot Soak (grams/test) Useful Life(2)	Running Loss (grams/mile) Useful Life(2)
Passenger cars	1995 and subsequent (3)	2.0	0.05
Light-duty trucks		2.0	0.05
Medium-duty vehicles (6,001-8,500 lbs. GVWR)			
with fuel tanks < 30 gallons		2.0	0.05
with fuel tanks ≥ 30 gallons		2.5	0.05
(8,501-14,000 lbs. GVWR) (4)		3.0	0.05
Heavy-duty vehicles (over 14,000 lbs. GVWR)		2.0	$0.05
Hybrid electric passenger cars	1993 and subsequent (5)	2.0	0.05
Hybrid electric light-duty trucks		2.0	0.05
Hybrid electric medium-duty vehicles		2.0	0.05

(1) Organic Material Hydrocarbon Equivalent for alcohol-fueled vehicles.

(2) For purposes of this paragraph, "useful life" shall have the same meaning as provided in section 2112, Title 13, California Code of

Regulations. Approval of vehicles which are not exhaust emission tested using a chassis dynamometer pursuant to section 1960.1, Title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

(3) The running loss and useful life three-day diurnal plus hot soak evaporative emission standards (hereinafter "running loss and useful life standards") shall be phased-in beginning with the 1995 model year. Each manufacturer, except small volume manufacturers, shall certify the specified percent (a) of passenger cars and (b) of light-duty trucks, medium-duty vehicles and heavy-duty vehicles to the running loss and useful life standards according to the following schedule:

Model Year	*Minimum Percentage of Vehicles Certified to Running Loss and Useful Life Standards**
1995	10 percent
1996	30 percent
1997	50 percent

* The minimum percentage of motor vehicles of each vehicle type required to be certified to the running loss and useful life standards shall be based on the manufacturer's projected California model-year sales (a) of passenger cars and (b) of light-duty trucks, medium-duty vehicles and heavy-duty vehicles. Optionally, the percentage of motor vehicles can also be based on the manufacturer's projected California model-year sales (a) of passenger cars and light-duty trucks and (b) of medium-duty vehicles and heavy-duty vehicles.

Beginning with the 1998 model year, all motor vehicles subject to the running loss and useful life standards, including those produced by small volume manufacturers, shall be certified to the specified standards.

All 1995 through 1997 model year motor vehicles which are not subject to running loss and useful life standards pursuant to the phase-in schedule shall comply with the 50,000-mile standards in effect for 1980 through 1994 model-year vehicles.

(4) For the <u>1995</u> model year only, the evaporative emission standards for complete vehicles in this weight range shall be 2.0 grams/test and compliance with the evaporative emission standards shall be based on the SHED conducted in accordance with the procedures set forth in Title 40, Code of Federal Regulations, sections 86.130-78 through 86.143-90 as they existed July 1, 1989. For the 1995 and subsequent model years, the evaporative emission standards for incomplete vehicles in this weight range shall be 2.0 grams/test

and compliance with the evaporative emission standards shall be based on the test procedures specified in paragraph 4.g. of the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles."

(5) The running loss and useful life standards for all hybrid electric vehicles shall be effective in the 1993 and subsequent model years.

(C) For vehicles identified below, tested in accordance with the test procedure which includes the hot soak test and the 48 hour diurnal test, the evaporative emission standards are:

Vehicle Type	*Model Year*	*Hydrocarbon (1) Two-Day Diurnal + Hot Soak (grams/test) Useful Life(2)*
Passenger cars	1996 and subsequent (3)	2.5
Light-duty trucks		2.5
Medium-duty vehicles		
(6,001 - 8,500 lbs. GVWR)		
with fuel tanks < 30 gallons		2.5
with fuel tanks ≥ 30 gallons		3.0
(8,501 - 14,000 lbs. GVWR)		3.5
Heavy-duty vehicles (over 14,000 lbs. GVWR)		4.5
Hybrid electric passenger cars	1996 and subsequent (3)	2.5
Hybrid electric light-duty trucks		2.5
Hybrid electric medium-duty vehicles		2.5

(1) Organic Material Hydrocarbon Equivalent for alcohol-fueled vehicles.

(2) For purposes of this paragraph, "useful life" shall have the same meaning as provided in section 2112, Title 13, California Code of Regulations. Approval of vehicles which are not exhaust emission tested using a chassis dynamometer pursuant to section 1960.1, Title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

(3) The two-day diurnal plus hot soak evaporative emission standards (hereinafter "supplemental standards") shall be phased-in beginning with the 1996 model year. Those vehicles certified under the running loss and useful life standards for the 1996 and subsequent model years must also be certified under the supplemental standards.

(2) Evaporative emissions for gasoline-fueled motorcycles subject to exhaust emission standards under this article shall not exceed:

Motorcycle Class	*Model Year*	*Hydrocarbons (grams per test)*
Class I and II (50-279cc)	1983 and 1984	6.0
	1985 and subsequent	2.0
Class III (280cc and larger)	1984 and 1985	6.0
	1986 and subsequent	2.0
Class III (280cc and larger) (Optional Standard for Small-Volume Motorcycle Manufacturers)	1986-1988	6.0

(c) The procedure for determining compliance with the standards in subsection (b) above is set forth in "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles," adopted by the state board on April 16, 1975, as last amended ~~September 21, 1994, effective December 15, 1994~~ ______________________.

(d) Motorcycle engine families certified to 0.2 grams per test or more below the applicable standards shall be exempted from the state board's "Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks" pursuant to section 2235, Title 13, California Code of Regulations.

(e) Small volume motorcycle manufacturers electing to certify 1986, 1987, or 1988 model-year Class III motorcycles in accordance with the optional 6.0 gram per test evaporative emission standard shall submit, with the certification application, a list of the motorcycle models for which it intends to seek California certification and estimate sales data for such models. In addition, each such manufacturer shall, on or before July 1 of each year in which it certifies motorcycles under the optional standard, submit a report describing its efforts and progress toward meeting the more stringent evaporative emission standards. The report shall also contain a description of the manufacturer's current hydrocarbon evaporative emission control development status, along with supporting test data, and shall summarize future planned development work.

(f) For purposes of this section, a small volume motorcycle manufacturer means a manufacturer which sells less than 5,000 new motorcycles per year in California.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018, 43101, 43104, and 43107, Health and Safety Code. Reference: Sections 39003, 39500, 39667, 43000, 43013, 43018, 43100, 43101, 43102, 43104, and 43107, Health and Safety Code.

Appendix D

PROPOSED

State of California
AIR RESOURCES BOARD

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 1978 AND SUBSEQUENT MODEL MOTOR VEHICLES

ADOPTED: April 16, 1975
AMENDED: May 14, 1975
AMENDED: March 31, 1976
AMENDED: October 5, 1976
AMENDED: November 23, 1976
AMENDED: June 8, 1977
AMENDED: December 19, 1977
AMENDED: October 12, 1979
AMENDED: April 23, 1980
AMENDED: June 26, 1980
AMENDED: June 8, 1981
AMENDED: March 9, 1983
AMENDED: October 30, 1985
AMENDED: January 22, 1990
AMENDED: May 15, 1990; effective July 15, 1990
AMENDED: November 20, 1991; effective January 16, 1992
AMENDED: September 22, 1993; effective December 8, 1993
AMENDED: September 21, 1994; effective December 15, 1994
AMENDED: ____________________

Note: The regulatory amendments proposed in this rulemaking are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the version of the test procedures adopted on September 21, 1994.

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CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 1978 AND SUBSEQUENT MODEL MOTOR VEHICLES

The provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts A and B, as they pertain to evaporative emission standards and test procedures and as they were amended or adopted as of July 1, 1989, are hereby adopted as the California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles, with the following exceptions and additions:

1. These standards and test procedures are applicable to all new 1978 and subsequent model gasoline-fueled and 1993 and subsequent model alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, hybrid electric vehicles, and motorcycles.

   These standards and test procedures are applicable to all new 1983 and subsequent model liquefied petroleum gas (LPG)-fueled passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, hybrid electric vehicles, and motorcycles. In those instances that the testing conditions or parameters are not practical or feasible for such vehicles, the manufacturer shall provide a test plan that provides equal or greater confidence in comparison to these test procedures. The test plan must be approved in advance by the Executive Officer.

   A manufacturer may implement, for 1995 model motor vehicles, test procedure requirements mandated for 1996 and subsequent model motor vehicles upon approval of the Executive Officer. The Executive Officer shall approve such a request if the manufacturer provides a demonstration that the effectiveness of the evaporative control system is not diminished.

   Carry-over of 1995 model year data will be allowed if the Executive Officer determines that the carry-over data will adequately represent the performance of the vehicle to be certified. Applications for carry-over must be accompanied by an engineering analysis demonstrating that the durability and emissions of the vehicle for which certification is being sought will be adequately represented by a certified platform/powertrain/fuel tank combination application.

   These standards and test procedures do not apply to motor vehicles which are exempt from exhaust emission certification, petroleum-fueled diesel vehicles, compressed natural gas-fueled vehicles, or hybrid electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions.

   a. The evaporative emission standards for vehicles subject to these procedures, except motorcycles, are as follows:

      i. For vehicles identified below, tested in accordance with the test procedure based on the Sealed Housing for Evaporative

Determination (SHED) as set forth in Title 40, Code of Federal Regulations, sections 86.130-78 through 86.143-90 as they existed July 1, 1989, the evaporative emission standards are:

Class of Vehicle	*Model Year*	*Hydrocarbons (1) Diurnal + Hot Soak (grams/test) 50K miles*
Passenger Cars	1978 and 1979	6.0
Light-Duty Trucks		6.0
Medium-Duty Vehicles		6.0
Heavy-Duty Vehicles		6.0
Passenger Cars	1980 - 1994 (2)	2.0
Light-Duty Trucks		2.0
Medium-Duty Vehicles		2.0
Heavy-Duty Vehicles		2.0

(1) The applicable evaporative emission standards for alcohol-fueled vehicles are expressed in terms of Organic Material Hydrocarbon Equivalent (OMHCE).

(2) Other than hybrid electric vehicles.

ii. For the vehicles identified below, tested in accordance with the test procedure which includes the running loss test, the hot soak test, and the three-day diurnal test (hereinafter "three-day diurnal sequence"), the evaporative emission standards are:

Class of Vehicle	*Model Year*	*Hydrocarbons (1)* Three-Day Diurnal + Hot Soak (grams/test) Useful Life(2)	*Hydrocarbons (1)* Running Loss (grams/mile) Useful life(2)
Passenger Cars	1995 and subsequent (3)	2.0	0.05
Light-Duty Trucks		2.0	0.05
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)			
with fuel tanks < 30 gallons		2.0	0.05
with fuel tanks $\geq$ 30.0 gallons		2.5	0.05
(8,501 - 14,000 lbs. GVWR) (4)		3.0	0.05
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)		2.0	0.05
Hybrid Electric Passenger Cars	1993 and subsequent (5)	2.0	0.05
Hybrid Electric Light-Duty Trucks		2.0	0.05
Hybrid Electric Medium-Duty Vehicles		2.0	0.05

(1) The applicable evaporative emission standards for alcohol-fueled vehicles are expressed as OMHCE.

(2) For purposes of this paragraph, "useful life" shall have the same meaning as provided in section 2112, Title 13, California Code of Regulations. Approval of vehicles which are not exhaust emission tested using a chassis dynamometer pursuant to section 1960.1, Title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

(3) The running loss and useful life three-day diurnal plus hot soak evaporative emission standards (hereinafter "running loss and useful life standards") shall be phased in beginning with the 1995 model year. Each manufacturer, except small volume manufacturers, shall certify the specified percent (a) of passenger cars and (b) of light-duty trucks, medium-duty vehicles and heavy-duty vehicles to the running loss and useful life standards according to the following schedule:

Model Year	Minimum Percentage of Vehicles Certified to Running Loss and Useful Life Standards*
1995	10 percent
1996	30 percent
1997	50 percent

* The minimum percentage of motor vehicles in each vehicle type required to be certified to the running loss and useful life standards shall be based on the manufacturer's projected California model-year sales (a) of passenger cars and (b) of light-duty trucks, medium-duty vehicles and heavy-duty vehicles. Optionally, the percentage of motor vehicles can also be based on the manufacturer's projected California model-year sales (a) of passenger cars and light-duty trucks and (b) of medium-duty vehicles and heavy-duty vehicles.

Beginning with the 1998 model year, all motor vehicles subject to the running loss and useful life standards, including those produced by small volume manufacturers, shall be certified to the specified standards.

All 1995 through 1997 model-year motor vehicles which are not subject to running loss and useful life standards pursuant to the phase-in schedule shall comply with the 50,000-mile standards in effect for 1980 through 1994 model-year vehicles.

(4) For the 1995 model year only, the evaporative emission standards for complete vehicles in this weight range shall be 2.0 grams/test and compliance with the evaporative emission standards shall be based on the SHED conducted in accordance with the procedures set

forth in Title 40, Code of Federal Regulations, sections 86.130-78 through 86.143-90 as they existed July 1, 1989. For the 1995 and subsequent model years, the evaporative emission standards for incomplete vehicles in this weight range shall be 2.0 grams/test and compliance with the evaporative emission standards shall be based on the test procedures specified in paragraph 4.g.

(5) The running loss and useful life standards for all hybrid electric vehicles shall be effective in the 1993 and subsequent model years.

iii. For vehicles identified below, tested in accordance with the test procedure sequence which includes the hot soak test and the two-day diurnal test (hereinafter "two-day diurnal sequence"), the evaporative emission standards are:

Class of Vehicle	*Model Year*	*Hydrocarbons (1) Two-Day Diurnal + Hot Soak (grams/test) Useful Life(2)*
Passenger Cars	1996 and subsequent (3)	2.5
Light-Duty Trucks		2.5
Medium-Duty Vehicles		
(6,001 - 8,500 lbs. GVWR)		
with fuel tanks < 30 gallons		2.5
with fuel tanks ≥ 30.0 gallons		3.0
(8,501 - 14,000 lbs. GVWR)		3.5
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)		4.5
Hybrid Electric Passenger Cars	1996 and subsequent (3)	2.5
Hybrid Electric Light-Duty Trucks		2.5
Hybrid Electric Medium-Duty Vehicles		2.5

(1) The applicable evaporative emission standards for alcohol vehicles are expressed as OMHCE.

(2) For purposes of this paragraph, "useful life" shall have the same meaning as provided in section 2112, Title 13, California Code of Regulations. Approval of vehicles which are not exhaust emission tested using a chassis dynamometer pursuant to section 1960.1, Title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

(3) The two-day diurnal plus hot soak evaporative emission standards (hereinafter "supplemental standards") shall be phased in beginning with the 1996 model year. Those vehicles certified under the running loss and useful life standards for the 1996 and subsequent model years must also be certified under the supplemental standards.

b. Evaporative emission standards for gasoline-fueled motorcycles are:

Motorcycle Class	*Model Year*	*Hydrocarbons (grams per test)*
Class I and Class II (50-279 cc)	1983 - 1984 1985 and subsequent	6.0 2.0
Class III (280 cc and greater)	1984 - 1985 1986 and subsequent	6.0 2.0
Class III (280cc and greater) (Optional Standard for Small-Volume Motorcycle Manufacturers)	1986 - 1988	6.0

2. The definitions in section 1900, Title 13, California Code of Regulations, and in the applicable model-year California exhaust emission standards and test procedures, are hereby incorporated into this test procedure by reference. For the purposes of this test procedure and section 1976 of Title 13, California Code of Regulations, "small volume manufacturer" shall mean any vehicle manufacturer with California sales less than or equal to 3000 new vehicles per model year based on the average number of vehicles sold by the manufacturer in the previous three consecutive model years.

The following definitions shall apply:

1. "Diurnal evaporative emissions" means evaporative emissions resulting from the daily cycling of ambient temperatures.

2. "Hot soak evaporative emissions" means evaporative emissions after termination of engine operation.

3. "Running loss evaporative emissions" means evaporative emissions that occur during vehicle operation.

3. a. Application for Certification

Revise 40 CFR 86.091-21 as follows:

A. Replace section (b)(1)(i) with: Identification and description of the vehicles (or engines) covered by the application and a description (including a list and part numbers of all major emission control system parts and fuel system components) of their engine (vehicles only) emission control system and fuel system components, including if applicable, the turbocharger and intercooler. This shall include a detailed description of each auxiliary emission control device (AECD) to be installed in or on any certification test vehicle (or certification test engine).

B. Replace section (b)(2) with: For 1992 and subsequent model-year TLEVs, LEVs, and ULEVs not certified exclusively on gasoline, projected California sales data and fuel economy data 19 months prior to January 1 of the calendar year with the same numerical designation as the model year for which the vehicles are certified, and projected California sales data for all vehicles, regardless of operating fuel or vehicle emission category, sufficient to enable the Executive Officer to select a test fleet representative of the vehicles (or engines) for which certification is requested at the time of certification.

C. Replace section (b)(4)(i) with: For passenger cars, light-duty trucks, and heavy-duty vehicles with a GVW less than 14,000 pounds, a description of the test procedures to be used to establish the evaporative emission deterioration factors, as appropriate, required to be determined and supplied in section 4 of these test procedures.

D. Add section (b)(8) to read: For each passenger car or light-duty truck engine family, the exhaust emission standards (or family emission limits, if applicable) to which the engine family is to be certified, and the corresponding exhaust emission standards (or family emission limits, if applicable) which the engine family must meet in-use.

E. Add section (b)(9) to read: For each passenger car, light-duty truck, medium-duty vehicle, or heavy-duty vehicle evaporative emission family, a description of any unique procedures required to perform evaporative and/or refueling emission tests for all vehicles in that evaporative/refueling emission family, and a description of the method used to develop those unique procedures.

F. Add section (b)(10) to read: For each passenger car, light-duty truck, medium-duty vehicle, or heavy-duty vehicle evaporative/refueling emission family:

(i) Canister working capacity, according to the procedures specified in section 4.g.iii of these test procedures;

(ii) Canister bed volume; and

(iii) Fuel liquid and vapor temperature profiles for the running loss test, according to the procedures specified in section 4.f of these test procedures.

G. Replace section (e) to read: For vehicles equipped with gasoline-fueled or methanol-fueled heavy-duty engines, the manufacturer shall specify a maximum nominal fuel tank capacity for each evaporative/refueling emission family-emission control system combination.

b. In selecting medium-duty test vehicles, the Executive Officer shall consider the availability of test data from comparably equipped light-duty vehicles and the size of medium-duty vehicles as it relates to the practicability of evaporative emission testing.

4. For all motor vehicles subject to these test procedures, except heavy-duty vehicles over 14,000 lbs GVWR, incomplete medium-duty vehicles (see paragraph 5. below), and motorcycles (see paragraphs 7. and 8. below):

Demonstration of system durability and determination of an evaporative emission (diurnal and hot soak) and running loss emission deterioration factor (DF) for each evaporative emission engine family shall be based on tests of representative vehicles and/or systems. For purposes of evaporative emission durability testing, a representative vehicle is one which, with the possible exception of the engine and drive train, was built at least three months prior to the commencement of evaporative emission testing, or is one which the manufacturer demonstrates has stabilized non-fuel-related evaporative emissions.

a. For 1978 model evaporative emission engine families which require durability testing for exhaust emissions certification, either:

i. Evaporative emission testing shall be conducted on all durability vehicles at the 5,000, 10,000, 20,000, 30,000, 40,000, and 50,000 mile test points. Testing may be performed at more frequent intervals with advance written approval from the Executive Officer. The results of all valid evaporative emission tests within each evaporative emission engine family shall be plotted as a function of mileage, and a least-squares-fit straight line shall be drawn through the data. The evaporative emission DF is defined as the interpolated 50,000 mile value on that line minus the interpolated 4,000 mile value on that line, but in no case shall the factor be less than zero. The interpolated 4,000 and 50,000 mile points on this line must be within the standards of paragraph 1. of these test procedures or the data will not be acceptable for use in the calculation of a DF, unless no applicable data point exceeded the standard.

OR

ii. The manufacturer shall propose in its preliminary application for certification a method for durability testing and for determination of a DF for each evaporative emission engine family. The 4,000 and 50,000 mile test points (or their equivalent) used in determining the DF must be within the standards of paragraph 1. or data will not be acceptable for use in the calculation of a DF. The Executive Officer shall review the method, and shall approve it if it meets the following requirements:

A. The method must cycle and test the complete evaporative emission control system for the equivalent of at least 50,000 miles of typical customer use.

B. The method must reflect the flow of liquid and gaseous fuel through the evaporative emission control system, and the exposure (both peak and cyclical) to heat, vibration, and ozone expected through 50,000 miles of typical customer use.

C. The method must have the specifications for acceptable system performance, including maximum allowable leakage after 50,000 miles of typical customer use.

No evaporative emission control system durability testing shall be required for 1978 model-year vehicles which do not require exhaust emission control system durability testing, unless the Executive Officer determines that durability performance is likely to be significantly inferior to 1977 model-year systems.

b. For 1979 through 1994 evaporative emission engine families and 1995 and subsequent evaporative emission engine families which are not subject to the running loss and useful life standards specified in paragraph 1. of this test procedure, both paragraphs 4.a.i. and 4.a.ii. shall apply to all families selected for exhaust emission durability testing, and paragraph 4.a.ii. shall apply to those evaporative emission engine families which are not subject to testing for exhaust emission durability. The DFs determined under paragraph 4.a.i., if any, shall be averaged with the DFs determined under paragraph 4.a.ii. to determine a single evaporative emission DF for each evaporative emission engine family.

c. Engine families subject to the running loss and useful life standards specified in paragraph 1. of this test procedure shall demonstrate compliance with durability requirements using one of the following:

i. Evaporative emission testing shall be conducted on all durability vehicles at 5,000 and 10,000 miles, and at every 10,000 mile test point interval thereafter to the applicable final test point. Testing may be performed at more frequent intervals with advance written approval from the Executive Officer. Compliance with the running loss and useful life standards shall be demonstrated as follows: The results of all valid evaporative emission and running loss emission tests within each evaporative emission engine family shall be plotted as a function of mileage, and a least-squares-fit straight line shall be drawn through the data. The evaporative emission and running loss emission DFs shall be defined as the interpolated value at the applicable useful life mileage on that line, minus the interpolated 4,000 mile value on that line, but in no case shall the factor be less than zero. The interpolated 4,000 and 100,000 mile points (for passenger cars and light-duty trucks), or 4,000 and 120,000 mile points (for medium-duty vehicles and heavy-duty vehicles) on this line must be within the standards of paragraph 1. or the data will not be acceptable for use in the calculation of a DF, unless no applicable data point exceeded the standard.

OR

ii. At least one evaporative emission test shall be conducted on all passenger car and light-duty truck durability vehicles at 5,000, 40,000, 70,000, and 100,000 mile test points. At least one evaporative emission test shall be conducted on all medium-duty durability vehicles at 5,000, 40,000, 70,000, 90,000, and 120,000 mile test points. With prior written approval from the Executive Officer, manufacturers may terminate evaporative emissions testing at the mileage corresponding to 75 percent of the vehicle's useful life if no significant vehicle maintenance or emissions change are observed. Testing may be performed at more frequent intervals also with advance written approval from the Executive Officer. Evaporative emission testing may be performed at corresponding exhaust emission mileage points subject to section 6.a.4. of the "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 §1960.1(k) of Title 13, California Code of Regulations. An alternative durability test schedule based on Appendix III of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" may be used. Compliance with the running loss and useful life standards shall be demonstrated as follows: The results of all valid evaporative emission and running loss emission tests within each evaporative emission engine family shall be plotted as a function of mileage, and a least-squares-fit straight line shall be drawn through the data. The evaporative emission and running loss emission DFs are defined as the interpolated value at the useful life mileage on that line minus the interpolated 4,000 mile value on that line, but in no case shall the factor be less than zero. The interpolated 4,000 and 100,000 mile points (for passenger cars and light-duty trucks) or 4,000 and 120,000 mile points (for medium-duty vehicles) must be within the standards of paragraph 1. or the data will not be acceptable for use in the calculation of a DF, unless no applicable data point exceeded the standard.

OR

iii. The manufacturer shall propose in its preliminary application for certification a method for durability testing and for determination of evaporative emission and running loss emission DFs for each evaporative emission engine family. The 4,000, and 100,000 or 120,000 "useful life" mile test points (or their equivalent) used in determining a DF must be within the standards of paragraph 1. or data will not be acceptable for use in the calculation of a DF. The Executive Officer shall review the method, and shall approve it if it meets the following requirements:

A. The method must cycle and test the complete evaporative emission control system for the equivalent of the applicable vehicle useful life (i.e., 100,000 or 120,000 miles) of typical customer use.

B. The method must reflect the flow of liquid and gaseous fuel through the evaporative emission control system, and the exposure (both peak and cyclical) to heat, vibration, and ozone expected based on typical customer use through the applicable useful life.

C. The method must have the specifications for acceptable system performance, including maximum allowable leakage based on typical customer use through the applicable vehicle useful life.

For 1995 and subsequent model evaporative emission engine families subject to the running loss and useful life standards specified in paragraph 1. of this test procedure, except as noted below, either paragraphs 4.c.i and 4.c.iii., or paragraphs 4.c.ii. and 4.c.iii. shall apply to all families selected for exhaust emission durability testing. Only ~~P~~ paragraph 4.c.iii. shall ~~only~~ apply to those evaporative emission engine families which are not subject to testing for exhaust emission durability. For all 1993 and subsequent model hybrid electric vehicles subject to the running loss and useful life emission standards specified in paragraph 1. of this test procedure, paragraphs 4.c.i. and 4.c.iii. shall apply to all families selected for exhaust emission durability testing, and paragraph 4.c.iii. shall apply to those evaporative emission engine families which are not subject to testing for exhaust emission durability.

For 1995 and subsequent model motor vehicles subject to the running loss and useful life standards, the requirements of paragraph 4.c.i or paragraph 4.c.ii. may be met by an emissions test sequence demonstrating compliance with the applicable exhaust and evaporative standards at the end of the useful life if the paragraph 4.c.iii. procedure includes on-road, useful life deterioration on the evaporative test vehicle. The test vehicle must be deteriorated based on typical customer use throughout the applicable useful life. The manufacturer may perform unscheduled maintenance at the final test point only upon prior Executive Officer approval, which shall be granted if the Executive Officer determines that the exhaust emissions control system will not be affected, and the manufacturer demonstrates that the effectiveness of the evaporative emissions control system is not diminished. The unscheduled maintenance must be conducted in accordance with section 5 of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-duty Trucks, and Medium-Duty Vehicles." For the 1995 model year only, a manufacturer may use an engineering evaluation to satisfy the requirement for the exhaust durability data vehicle to comply with the applicable evaporative standards.

The DFs determined under paragraph 4.c.i. or 4.c.ii., if any, shall be averaged with the DFs determined under paragraph 4.c.iii. to determine a single evaporative emission DF for each evaporative emission engine family. Evaporative emission DFs shall be generated for the running loss test and for the hot soak and the diurnal test in the three-day diurnal sequence, and for the hot soak and the diurnal test in the two-day diurnal sequence. The manufacturer may carry-across the DF generated in the three-day diurnal sequence to the two-day diurnal sequence if the manufacturer can demonstrate that the DF generated in the three-day diurnal sequence is at least as great as the DF generated in the two-day diurnal sequence.

d. Instrumentation

The instrumentation necessary to perform evaporative emission testing is described in 40 CFR 86.107-90. For 1993 and subsequent model hybrid electric vehicles and 1995 and subsequent model motor vehicles subject to running loss and useful life standards, the following language is applicable in lieu of §86.107-90(a)(1):

i. Diurnal Evaporative Emissions Measurement Enclosure

A. The diurnal evaporative emissions measurement enclosure shall be equipped with an internal blower or blowers coupled with an air temperature management system (typically air to water heat exchangers and associated programmable temperature controls) to provide for air mixing and temperature control. For 1993 through 1995 model hybrid electric vehicles and 1995 model motor vehicles, the blower(s) shall be sized to provide a nominal total flow rate within a range of 0.3 to 0.6 ft^3/min per ft^3 of the nominal enclosure volume (V_n). For 1996 and subsequent model motor vehicles, the blower(s) shall provide a nominal total flow rate of 0.8 ± 0.2 ft^3/min per ft^3 of the V_n. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The air circulation blower(s), plus any additional blowers if needed, shall also maintain a minimum wind speed of 5 mph under the fuel tank of the test vehicle. The Executive Officer may adjust wind speed and location to ensure sufficient air circulation around the fuel tank. The wind speed requirement may be satisfied by consistently using a blower configuration that has been demonstrated to meet a broad 5-mph air flow in the vicinity of the vehicle's fuel tank, subject to verification by the Executive Officer.

The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall and with a thermocouple located underneath the vehicle where it would provide a temperature measurement representative of the temperature of the air under the fuel tank. The temperature conditioning system shall be capable of controlling the internal enclosure air temperature to follow the prescribed temperature versus time cycle as specified in 40 CFR 86.133-90 as modified by paragraph 4.g.x. of these procedures within an instantaneous tolerance of ± 3.0°F ~~of the nominal temperature versus time profile throughout the test,~~ and an average tolerance of ± 2.0°F ~~over the duration of the test~~ as measured by the vehicle underbody thermocouple, and within an instantaneous tolerance of ± 5.0°F as measured by the side wall thermocouples. The control system shall be tuned to provide a smooth temperature pattern which has a minimum of overshoot, hunting, and instability about the desired long term temperature profile. ~~Another thermocouple shall be placed near the fuel tank to verify adequate air mixing and to ensure that the average tolerance specified for the temperature conditioning system is met.~~

B. The enclosure shall be of sufficient size to contain the test vehicle with personnel access space. It shall use materials on its interior surfaces which do not adsorb or desorb hydrocarbons or alcohols (if the enclosure is used for alcohol-fueled vehicles). The enclosure shall be insulated to enable the test temperature profile to be achieved with a heating/cooling system which has ~~maximum surface temperatures in the enclosure no greater than 25.0°F above the maximum diurnal temperature specification, and~~ minimum surface temperatures in the enclosure no less than 25.0°F below the minimum diurnal temperature specification. The enclosure shall be equipped with a pressure transducer with an accuracy and precision of ± 0.1 inches H_2O. The enclosure shall be constructed with a minimum number of seams and joints which provide potential leakage paths. Particular attention shall be given to sealing and gasketing of such seams and joints to prevent leakage.

C. The enclosure shall be equipped with features which provide for the effective enclosure volume to expand and contract in response to both the temperature changes of the air mass in the enclosure, and any fluctuations in the ambient barometric pressure during the duration of the test. Either a variable volume enclosure or a fixed volume enclosure may be used for diurnal emission testing.

I. The variable volume enclosure shall have the capability of latching or otherwise constraining the enclosed volume to a known, fixed value which shall be termed the nominal enclosure volume (V_n). The nominal enclosure volume shall be determined by measuring all pertinent dimensions of the enclosure in its latched configuration, including internal fixtures, based on a temperature of 84°F, to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. In addition, the enclosure volume shall be measured based on a temperature of 65°F and 105°F. The latching system shall provide a fixed volume with an accuracy and repeatability of $0.005xV_n$. Two potential means of providing the volume accommodation capabilities are a moveable ceiling which is joined to the enclosure walls with a flexure; or a flexible bag or bags of Tedlar or other suitable materials which are installed in the enclosure and provided with flowpaths which communicate with the ambient air outside the enclosure. By moving air into and out of the bag(s), the contained volume can be adjusted dynamically. The total enclosure volume accommodation shall be sufficient to balance the volume changes produced by the difference between the extreme enclosure temperatures and the ambient laboratory temperature with the addition of a superimposed barometric pressure change of 0.8 in.

Hg. A minimum total volume accommodation range of ± $0.07xV_n$ shall be used. The action of the enclosure volume accommodation system shall limit the differential between the enclosure internal pressure and the external ambient barometric pressure to a maximum value of ± 2.0 inches H_2O.

II. The fixed volume enclosure shall be constructed with rigid panels that maintain a fixed enclosure volume, which shall be referred to as the nominal enclosure volume (V_n). V_n shall be determined by measuring all pertinent dimensions of the enclosure including internal fixtures to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. The enclosure shall be equipped with an outlet flow stream that withdraws air at a low, constant rate and provides makeup air as needed, or by reversing the flow of air into and out of the enclosure in response to rising or falling temperatures. ~~from the enclosure throughout the test. An inlet flow stream may provide make-up air to balance the outgoing flow with incoming ambient air.~~ If inlet air is added continuously throughout the test, it ~~Inlet air~~ must be filtered with activated carbon to provide a relatively constant hydrocarbon and alcohol level. Any method of volume accommodation shall maintain the differential between the enclosure internal pressure and the barometric pressure ~~between 0 and -2~~ to a maximum value of ±2.0 inches of water. The equipment shall be capable of measuring the mass of hydrocarbon, and alcohol (if the enclosure is used for alcohol-fueled vehicles) in the inlet and outlet flow streams with a resolution of 0.01 gram. A bag sampling system may be used to collect a proportional sample of the air withdrawn from and admitted to the enclosure. Alternatively, the inlet and outlet flow streams may be continuously analyzed using an on-line Flame Ionization Detector (FID) analyzer and integrated with the flow measurements to provide a continuous record of the mass hydrocarbon and alcohol removal.

D. An online computer system or stripchart recorder shall be used to record the following parameters during the diurnal evaporative emissions test sequence:

-Enclosure internal air temperature

-Diurnal ambient air temperature specified profile as defined in §86.133-90 as modified in paragraph 4.g.x.

-Vehicle fuel tank liquid temperature

-Enclosure internal pressure

-Enclosure temperature control system surface temperature(s)

-FID output voltage recording the following parameters for each sample analysis:

-zero gas and span gas adjustments

-zero gas reading

-Eenclosure sample reading

-zero gas and span gas readings

The data recording system shall have a time resolution of 30 seconds and shall provide a permanent record in either magnetic, electronic or paper media of the above parameters for the duration of the test.

E. Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternative equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

ii. Running Loss Measurement Facility

A. For all types of running loss measurement test facilities, the following shall apply:

I. The measurement of vehicle running loss fuel vapor emissions shall be conducted in a test facility which is maintained at a nominal ambient temperature of 105.0°F. Manufacturers have the option to perform running loss testing in either an enclosure incorporating atmospheric sampling equipment, or in a cell utilizing point source sampling equipment. Confirmatory testing or in-use compliance testing may be conducted by the Executive Officer using either sampling procedure. The test facility shall have space for personnel access to all sides of the vehicle and shall be equipped with the following test equipment:

-A chassis dynamometer which meets the requirements of 40 CFR 86.108-79.

-A fuel tank temperature management system which meets the requirements specified in ii.A.III. of this paragraph.

-A running loss fuel vapor hydrocarbon analyzer which meets the requirements specified in §86.107-90(a)(2)(i) and a running loss fuel vapor alcohol analyzer which meets the requirements specified in §86.107-90(a)(2)(ii).

-A running loss test data recording system which meets the requirements specified in ii.A.IV. of this paragraph.

II. All types of running loss test facilities shall be configured to provide an internal ambient temperature of $105^{o}F \pm 5^{o}F$ maximum and $\pm 2^{o}F$ on average throughout the running loss test sequence. This shall be accomplished by any one or combination of the following techniques:

-Using the test facility without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.

-Adding insulation to the test facility walls.

-Using the test facility artificial cooling system (if so equipped) with the setpoint of the cooling system adjusted to a value not lower than $105.0^{o}F$, where the cooling system setpoint refers to the internal test facility air temperature.

-Using a full range test facility temperature management system with heating and cooling capabilities.

III. Cell/enclosure temperature management shall be ~~conducted~~ measured at the inlet of the vehicle cooling fan. The vehicle cooling fan shall be a road speed modulated fan which is controlled to a discharge velocity which matches the dynamometer roll speed at least up to 30 mph throughout the driving cycle. The fan outlet ~~shall airflow~~ may discharge airflow to both the vehicle radiator air inlet(s) and the vehicle underbody. An additional fan, not to exceed 8,000 cfm, may be used to discharge airflow from the front of the vehicle directly to the vehicle underbody to control fuel temperatures.

The fuel tank temperature management system shall be configured and operated to control the fuel tank temperature profile of the test vehicle during the running loss test sequence. The use of a discrete fuel tank temperature management system is not required provided that the existing temperature and airflow conditions in the test facility are sufficient to match the on-road fuel tank liquid (T_{liq}) temperature profile of the test vehicle within a tolerance of ± 3.0°F throughout the running loss driving cycle, and, if applicable, the fuel tank vapor (T_{vap}) temperature profile of the test vehicle within a tolerance of ± 5°F throughout the running loss driving cycle and ± 3.0°F during the final 120 second idle period of the test. The system shall provide a ducted air flow directed at the vehicle fuel tank which can be adjusted in flow rate and/or temperature of the discharge air to manage the fuel tank temperature. The system shall monitor the vehicle fuel tank temperature sensors located in the tank according to the specifications in paragraph 4.f. (§86.129-80(d)(1)) during the running loss drive cycle. The measured temperature shall be compared to a reference on-road profile for the same platform/powertrain/fuel tank combination developed according to the procedures in §86.129-80(~~e~~d). The system shall adjust the discharge flow and/or temperature of the outlet duct to maintain the tank liquid temperature profile within ± 3.0°F of the reference on-road liquid temperature profile throughout the test. ~~Additionally,~~ If applicable, the vapor temperature shall match the reference on-road vapor temperature profile within ± 5.0°F throughout the test and ± 3.0°F during the final 120 second idle period ~~shall match the reference on-road vapor temperature within ± 3.0°F~~. The system shall be designed to avoid heating or cooling of the fuel tank vapor space in a way that would cause vapor temperature behavior to be unrepresentative of the vehicle's on-road vapor profile. The system shall provide a discharge airflow ~~not to exceed 6000 cfm~~ up to 4,000 cfm. With advance Executive Officer approval, the system may provide a discharge airflow with a maximum of 6,000 cfm.

For 1996 and subsequent model motor vehicles, blowers or fans shall be used to mix the enclosure contents during evaporative emission testing. The blowers or fans shall have a total capacity of at least 1.0 ft^3/min per ft^3 of the nominal enclosure volume. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification.

The temperature of the air supplied to the outlet duct shall be within a range of ~~70~~ 90°F to 160°F for systems which utilize artificial heating and/or cooling of the air supply to the outlet duct. This requirement does not apply to systems which recirculate air from inside the test cell without temperature conditioning the airflow. The control system shall be tuned and operated to provide a smooth and continuous fuel tank temperature profile which is representative of the on-road temperature profile.

Direct fuel heating may be used to control fuel temperatures for vehicles under exceptional circumstances in which airflow alone is insufficient to control fuel temperatures. The heating system must not cause hot spots on the tank wetted surface that could cause local overheating of the fuel. Heat must not be applied to the vapor in the tank above the liquid fuel, nor near the liquid-vapor interface.

IV. An on-line computer system or strip-chart recorder shall be used to record the following parameters during the running loss test sequence:

- -Cell/enclosure ambient temperature
- -Vehicle fuel tank liquid (T_{liq}) and, if applicable, vapor space (T_{vap}) temperatures
- -Vehicle coolant temperature
- -Vehicle fuel tank headspace pressure
- -Reference on-road fuel tank temperature profile developed according to paragraph 4.f. (§86.129-80(d))
- -Dynamometer rear roll speed (if applicable)
- -FID output voltage recording the following parameters for each sample analysis:
  - -zero gas and span gas adjustments

- -zero gas reading
- -dilute sample bag reading (if applicable)
- -dilution air sample bag reading (if applicable)
- -zero gas and span gas readings

-methanol sampling equipment data:

- -the volumes of deionized water introduced into each impinger
- -the rate and time of sample collection
- -the volumes of each sample introduced into the gas chromatograph
- -the flow rate of carrier gas through the column
- -the column temperature
- -the chromatogram of the analyzed sample

B. If an enclosure, or atmospheric sampling, running loss facility is used, the following requirements (in addition to those in subparagraph A. above) shall also be applicable:

I. The enclosure shall be readily sealable and rectangular in shape. When sealed, the enclosure shall be gas tight in accordance with 40 CFR 86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbons, and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface should be of flexible, impermeable, and non-reactive material to allow for minor volume changes, resulting from temperature changes.

II. In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F.

III. For 1996 and subsequent model motor vehicles, the enclosure shall be equipped to supply air to the vehicle, at a temperature of 105 ± 5°F, from sources outside of the running loss enclosure directly into the operating engine's air intake system. Supplemental air requirements shall be supplied by drawing air from the engine intake source.

C. If a point source running loss measurement facility (cell) is used, the following requirements (in addition to those in subparagraph A. above) shall also be applicable:

I. The running loss vapor collection system shall be configured to collect all running loss emissions from each of the discrete emissions sources, which include vehicle fuel system vapor vents, and transport the collected vapor emissions to a CFV or PDP based dilution and measurement system. The collection system shall consist of a collector at each discrete vehicle emissions source, lengths of heated sample line connecting each collector to the inlet of the heated sample pump, and lengths of heated sample line connecting the outlet of the heated sample pump to the inlet of the running loss fuel vapor sampling system. Up to 3 feet of unheated line connecting each of the vapor collectors to the heated sample lines shall be allowed. Each heated sample pump and its associated sample lines shall be maintained at a temperature between 175.0°F and 200.0°F to prevent condensation of fuel vapor in the sample lines. The heated sample pump(s) and its associated flow controls shall be configured and operated to draw a flow of ambient air into each collector at a flow rate of at least 40 standard cubic feet per hour (SCFH). The flow controls on each heated sampling system shall include an indicating flow meter which provides an alarm output to the data recording system if the flow rate drops below 40 SCFH by more than 5 percent. The collector inlet for each discrete emissions source shall be placed in proximity to the source as necessary to capture any fuel vapor emissions without significantly affecting flow or pressure of the normal action of the source. The collector inlets shall be designed to interface with the configuration and orientation of each specific source. For vapor vents which terminate in a tube or hose barb, a short length of tubing of an inside diameter larger throughout its length than the inside diameter of the vent outlet, may be used to extend the vent into the mouth of the collector as illustrated in Figure 1. For those vapor vent designs which are not compatible with such collector configurations and other emissions sources, the vehicle manufacturer shall supply a collector which is configured to interface with the vapor vent design or the specific emissions source design, and which terminates in a fitting approved by the Executive Officer. The Executive Officer shall approve the fitting if the manufacturer demonstrates that it is capable of capturing all vapor<u>s</u> emitted from the source.

II. The running loss fuel vapor sampling system shall be a CFV or PDP based dilution and measurement system which further dilutes the running loss fuel vapors collected by the vapor collection system(s) with ambient air, collects continuously proportional samples of the diluted running loss vapors and dilution air in sample bags, and measures the total dilute flow through the sampling system over each test interval. In practice, the system shall be configured and operated in a manner which is directly analogous to an exhaust emissions constant volume sampling system, except that the input flow to the system is the flow from the running loss vapor collection system(s) instead of vehicle exhaust flow. The system shall be configured and operated to meet the following requirements:

(1) The running loss fuel vapor sampling system shall be designed to measure the true mass of fuel vapor emissions collected by the running loss vapor collection system from the specified discrete emissions source. The total volume of the mixture of running loss emissions and dilution air shall be measured, and a continuously proportionated sample of volume shall be collected for analysis. Mass emissions shall be determined from the sample concentration and total flow over the test period.

(2) The PDP-CVS shall consist of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling system, and associated valves, pressure and temperature sensors. The PDP-CVS shall conform to the following requirements:

-The gas mixture temperature, measured at a point immediately ahead of the positive displacement pump, shall be within ± 10°F of the designed operating temperature at the start of the test. The gas mixture temperature variation from its value at the start of the test shall be limited to ± 10°F during the entire test. The temperature measuring system shall have an accuracy and precision of ± 2°F.

-The pressure gauges shall have an accuracy and precision of ± 1.6 inches of water (± 0.4 kPa).

-The flow capacity of the CVS shall not exceed 350 CFM (0.165 m^3/s).

-Sample collection bags for dilution air and running loss fuel vapor samples shall be sufficient size so as not to impede sample flow.

(3) The CFV sample system shall consist of a dilution air filter and mixing assembly, a sampling venturi, a critical flow venturi, a sampling system and assorted valves, and pressure and temperature sensors. The CFV sample system shall conform to the following requirements:

-The temperature measuring system shall have an accuracy and precision of ± 2°F and a response time of 0.100 seconds of 62.5 percent of a temperature change (as measured in hot silicone oil).

-The pressure measuring system shall have an accuracy and precision of ± 1.6 inches of water (0.4 kPa).

-The flow capacity of the CVS shall not exceed 350 CFM (0.165 m^3/s).

-Sample collection bags for dilution air and running loss fuel vapor samples shall be of sufficient size so as not to impede sample flow.

III. The on-line computer system or strip-chart recorder specified in ii.A.IV. of this paragraph shall be used to record the following additional parameters during the running loss test sequence, if applicable:

-CFV (if used) inlet temperature and pressure

-PDP (if used) inlet temperature and pressure and differential pressure

-Running loss vapor collection system low flow alarm~~(s)~~ events

D. Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternate equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

iii. Hot Soak Evaporative Emissions Measurement Enclosure

The enclosure shall be readily sealable, rectangular in shape, with space for personnel access to all sides of the vehicle. When sealed, the enclosure shall be gas tight in accordance with §86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbon, and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface shall be of flexible, impermeable and non-reactive material to allow for minor volume changes, resulting from temperature changes. The enclosure shall be configured to provide an internal enclosure ambient temperature of 105°F ± 5°F maximum and ± 2°F on average during the test time interval from 5 minutes after the enclosure is closed and sealed until the end of the one hour hot soak interval. For the first 5 minutes, the ambient temperature shall be maintained at 105°F ± 10°F. For 1996 and subsequent model motor vehicles, the enclosure shall be equipped with an internal air circulation blower(s). The blower(s) shall be sized to provide a nominal total flow rate within a range of 0.8 ± 0.2 ft^3/min per ft^3 of the nominal enclosure volume. The inlets and outlets of the blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall. This shall be accomplished by any one or combination of the following techniques:

- -Using the enclosure without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.
- -Adding insulation to the enclosure walls.
- -Using the enclosure artificial cooling system (if so equipped) with the setpoint of the cooling system adjusted to a value not lower than 105.0°F, where the cooling system setpoint refers to the internal enclosure air temperature.
- -Using a full range enclosure temperature management system with heating and cooling capabilities.

In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be ~~within~~ a ~~range of~~ a minimum of 70.0°F ~~to 125.0~~°F.

For 1995 through 1997 vehicles subject to running loss and useful life standards, and 1998 and subsequent motor vehicles, except petroleum-fueled diesel vehicles, electric vehicles, and motorcycles, omit §86.107-90(a)(4).

e. Calibrations

Evaporative emission enclosure calibrations are specified in 40 CFR 86.117-90. Methanol measurements may be omitted when methanol-fueled vehicles will not be tested in the evaporative enclosure. For all 1993 and subsequent model hybrid electric vehicles and 1995 and subsequent model motor vehicles subject to running loss and useful life standards, section 86.117-90 is amended to include an additional subsection (which shall be cited herein as subsection (e) of §86.117-90), to read:

(e)(1) Diurnal evaporative emission enclosure. The diurnal evaporative emission measurement enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic hydrocarbon (HC) and ~~alcohol~~ methanol retention check and calibration. Calibration for HC and methanol may be conducted in the same test run or in sequential test runs.

(i) The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in §86.117-90(a)(1) through (a)(6).

The enclosure shall be maintained at a nominal temperature of 105.0°F throughout the four hour period. Variable volume enclosures may be operated in either the latched volume configuration, or with the variable volume feature active. Fixed volume enclosures shall be operated with inlet and outlet flow streams closed. The allowable enclosure background emissions of HC and/or methanol as calculated according to §86.117-90(a)(7) shall not be greater than 0.05 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading (C_{HCi}) and the initial methanol concentration reading (C_{CH3OHi}) is taken and the four hour background measurement period begins.

(ii) The initial determination of enclosure internal volume shall be performed according to the procedures specified in paragraph 4.d.i.C. If the enclosure will be used for hot soak determination, the determination of enclosure internal volume shall also be performed based on 105°F.

(iii) The ~~hydrocarbon~~ HC and ~~alcohol~~ methanol measurement and retention checks shall evaluate the accuracy of enclosure HC and ~~alcohol~~ methanol mass measurements and the ability of the enclosure to retain trapped HC and ~~alcohol~~ methanol. The check shall be conducted over a 24 hour period with all of the normally functioning subsystems of the enclosure active. A known mass of propane and/or methanol shall be injected into the enclosure and an initial enclosure mass measurement(s) shall be made. The enclosure shall be subjected to the temperature cycling specified in paragraph 4.g.x.G. of these procedures (revising §86.133-90(l)) for a 24 hour period. A final enclosure mass measurement(s) shall be made. The following procedure shall be performed prior to the introduction of the enclosure into service and following any modifications or repairs to the enclosure that may impact the integrity of this enclosure; otherwise, the following procedure shall be performed on a monthly basis. (If six consecutive monthly retention checks are successfully completed without corrective action, the following procedure may be determined quarterly thereafter as long as no corrective action is required.)

(A) Zero and span the ~~hydrocarbon~~ HC analyzer.

(B) Purge the enclosure until a stable enclosure HC level is attained.

(C) Turn on the enclosure air mixing and temperature control system and adjust it for an initial temperature of 105.0°F and a programmed temperature profile covering one diurnal cycle over a 24 hour period according to the profile specified in paragraph 4.g.x.G. of these procedures (revising §86.133-90). Close the enclosure door. On variable volume enclosures, latch the enclosure to the enclosure volume measured at 105°F. On fixed volume enclosures, close the outlet and inlet flow streams.

(D) When the enclosure temperature stabilizes at 105.0°F ± 3.0°F seal the enclosure; measure the enclosure background HC concentration (C_{HCe1}), and/or background methanol concentration (C_{CH3OH1}), and the temperature (T_1), and pressure (P_1) in the enclosure.

(E) Inject into the enclosure a known quantity of propane between 2 to 6 grams and and/or a known quantity of methanol in gaseous form between 2 to 6 grams. The injection method shall use a critical flow orifice to meter the propane and/or methanol at a measured temperature and pressure for a measured time period. Techniques which provide equivalent resolution an accuracy and precision (± 0.2 of ± 0.5 percent) of the injected mass are also acceptable. Allow the enclosure internal HC and/or methanol concentration to mix and stabilize for up to 300 seconds. Measure the enclosure HC concentration (C_{HCe2}), and/or the enclosure methanol concentration (C_{CH3OH2}), and. For fixed volume enclosures, measure the temperature (T_2) and pressure in the enclosure (P_2). On variable volume enclosures, unlatch the enclosure. On fixed volume enclosures, open the outlet and inlet flow streams. Start the temperature cycling function of the enclosure air mixing and temperature control system. These steps shall be completed within 900 seconds of sealing the enclosure.

(F) For fixed volume enclosures, G calculate the initial recovered HC mass (M_{HCe1}) according to the following formula:

$$M_{HCe1} = (3.05 \times V \times 10^{-4} \times [P_2(C_{HCe2} - rC_{CH3OH2})/T_2 - P_1(C_{HCe1} - rC_{CH3OH1})/T_1])$$

where:

V is the enclosure volume at 105°F (ft^3)

P_{n1} is the enclosure initial pressure at event n (inches Hg absolute)

P_2 is the enclosure final pressure (inches Hg absolute)

C_{HCen} is the enclosure HC concentration at event n (ppm C)

C_{CH3OHn} is the enclosure methanol concentration calculated according to §86.117-90 (d)(2)(iii) at event n (ppm C carbon) r is the FID response factor to methanol

T_{R1} is the enclosure initial temperature at event R (^{o}R)

T_2 is the enclosure final temperature (^{o}R)

For variable volume enclosures, calculate the initial recovered HC mass and initial recovered methanol mass according to the equations used above except that P_2 and T_2 shall equal P_1 and T_1.

Calculate the initial recovered methanol mass (M_{CH3OH1}) according to §86.117-96(d)(1), as amended March 24, 1993.

If the recovered HC mass agrees with the injected mass within 2.0 percent and/or the recovered methanol mass agrees with the injected mass within 6.0 percent, continue the test for the 24 hour temperature cycling period. If the recovered mass differs from the injected mass by greater than ~~2.0 percent~~ the acceptable percentage(s) for HC and/or methanol, repeat the enclosure concentration measurement in step (E) and recalculate the initial recovered HC mass (M_{HCe1}) and/or methanol mass (M_{CH3OH1}). If the recovered mass based on the latest concentration measurement agrees within ~~2.0~~ the acceptable percentage(s) of the injected mass, continue the test for the 24 hour temperature cycling period and substitute this second enclosure concentration measurement for C_{HCe2} and/or C_{CH3OH2} in all subsequent calculations. In order to be a valid calibration, the final measurement of C_{HCe2} and C_{CH3OH2} shall be completed within the 900 second time limit outlined above. If the discrepancy persists, the test shall be terminated and the cause of the difference determined, followed by the correction of the problems(s) and the restart of the test.

(G) At the completion of the 24 hour temperature cycling period, measure the final enclosure HC concentration (C_{HCe3})~~,~~ and/or the final enclosure methanol concentration (C_{CH3OH3})~~, and~~. For fixed-volume enclosures, measure the final pressure (P_3) and final temperature (T_3) in the enclosure.

For fixed volume enclosures, ~~C~~ calculate the final recovered HC mass (M_{HCe2}) as follows:

$$M_{HCe2} = [3.05 \times V \times 10^{-4} \times (P_3(C_{HCe3} - rC_{CH3OH3})/T_3 - P_1(C_{HCe1} - rC_{CH3OH1})/T_1)] + M_{HC,out} - M_{HC,in}$$

where:

V is the enclosure volume at $105^{o}F$ (ft^3)

P_1 is the enclosure initial pressure (inches Hg absolute)

P_3 is the enclosure final pressure (inches Hg absolute)

C_{HCe3} is the enclosure HC concentration at the end of the 24 hour temperature cycling period (ppm C)

C_{CH3OH3} is the enclosure methanol concentration at the end of the 24 hour temperature cycling period, calculated according to §86.117-90 (d)(2)(iii) (ppm ~~carbon~~ C)

r is the FID response factor to methanol

T_{i1} is the enclosure initial temperature (^{o}R)

T_3 is the enclosure final temperature (^{o}R)

$M_{HC,out}$ is mass of ~~hydrocarbon~~ HC exiting the enclosure, ~~in the case of fixed volume enclosures~~ (grams)

$M_{HC,in}$ is mass of ~~hydrocarbon~~ HC entering the enclosure, ~~in the case of fixed volume enclosures~~ (grams)

For variable volume enclosures, calculate the final recovered HC mass and final recovered methanol mass according to the equations used above except that P_3 and T_3 shall equal P_1 and T_1, and $M_{HC,out}$ and $M_{HC,in}$ shall equal zero.

Calculate the final recovered methanol mass (M_{CH3OH2}) according to §86.117-96(d)(1), as amended March 24, 1993.

(H) If the calculated final recovered HC mass for the enclosures is not within 3 percent of the initial enclosure mass or the calculated final recovered methanol mass for the enclosures is not within 6 percent of the initial enclosure mass, then action shall be required to correct the error to the acceptable level.

(e)(2) The running loss equipment shall be calibrated as follows:

(i) The chassis dynamometer shall be calibrated according to the requirements of 40 CFR 86.118-78. The calibration shall be conducted at a typical ambient temperature of 75°F ± 5°F.

(ii) The running loss ~~hydrocarbon~~ HC analyzer shall be calibrated according to the requirements of 40 CFR 86.121-90.

(iii) If a point source facility is used, the running loss fuel vapor sampling system shall be calibrated according to the requirements of 40 CFR 86.119-90, with the additional requirement that the CVS System Verification ~~at~~ in 40 CFR 86.119-90(c) be conducted by injecting the known quantity of propane into the inlet of the most frequently used fuel vapor collector configured to collect vapors from the source of the evaporative emission vapor storage canister. This procedure shall be conducted in the running loss test cell with the collector installed in a vehicle in the normal test configuration, except that the vent hose from the vehicle evaporative emission canister shall be routed to a ventilation outlet to avoid unrepresentative background HC concentration levels. The propane injection shall be conducted by injecting approximately 4 grams of propane into the collector while the vehicle is operated over one Urban Dynamometer Driving Schedule (UDDS) test procedure, as described in 40 CFR 86.115-78 and Appendix I. The propane injection shall be conducted at a typical ambient temperature of 75°F ± 5°F.

(iv) In the event the running loss test is conducted using the atmospheric sampling measurement technique, the following procedure shall be used for the enclosure calibration:

(A) The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0°F throughout the four hour period. The allowable enclosure background emissions as calculated according to §86.117-90 (a)(7) shall not be greater than 0.2 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading is taken.

(B) The initial determination of enclosure internal volume shall be performed according to the procedures specified in §86.117-90 (b).

(C) The enclosure shall meet the calibration and retention requirements of §86.117-90(c). The propane injection recovery test shall be conducted with a test vehicle being driven over one UDDS cycle in the enclosure during the propane injection test. The vehicle used shall be configured and operated under conditions which ensure that its own running loss contribution is negligible, by using fuel of the lowest available volatility (7.0 psi RVP), maintaining the tank temperature at low levels (<100°F), and routing the canister vent to the outside of the enclosure.

(v) Hot soak enclosure. The hot soak enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic ~~hydrocarbon~~ <u>HC</u> and ~~alcohol~~ <u>methanol</u> retention check and calibration. The hot soak enclosure calibration shall be conducted according to the method specified in section (e)(1) with a retention check of 4 hours at 105°F or the method specified in section (e)(2)(iv).

(vi) Diurnal and hot soak enclosure ~~hydrocarbon~~ <u>HC</u> analyzer. The ~~hydrocarbon~~ <u>HC</u> analyzers used for measuring the diurnal and hot soak samples shall be calibrated according to the requirements of §86.121-90.

(vii) Other equipment. Other test equipment including temperature and pressure sensors and the associated amplifiers and recorders, flow measurement devices, and other instruments shall be calibrated and operated according to the manufacturer's specifications and recommendations, and good engineering practice.

f. Road Load Power, Test Weight, Inertia Weight Class, and Running Loss Fuel Tank Temperature Profile Determination

For all 1993 and subsequent model hybrid electric vehicles and 1995 and subsequent model motor vehicles subject to running loss and useful life standards, §86.129-80 is amended to include an additional subsection (which shall be cited herein as subsection (d) of §86.129-80), to read:

(d) Determination of running loss test fuel tank temperature profile

The manufacturer shall establish for each combination of vehicle platform/powertrain/fuel tank submitted for certification a representative profile of fuel tank liquid and vapor temperature versus time to be used as the target temperature profile for the running loss evaporative emissions test drive cycle. If a vehicle has more than one fuel tank, a profile shall be established for each tank. For 1996 and subsequent model motor vehicles, if manufacturers use a vehicle model to develop a profile to represent multiple vehicle models, the vehicle model selected must have the greatest expected fuel liquid temperature and fuel vapor temperature increase during driving of all of the vehicle models it will represent. For 1996 and subsequent model motor vehicles, manufacturers must select test vehicles with any available vehicle options that could increase fuel temperature during driving, such as any feature that limits underbody air flow. The profile shall be established by driving the vehicle on-road over the same driving schedule as is used for the running loss evaporative emissions test according to the following sequence:

(1) The vehicle to be used for the fuel tank temperature profile determination shall be equipped with at least 2 thermocouples installed so as to provide a representative bulk liquid average fuel temperature. The specific placement of the thermocouples shall take into account the tank configuration and orientation and shall be along the major axis of the tank. The thermocouples shall not be placed within internal reservoirs or other locations which are thermally isolated from the bulk volume of the fuel. The thermocouples shall be placed at a vertical depth equivalent to the mid-volume of the liquid fuel at a fill level of 40 percent of nominal tank capacity. A third thermocouple, shall be installed in the approximate center of the vapor space of the fuel tank. A pressure transducer with a minimum precision and accuracy of ± 1.0 inches H_2O shall be connected to the vapor space of the fuel tank. A means of conveniently draining the fuel tank shall be provided. The vehicle shall be equipped with a driver's aid which shall be configured to provide the test driver with the desired UDDS vehicle speed versus time trace as defined in Part 86, Appendix I and with the desired NYCC vehicle speed versus time trace as defined in Part 86, Appendix I of the CFR, amended as of March 24, 1993, and the actual vehicle speed. Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). A computer, data logger, or strip chart data recorder shall record the following parameters during the test run:

-Desired speed

-Actual speed

-Average liquid fuel temperature (T_{liq})

-Vapor space temperature (T_{vap})

-Vapor space pressure

The data recording system shall provide a time resolution of 1 second, and an accuracy of ± 1 MPH, ± 2.0°F, and ±

1.0 inches H_2O. The temperature and pressure signals may be recorded at intervals of up to 30 seconds.

(2) The temperature profile determination shall be conducted during ambient conditions which include:

-ambient temperature above 95°F and increasing or stable (± 2°F)

-sunny or mostly sunny with a maximum cloud cover of 25 percent

-wind conditions calm to light with maximum sustained wind speeds of 15 MPH mph; temporary gusts of wind between 15 and 25 mph may occur up to 5 percent of the total driving time

-road surface temperature (T_{sur}) at least 20°F above ambient temperature (T_{amb}) for 1993 to 1995 model hybrid vehicles and 1995 model motor vehicles, and at least 30°F above T_{amb} or at least 135°F, whichever is less for 1996 and subsequent model motor vehicles

The track surface temperature shall be measured with an embedded sensor, a portable temperature probe, or an infrared pyrometer which can provide an accuracy of ± 2.0°F. Temperatures must be measured on a surface representative of the surface where the vehicle is driven. The test shall be conducted on a track or other restricted access facility so that the speed versus time schedule can be maintained without undue safety risks.

Prior to the start of the profile generation, the fuel tank may be artificially heated to the ambient temperature to a maximum of 105°F. The vehicle may be soaked in a temperature-controlled enclosure. Fans blowing ambient air may be used to help control fuel temperatures. Engine idling may not be used to control fuel temperatures. If the fuel tank is artificially heated, the average liquid fuel temperature and the vapor temperature must be stabilized for at least one hour at the ambient temperature within ± 2°F to a maximum of 105°F before the profile generation begins. If the allowance for a lower initial fuel temperature established in section 4.g.vii is used, the fuel in the test vehicle may not be stabilized at a temperature higher than the established lower initial temperature.

Tank pressure shall not exceed 10 inches of water 30 seconds after the start of the engine until the end of engine operation during the temperature profile determination unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel cap was removed at the end of the running loss fuel tank temperature profile determination.

(3) The vehicle fuel tank shall be drained and filled to 40 percent of the nominal tank capacity with fuel meeting the requirements of paragraph 4.i. of these procedures. The vehicle shall be moved to the location where the driving cycle is to be conducted. It may be driven a maximum distance of 5.0 miles, longer distances shall require that the vehicle be transported by other means. The vehicle shall be parked for a minimum of 12 hours in an open area on a surface that is representative of the test road. The orientation of the front of the vehicle during parking (N, SW, etc.) shall be documented. Once the 12 hour minimum parking time has been achieved and the ambient temperature and weather conditions and track surface temperature are within the allowable ranges, the vehicle engine shall be started. The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F. The vehicle may be operated at minimum throttle for periods up to 60 seconds prior to beginning the first UDDS cycle in order to move from the parking location onto the road surface. The driver's aid shall be started and the vehicle operated over three sequential UDDS cycles with the transmission operated in the same manner as specified in 40 CFR 86.128-79. For 1996 and subsequent model motor vehicles, the vehicles shall be operated over one UDDS cycle, then two NYCCs, and another UDDS cycle instead of over three UDDS cycles. The end of each UDDS cycle and the end of the two NYCCs, if applicable, shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in §86.128-79 except for the following:

Revise section (c) to include: Idle modes may be run with automatic transmission in "Neutral" and shall be placed in "Drive" with the wheels braked at least 5 seconds before the end of the idle mode. Manual transmission may be in "Neutral" with the clutch engaged and shall be placed in gear with the clutch disengaged at least 5 seconds before the end of the idle mode.

The data recording system shall provide a record of the required parameters over the entire sequence from the initiation of the first UDDS cycle to the end of the third 120 second idle period. Following the completion of the test, the data recording system and driver's aid shall be turned off.

(4) In addition to the vehicle data recording, the following parameters shall be documented for the running loss test fuel tank temperature determination:

-Date and time of vehicle fueling

-Odometer reading at vehicle fueling

-Date and time vehicle was parked and parking location and orientation

-Odometer reading at parking

-Time and temperature of fuel tank heating, if applicable

-Date and time engine was started

-Time of initiation of first UDDS cycle

-Time of completion of third 120 second idle period

-Ambient temperature and track surface temperature at initiation of first UDDS cycle (T_{amb1} and T_{sur1})

-Ambient temperature and track surface temperature at completion of third 120 second idle period (T_{amb2} and T_{sur2})

(5) The three UDDS cycle driving traces and the two UDDS and two NYCC driving traces shall be verified to meet the speed tolerance requirements of 40 CFR 86.115-78 (b)(1), amended as follows:

Revise (v) to read: When conducted to meet the requirements of §86.129, up to three additional occurrences of speed variations greater than the tolerance are acceptable, provided they occur for less than 15 seconds on any occasion. All speed variations must be clearly documented as to the time and speed at that point in relation to the driving schedule.

Add (vi) to read: When conducted to meet the requirements of §86.129 and §86.132, the speed tolerance shall be as specified above, except that the upper and lower limits shall be 4 mph.

The following temperature conditions shall be verified:

$(T_{amb1}) \geq 95.0^{o}F$

$(T_{amb2}) \geq (T_{amb1} - 2.0^{o}F)$

For 1993 to 1995 model hybrid vehicles and 1995 model motor vehicles:

$(T_{sur1} - T_{amb1}) \geq 20.0^{o}F$

$(T_{sur2} - T_{amb2}) \geq 20.0^{o}F$

For 1996 and subsequent model motor vehicles:

$(T_{sur(n)} - T_{amb(n)}) \geq 30.0^{o}F$

where n is the incremental measurements in time.

or $T_{sur} > 135^{o}F$

Failure to comply with any of these requirements shall result in a void test, and require that the entire test procedure be repeated beginning with the fuel drain specified in (d)(3) of this subparagraph. If all of these requirements are met, the following calculations shall be performed:

$T_{corr} = T_{(i)} - T_{o}$

where: $T_{(i)}$ is the liquid fuel temperature or vapor fuel temperature during the drive (^{o}F) where i is the incremental measurements in time

T_{o} is the corresponding liquid fuel temperature or vapor fuel temperature observed at the start of the specified driving schedule (^{o}F)

The individual tank liquid (T_{liq}) and vapor space (T_{vap}) temperatures recorded during the test run shall be adjusted by arithmetically adding the corresponding temperature correction (T_{corr}) adjustment calculated above to $105^{o}F$. If T_{o} is higher than the corresponding ambient temperature by $2^{o}F$, the temperature correction shall be determined by the above equation plus the difference in T_{o} and the corresponding ambient temperature.

(6) Other methodologies for developing corrected liquid and vapor space temperature profiles are acceptable if approved in advance by the Executive Officer. The Executive Officer shall approve an alternate method if the manufacturer demonstrates equivalence to data collected at 105°F.

g. Test Procedure

For all 1993 and subsequent model hybrid electric vehicles and 1995 and subsequent model motor vehicles subject to running loss and useful life standards, the test sequence described in 40 CFR 86.130 through 86.140 shall be performed with the following modifications:

i. General Requirements.

The following language shall be applicable in lieu of §86.130-78:

For 1993 to 1995 model hybrid electric vehicles and 1995 model motor vehicles, the test sequence shown in Figure 2 (Figure 3 for hybrid electric vehicles) describes the steps encountered as the vehicle undergoes the three-day diurnal sequence to determine conformity with the standards set forth. For 1996 and subsequent model motor vehicles, the test sequence shown in Figure 4 (Figure 5 for hybrid electric vehicles) describes the steps encountered as the vehicle undergoes the three-day diurnal sequence and the supplemental two-day diurnal sequence to determine conformity with the standards set forth. Methanol measurements may be omitted when methanol-fueled vehicles will not be tested in the evaporative enclosure. Ambient temperature levels encountered by the test vehicle throughout the entire duration of this test sequence shall not be less than 68°F nor more than 86°F, unless otherwise specified. The temperatures monitored during testing shall be representative of those experienced by the test vehicle. The test vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution. The temperature tolerance of a soak period may be waived for up to 10 minutes to allow purging of the enclosure or transporting the vehicle into the enclosure.

If tests are invalidated after collection of emission data from previous test segments, the test may be repeated to collect only those data points needed to complete emission measurements. Compliance with emission standards may be determined by combining emission measurements from these different test runs. If any emission measurements are repeated, the new measurements supersede previous values.

The three-day diurnal test sequence shown in Figure 2 (and Figure 3 for hybrid electric vehicles) is briefly described as follows:

A. The fuel tank shall be drained and filled to the prescribed tank fuel volume, as specified in 40 CFR 86.082-2, in preparation for the vehicle preconditioning.

B. The vehicle preconditioning drive shall be performed in accordance with 40 CFR 86.132-90, except that following the vehicle fueling step at §86.132-90(a)(1) a minimum soak period of 6 hours shall be provided to allow the vehicle to stabilize to ambient temperature prior to the preconditioning drive. Vehicles performing consecutive tests at a test point with the same fuel specification and while remaining under laboratory ambient temperature conditions for at least 6 hours, may eliminate the initial fuel drain and fill and vehicle soak. In such cases, each subsequent test shall begin with the preconditioning drive. For hybrid electric vehicles only, the manufacturer may elect to perform the All-Electric Range Test pursuant to §9.f. of the "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 §1960.1(k) of Title 13, California Code of Regulations prior to vehicle preconditioning.

C. Following the vehicle preconditioning drive, the fuel tank shall be drained and then filled to 40 percent capacity.

D. The vehicle shall be allowed to soak for 12 to 36 hours prior to the exhaust emissions test.

E. During the 12 to 36 hour soak specified in subparagraph D. above, the vehicle's canister shall be purged with a volume of air equivalent to 300 canister charcoal bed volumes at a flow rate of 48 SCFH (22.7 slpm). For hybrid electric vehicles, the battery pack shall be discharged to the state of charge that satisfies one of the following two conditions: (1) the state of charge is at the lowest level allowed by the control unit of the auxiliary power unit, or (2) the state of charge is set such that auxiliary power unit operation will be at its maximum power level at the beginning and through the emission test.

F. The canister shall then be loaded using a butane-nitrogen mixture.

G. Perform exhaust emission tests in accordance with procedures as provided in section 1960.1(k), Title 13, California Code of Regulations, and these procedures.

H. Upon completion of the hot start test, the vehicle shall be parked in a temperature controlled area between one to six hours to stabilize the fuel temperature at 105°F for one hour~~s~~. Artificial cooling or heating of the fuel tank may be induced to achieve a fuel temperature of 105°F. The initial fuel and, if applicable, vapor temperatures for the running loss test may be less than 105°F with advance Executive Order approval if the manufacturer is able to provide data demonstrating ~~that~~ a ~~lower~~ initial temperatures at least 3°F lower than the required 105°F starting temperature. ~~reflects the maximum fuel temperature achieved by a stabilized vehicle during a 105°F day.~~

I. A running loss test shall be performed after the fuel tank is stabilized at 105°F. The fuel tank temperature shall be controlled using a specified tank temperature profile for that vehicle during the test. The temperature profile shall be achieved either using temperature controllers or by an air management system that would simulate airflow conditions under the vehicle during driving.

J. The hot soak enclosure test shall then be performed at an enclosure ambient temperature of 105°F.

K. Upon completion of the hot soak enclosure test, the vehicle shall be soaked for no less than 6 hours nor more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65°F.

L. A three-day diurnal test shall be performed in a variable temperature enclosure.

The supplemental two-day diurnal sequence in Figure 4 (and Figure 5 for hybrid electric vehicles) shall be conducted according to the steps described in (A) through (D), (F), (G), followed by (J) through (L) of this paragraph except that the ambient temperature of the hot soak test is conducted at an ambient temperature between 68°F and 86°F at all times and that the diurnal test will consist of a two-day test.

ii. Vehicle Preparation

Amend 40 CFR 86.131-90 to read:

(a) Prepare the fuel tank(s) for recording the temperature(s) of the prescribed test fuel liquid and, if applicable, fuel vapor according to the requirements of paragraph 4.f. (§86.129-80(d)(1)). Measurement of the fuel vapor temperature is optional. If vapor temperature is not measured, the measurement of the fuel tank pressure is not required.

(b) If applicable, T the vehicle shall be equipped with a pressure transducer to monitor the fuel tank headspace pressure during the test. The transducer shall have an accuracy and precision of ± 1.0 inches water.

(c) Provide additional fittings and adapters, as required, to accommodate a fuel drain at the lowest point possible in the fuel tank(s) as installed on the vehicle.

(d) Provide valving or other means to allow purging and loading of the evaporative emission canister(s). Special care shall be taken during this step not to alter normal functions of the fuel vapor system components.

(e) For vehicles to be tested for running loss emissions, prepare the exhaust system by sealing and/or plugging all detectable sources of exhaust gas leaks. The exhaust system shall be tested or inspected to ensure that detectable exhaust hydrocarbons are not emitted into the running loss enclosure during the running loss test.

iii. Vehicle Preconditioning

Amend paragraph 86.132-90 by adding the following subparagraph (a)(2)(i) which reads:

(i) For hybrid electric vehicles, the battery pack shall be discharged to or just below the state-of-charge at which operation of the auxiliary power unit will be initiated by the vehicle's control strategy. One UDDS shall be used for preconditioning. If the auxiliary power unit is capable of being manually activated (which would cause the vehicle to be classified as a Type C HEV), the auxiliary power unit shall be activated at the beginning and throughout the emission test.

The following language shall be applicable in lieu of §86.132-90(a)(4):

The Executive Officer may also choose to conduct or require the performance of optional or additional preconditioning to ensure that the evaporative emission control system is subjected to conditions typical of normal driving. The optional preconditioning shall consist of no less than 20 and no more than 50 miles of on-road mileage accumulation under typical driving conditions.

The following language shall be applicable in lieu of §86.132-90(b):

A. Within five minutes of completion of preconditioning, the vehicle shall be driven off the dynamometer to a work area.

B. The fuel tank(s) of the prepared vehicle shall be drained and refilled with the applicable test fuel, as specified in paragraph 4.i. of these procedures, to the prescribed tank fuel volume, defined in §86.082-2. The vehicle shall be refueled within 1 hour of completion of the preconditioning drive.

C. Following the fuel drain and fill described in subparagraph B. above, the test vehicle shall be allowed to soak for a period of not less than 12 or more than 36 hours prior to the exhaust emissions test. During the soak period, the canister shall be connected to a pump or compressor~~, purged with air, then~~ and loaded with butane as described in D. below for the three-day diurnal sequence and in E. below for the supplemental two-day diurnal sequence. For all vehicles certified to the running loss and useful life standards which are subjected to exhaust emissions testing only, the canister loading procedure as set forth in paragraph 4.g.iii.D shall be used.

For vehicles designed to use fuel consisting of at least 80 percent methanol by volume, canister preconditioning shall be performed with a fuel vapor composition representative of the vapor space composition in the vehicle's fuel tank. Manufacturers shall develop a procedure to precondition the canister, if the vehicle is so equipped for the different fuel. The procedure shall represent a canister loading equivalent to that specified in D. below for the three-day diurnal sequence and in E. below for the supplemental two-day diurnal sequence and shall be approved in advance by the Executive Officer.

D. For the three-day diurnal sequence, the evaporative emissions storage canister(s) shall be preloaded with an amount of butane equivalent to 1.5 times the nominal working capacity. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister shall be preconditioned separately. In addition, for 1998 and later model year vehicles equipped with refueling canisters, these canisters shall be preconditioned for the three-day diurnal test sequence according to the procedure in section 4.g.iii.E.(I). If a vehicle is designed to actively control evaporative or refueling emissions without a canister, the manufacturer shall devise an appropriate preconditioning procedure subject to the approval of the Executive Officer. If canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning. The nominal working capacity of a carbon canister shall be established by determining the mass of butane required to load a stabilized canister to a two gram breakthrough. The 2 gram breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams. The determination of nominal capacity shall be based on the average capacity of no less than five canisters which are in a stabilized condition. For stabilization, each canister must be cycled no less than 10 times and no more than 100 times to a two gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ± 2 grams butane per hour. Each canister loading step must be preceded by canister purging with 300 canister bed volume exchanges at 48 SCFH. The following procedure shall be used to preload the canister:

I. Prepare the evaporative emission canister(s) for the canister purging and loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step so that the normal functions of the fuel system components or the normal pressure relationships in the system are not disturbed. The canister purge shall be performed with ambient air of controlled humidity to 50 ± 25 grains per pound of dry air. This may be accomplished by purging the canister in a room which is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal flow rate of 48 SCFH (22.7 slpm), and the duration shall be determined to provide a total purge volume flow through the canister equivalent to 300 canister charcoal bed volume exchanges.

II. The evaporative emission canister(s) shall then be loaded with an amount of commercial grade butane vapors equivalent to 1.5 times the nominal working capacity. Canister loading shall not be less than 1.5 times the nominal canister capacity. The canister shall be loaded with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. The butane shall be loaded into the canister at a rate of 15 ± 2 grams of butane per hour. If the canister loading at this rate takes longer than 12 hours, a manufacturer may determine a new rate, based on completing the canister loading in no less than 12 hours. Either a Critical Flow Orifice (CFO) butane injection device, a gravimetric method, or electronic mass flow controllers shall be used to fulfill the requirements of this step. The time of completion of the canister loading activity shall be recorded. Manufacturers shall disclose to the Executive Officer their canister loading procedure. The protocol may not allow for the replacement of components. In addition, the Executive Officer may require that the manufacturer demonstrate that the procedure does not unduly disturb the components of the evaporative system.

III. Reconnect the evaporative emission canister(s)<u>, if applicable</u>.

E. For the supplemental two-day diurnal sequence, the evaporative emission storage canister(s) shall be loaded to the point of breakthrough using either I or II below. <u>For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit.</u> For vehicles with multiple canisters <u>in a parallel configuration</u>, each canister shall be preconditioned separately. <u>In addition, for model year 1998 and later vehicles equipped with refueling canisters, these canisters shall be preconditioned for the supplemental two-diurnal test sequence according to the procedure in 4.g.iii.E(I).</u> Breakthrough may be determined by emission measurement in an enclosure or by measuring the weight gain of an auxiliary evaporative canister connected downstream of the vehicle's canister, in which case, the following references to the enclosure can be ignored. The auxiliary canister shall be well purged with <u>ambient air of humidity controlled to 50±25 grains per pound of</u> dry air prior to loading. Breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams.

I. The following procedure provides for loading of the canister to breakthrough with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. If the canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning.

1. Prepare the evaporative/refueling emission canister(s) for the canister loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the canister loading procedure. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. Place the vehicle in the sealed enclosure and measure emissions with the FID.

2. Load the canister with a mixture composed of 50/50 mixture by volume of butane and nitrogen at a rate of 40 $\pm$ 2 grams butane per hour. As soon as the canister reaches breakthrough, the vapor source shall be shut off.

3. Reconnect the evaporative/refueling emission canister, if applicable.

II. The following procedure provides for loading the canister with repeated diurnal heat builds to breakthrough.

1. The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the diurnal heat builds. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. The average temperature of the dispensed fuel shall be 60 $\pm 12^{\circ}$F. Within one hour of being refueled, the vehicle shall be placed, with the engine shut

off, in the evaporative emission enclosure. The fuel tank temperature sensor shall be connected to the temperature recording system. A heat source, specified in §86.107-90(a)(4), shall be properly positioned with respect to the fuel tank(s) and connected to the temperature controller.

2. The fuel may be artificially heated or cooled to the starting diurnal temperature of 65°F. Turn off purge blower (if not already off); close and seal enclosure doors; and initiate measurement of the hydrocarbon level in the enclosure. When the fuel temperature reaches 65°F, start the diurnal heat build. The diurnal heat build should conform to the following function to within ± 4°F:

$$F = T_o \pm 0.4t$$

F is the fuel temperature, °F
T_o is the initial temperature, °F
t is the time since beginning of test, minutes

3. As soon as breakthrough occurs or when the fuel temperature reaches 105°F, whichever occurs first, the heat source shall be turned off, the enclosure doors shall be unsealed and opened. If breakthrough has not occurred by the time the fuel temperature reaches 105°F, the heat source shall be removed from the vehicle, the vehicle shall be removed (with the engine still off) from the evaporative emission enclosure and the entire procedure outlined above shall be repeated until breakthrough occurs.

4. After breakthrough occurs, the fuel tank(s) of the prepared vehicle shall be drained and filled with test fuel, as specified in paragraph 4.i. of these procedures, to the "tank fuel volume" defined in §86.082-2. The fuel shall be stabilized to a temperature within ± 3°F of the lab ambient before beginning the driving cycle for the exhaust emission test.

iv. Dynamometer procedure.

To be conducted according to 40 CFR 86.135-90.

v. Engine starting and restarting.

Amend 40 CFR 86.136-90 to read as follows:

Revise section (c) to read: If the vehicle does not start after the manufacturer's recommended cranking time (or 10 continuous seconds in the absence of a manufacturer's recommendation), cranking shall cease for the period recommended by the manufacturer (or 10 seconds in the absence of a manufacturer's recommendation). This may be repeated for up to three start attempts. If the vehicle does not start after three attempts, the reason for failure to start shall be determined. The gas flow measuring device on the CVS (usually a revolution counter) or CFV shall be turned off and the sampler selector valves, including the alcohol sampler, placed in the "standby" position during this diagnostic period. In addition, either the CVS should be turned off, or the exhaust tube disconnected from the tailpipe during the diagnostic period. If failure to start is an operational error, the vehicle shall be rescheduled for testing from a cold start.

vi. Dynamometer test run, gaseous and particulate emissions.

To be conducted according to 40 CFR 86.137-90.

vii. Vehicle Fuel Tank Temperature Stabilization

Immediately after the hot transient exhaust emission test, the vehicle shall be soaked in a temperature controlled area between one hour to six hours, until the fuel and, if applicable, vapor temperatures are stabilized at 105°F ± 3°F for one hour. This is a preparatory step for the running loss test. Cooling or heating of the fuel tank may be induced to bring the fuel to 105°F. The fuel heating rate shall not exceed 5°F in any 1-hour interval. Higher fuel heating rates are allowed with Executive Officer approval if the 5°F per hour heating rate is insufficient to heat the fuel to 105°F in the allowed soak time. The vehicle fuel temperature stabilization step may be omitted on vehicles whose tank fuel and, if applicable, vapor temperatures are already at 105°F upon completion of the exhaust emission test.

The initial fuel and, if applicable, vapor temperatures for the running loss test may be less than 105°F with advance Executive Officer approval if the manufacturer is able to provide data justifying ~~lower~~ initial temperatures at least 3°F lower than the required 105°F starting temperature. The test data shall include the maximum fuel temperatures experienced by the vehicle during an extended parking event and after a UDDS cycle and be conducted on a day which meets the ambient conditions specified in section 4.f.(d)(2), except the ambient temperature must be at least 105°F. During the profile generation, the temperature offset shall apply. ~~The fuel and vapor temperatures shall reflect the~~

~~maximum fuel temperatures achieved by a stabilized vehicle during a 105°F day.~~

The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F.

viii. Running Loss Test

After the fuel temperature is stabilized at 105°F or at the temperature specified by the manufacturer, the running loss test shall be performed. During the test, the running loss measurement enclosure shall be maintained at 105°F ± 5°F maximum and within ± 2°F on average throughout the running loss test sequence. <u>Control of the vapor temperature throughout the test to follow the vapor temperature profile generated according to the procedures in section 4.f. is optional. In those instances where vapor temperature is not controlled to follow the profile, the measurement of the fuel tank pressure is not required, and A.X. and B.V below shall not apply. In the event that a vehicle exceeds the applicable emission standard during confirmatory testing or in-use compliance testing, and the vapor temperature was not controlled, the manufacturer may, utilizing its own resources, test the vehicle to demonstrate if the excess emissions are attributable to inadequate control of vapor temperature.</u> If the vehicle has more than one fuel tank, the fuel temperature in each tank shall follow the profile generated in paragraph 4.f. If a warning light or gauge indicates that the vehicle's engine coolant has overheated, the test run may be stopped.

A. If running loss testing is conducted using an enclosure which incorporates atmospheric sampling equipment, the manufacturer shall perform the following steps for each test:

I. The running loss enclosure shall be purged for several minutes immediately prior to the test. If at any time the concentration of hydrocarbons, of alcohol, or of alcohol and hydrocarbons exceeds 15,000 ppm C, the enclosure should be immediately purged. This concentration provides at least a 4:1 safety factor against the lean flammability limit.

II. Place the drive wheels of the vehicle on the dynamometer without starting the engine.

III. Attach the exhaust tube to the vehicle tailpipe(s).

IV. The test vehicle windows and the luggage compartments shall be closed.

V. The fuel tank temperature sensor and the ambient temperature sensor shall be connected to the temperature recording system and, if required, to the air management and temperature controllers. The vehicle cooling fan shall be positioned as described in 40 CFR 86.135-90(b). During the running loss test, the cover of the vehicle engine compartment shall be closed as much as possible, windows shall be closed, and air conditioning system (if so equipped) shall be operated according to the requirements of paragraph 4.f. (§86.129-80 (d)(3)). Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). The temperature recording system and the hydrocarbon and alcohol emission data recording system shall be started.

VI. Close and seal enclosure doors.

VII. <u>When the ambient temperature is 105°F ± 5°F, the running loss test shall begin.</u> Analyze enclosure atmosphere for hydrocarbons and alcohol at the beginning of each phase of the test (i.e., each UDDS and 120 second idle; the two NYCCs and 120 second idle) and record. This is the background hydrocarbon concentration, herein denoted as $C_{HCa(n)}$ for each phase of the test and the background methanol concentration, herein denoted as $C_{CH3OHa(n)}$ for each phase of the test. The methanol sampling must start simultaneously with the initiation of the hydrocarbon analysis and continue for 4.0 ± 0.5 minutes. Record the time elapsed during this analysis. If the 4 minute sample period is inadequate to collect a sample of sufficient concentration to allow accurate Gas Chromatography analysis, rapidly collect the methanol sample in a bag and then bubble the bag sample through the impingers at the specified flow rate. The time elapsed between collection of the bag sample and flow through the impingers should be minimized to prevent any losses.

VIII. For 1993 to 1995 model hybrid electric vehicles and 1995 model motor vehicles, the vehicle shall be driven through three UDDS test procedures. For 1996 and subsequent model motor vehicles, the vehicle shall be driven through one UDDS, then two NYCCs and followed by one UDDS. The UDDS and the NYCC driving traces shall be verified to meet the speed tolerance requirements of §86.115-78 (b). The end of each UDDS cycle and the two NYCCs, if applicable, shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in §86.128-79, modified by paragraph 4.f.d.3.

The fuel tank liquid temperature during the dynamometer drive shall be controlled within ± 3.0°F of the fuel tank temperature profile obtained on the road according to the procedures in paragraph 4.f. (§86.129-80(d)) for the same vehicle platform/powertrain/fuel tank configuration. For 1996 and subsequent model motor vehicles, the fuel tank vapor temperature throughout the running loss test shall agree with the corresponding vapor temperature with a tolerance of ± 5°F. A running loss test with a fuel tank vapor temperature that exceeded the corresponding vapor temperature profile by more than the + 5°F tolerance may be considered valid if test results comply with the applicable running loss evaporative emission standards. For 1995 and subsequent model motor vehicles, the fuel tank vapor temperature during the final 120 second idle period shall agree with the corresponding vapor temperature from the on-road profile within ± 3.0°F. <u>For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results.</u> The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

IX. For engine starting and restarting, the provisions of §86.136-90(a) and (e) shall apply. If the vehicle does not start after the manufacturer's recommended cranking time or 10 continuous seconds in the absence$f a manufacturer's recommendation, cranking shall cease for the period recommended by the manufacturer or 10 seconds in the absence of a manufacturer's recommendation. This may be repeated for up to three start attempts. If the vehicle does not start after these three attempts, cranking shall cease and the reason for failure to start shall be determined. If the failure is caused by a vehicle malfunction, corrective action of less than 30 minutes duration may be taken (according to §86.090-25), and the test continued, provided that the ambient conditions to which the vehicle is exposed are maintained at

105°F ± 5°F. When the engine starts, the timing sequence of the driving schedule shall begin. If the vehicle cannot be started, the test shall be voided.

X. Tank pressure shall not exceed 10 inches of water ~~30 seconds after the start of the engine until the end of engine operation~~ during the running loss test unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel cap was removed at the end of the test. Transitory incidents of the pressure exceeding 10 inches of water, not greater than 10 percent of the total driving time, shall be acceptable during the running loss test if the manufacturer can demonstrate that the tank pressure does not exceed 10 inches of water during in-use operation. No pressure checks of the evaporative system shall be allowed. If the manufacturer suspects faulty or malfunctioning instrumentation, a repair of the test instrumentation may be performed. Under no circumstances will any changes/repairs to the evaporative emissions control system be allowed.

XI. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the end of each phase of the test.

XII. Analyze the enclosure atmosphere for hydrocarbons and for alcohol following each phase. This is the sample hydrocarbon concentration, herein denoted as $C_{HCs(n)}$ for each phase of the test and the sample alcohol concentration, herein denoted as $C_{CH3OHs(n)}$ for each phase of the test. The sample hydrocarbon and alcohol concentration for a particular phase of the test shall serve as the background concentration for the next phase of the test. The running loss test ends with completion of the final 120 second idle and occurs 75 ± 2 minutes (if the three UDDS are conducted) or 72 ± 2 minutes (if the UDDS, two NYCCs, and the UDDS are conducted) after the test begins. The elapsed time of this analysis shall be recorded.

XIII. Turn off the vehicle cooling fan and the vehicle underbody fan if used. The test vehicle windows and luggage compartment shall be opened. This is a preparatory step for the hot soak evaporative emission test.

XIV. The technician may now leave the enclosure through one of the enclosure doors. The enclosure door shall be open no longer than necessary for the technician to leave.

XV. For certification purposes, I if background emissions of the test vehicle adversely affect test accuracy, a manufacturer may submit data to the Executive Officer demonstrating the problem. If, based on the information provided by the manufacturer, the Executive Officer determines that background emissions do adversely affect test accuracy, the manufacturer shall submit for Executive Officer approval ~~some means to compensate for the problem~~ the identification of the suspected source of the emissions, the methodology for quantification of the emissions, the amount of emissions, and the estimated decay rate for these emissions. The Executive Officer shall approve the use of correction factors to minimize the effects of the problem if supported by experimental data submitted by the manufacturer.

B. If running loss testing is conducted using a cell which incorporates point source sampling equipment, the manufacturer shall perform the following steps for each test:

I. The running loss test shall be conducted in a test cell meeting the specifications of §86.107-90 (a)(1) as modified by paragraph 4.d.ii of these procedures. Ambient temperature in the running loss test cell shall be maintained at 105 ± 5°F maximum and within ± 2°F on average throughout the running loss test sequence. The ambient test cell temperature shall be measured in the vicinity of the vehicle cooling fan, and it shall be monitored at a frequency of at least once every 15 seconds. The vehicle running loss collection system and underbody cooling apparatus (if applicable) shall be positioned and connected. The vehicle shall be allowed to re-stabilize until the liquid fuel tank temperature is within ± 3.0°F of the initial liquid fuel temperature calculated according to paragraph 4.f. (§86.129-80(d)(5)) before the running loss test may proceed.

II. The vehicle cooling fan shall be positioned as described in 40 CFR 86.135-90(b). During the running loss test, the cover of the vehicle engine compartment shall be closed as much as possible, windows shall be closed, and air conditioning system (if so equipped) shall be operated according to the requirements of paragraph 4.f. (§86.129-80 (d)(3)). Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s).

III. For 1993 to 1995 model hybrid electric vehicles and 1995 model motor vehicles, the vehicle shall be operated on the dynamometer over three UDDS. For 1996 and subsequent model motor vehicles, the vehicle shall be operated on the dynamometer over one UDDS, two NYCCs, and one UDDS. Each UDDS and NYCC driving trace shall be verified to meet the speed tolerance requirements of §86.115-78 (b) as modified by paragraph 4.f. Idle periods of 120 seconds shall be added to the end of each of the UDDS and to the end of the two NYCCs. The transmission may be operated according to the specifications of §86.128-79 as modified by paragraph 4.f.d.3. Engine starting and restarting shall be conducted according to paragraph 4.g.viii.A.IX.

IV. The fuel tank liquid temperature during the dynamometer drive shall be controlled within ± 3.0°F of the fuel tank liquid temperature profile obtained on the road according to the procedures in paragraph 4.f. (§86.129-80(d)) for the same vehicle platform/powertrain/fuel tank configuration. For 1996 and subsequent model motor vehicles, the fuel tank vapor temperature throughout the running loss test shall agree with the corresponding vapor temperature with a tolerance of ± 5°F. A running loss test with a fuel tank vapor temperature that exceeded the corresponding vapor temperature profile by more than the + 5°F tolerance may be considered valid if test results comply with the applicable running loss evaporative emission standards. For 1995 and subsequent model motor vehicles, the fuel tank vapor temperature during the final 120 second idle period shall agree with the corresponding vapor temperature from the on-road profile within ± 3.0°F. <u>For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results.</u> The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

V. Tank pressure shall not exceed 10 inches of water ~~30 seconds after the start of the engine until the end of engine operation~~ during the running loss test unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel cap was removed at the end of the test. Transitory incidents of the pressure exceeding 10 inches of water, not greater than 10 percent of the total driving time, shall be acceptable during the running loss test if the manufacturer can demonstrate that the tank pressure does not exceed 10 inches of water during in-use operation. No pressure checks of the evaporative system shall be allowed. If the manufacturer suspects faulty or malfunctioning instrumentation, a repair of the test instrumentation may be performed. Under no circumstances will any changes/repairs to the evaporative emissions control system be allowed.

VI. After the test vehicle is positioned on the dynamometer, the running loss vapor collection system shall be properly positioned at the specified discrete emissions sources, which include vapor vents of the vehicle's fuel system, if not already positioned. The typical vapor vents for current fuel systems are the vents of the evaporative emission canister(s) and the tank pressure relief vent typically integrated into the fuel tank cap as depicted in Figure 1. Other designated places, if any, where fuel vapor can escape, shall also be included.

VII. The running loss vapor collection system may be connected to the PDP-CVS or CFV bag collection system. Otherwise, running loss vapors shall be sampled continuously with analyzers meeting the requirements of §86.107-90(a)(2).

VIII. The temperature of the collection system until it enters the main dilution airstream shall be maintained between 175°F to 200°F throughout the test to prevent fuel vapor condensation.

IX. The sample bags shall be analyzed within 20 minutes of their respective sample collection phases, as described in §86.137-90(b)(15).

X. After the completion of the final 120 seconds, turn off the vehicle cooling fan and the vehicle underbody fan if used.

C. Manufacturers may use an alternative running loss test procedure if it provides an equivalent demonstration of compliance. However, confirmatory testing or in-use compliance testing may be conducted by the Executive Officer using either the running loss measurement enclosure incorporating atmospheric sampling equipment or point source sampling equipment as specified in paragraph 4.d.ii (§86.107-90(a)(1)), and the procedure as outlined in either paragraph 4.g.viii.A. or 4.g.viii.B. of this test procedure.

ix. Hot-soak test.

Amend 40 CFR 86.138-90 as follows:

Revise the first paragraph of this section to read: For the three-day diurnal sequence, the hot soak evaporative emission test shall be conducted immediately following the running loss test. The hot soak test shall be performed at an ambient temperature of 105°F ± 10.0°F for the first 5 minutes of the test. The remainder of the hot soak test shall be performed at 105°F ± 5.0°F and ± 2.0°F on average.

A. Revise section (a) to read: If the hot soak test is conducted in the running loss enclosure, the final hydrocarbon and alcohol concentration for the running loss test, calculated in paragraph 4.g.xi.C.2.II., shall be the initial hydrocarbon concentration (time=0 minutes) C_{HCe1} and the initial alcohol concentration (time=0 minutes) $C_{CH3OHe1}$ for the hot soak test. If the vehicle must be transported to a different enclosure, sections (b) through (f), as modified below, shall be conducted.

B. Revise section (d) to include: Analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the initial (time=0 minutes) hydrocarbon concentration, C_{HCe1} and the initial (time=0 minutes) alcohol concentration, $C_{CH3OHe1}$, required in paragraph 4.g.xi.C.(2)(I).

C. Revise section (e) to read: If the hot soak test is not conducted in the running loss enclosure, the vehicle engine compartment cover shall be closed, the cooling fan shall be moved, the vehicle shall be disconnected from the dynamometer and exhaust sampling system, and then driven at minimum throttle to the vehicle entrance of the enclosure.

D. Revise section (i) to read: If hot soak testing is not conducted in the same enclosure as running loss testing, the hot soak enclosure doors shall be closed and sealed within two minutes of engine shutdown and within ~~five~~ seven minutes after the end of the running loss test. If running loss and hot soak testing is conducted in the same enclosure, the hot soak test shall commence immediately after the completion of the running loss test.

E. Revise section (j) to read: The 60 ± 0.5 minutes hot soak begins when the enclosure door(s) are sealed or when the running loss test ends if the hot soak test is conducted in the running loss enclosure.

F. Add section (p) to read: For certification purposes, ~~I~~ if background emissions of the test vehicle adversely affect test accuracy, a manufacturer may submit data to the Executive Officer demonstrating the problem. If, based on the information provided by the manufacturer, the Executive Officer determines that background emissions do adversely affect test accuracy, the manufacturer shall submit for Executive Officer approval ~~some means to compensate for the problem~~ the identification of the suspected source of emissions, the methodology for quantification of the emissions, the amount of emissions, and the estimated decay rate for these emissions. The Executive Officer shall approve the use of correction factors to minimize the effects of the problem if supported by experimental data submitted by the manufacturer.

For the supplemental two-day diurnal test sequence, the hot soak test shall be conducted immediately following the hot start exhaust test. The hot soak test shall be performed at an ambient temperature between 68° to 86°F at all times. The hot soak test shall be conducted according to §86.138-90, revised by (A) through (F) of this paragraph.

x. Diurnal breathing loss test.

A three-day diurnal test shall be performed in a variable temperature enclosure, described in paragraph 4.d.i. of this test procedure. The test consists of three 24-hour cycles. For purposes of this diurnal breathing loss test, all references to methanol shall be applicable to alcohol.

If testing indicates that a vehicle design may result in fuel temperature responses during enclosure testing that are not representative of in-use summertime conditions, the Executive Officer may adjust air circulation and temperature during the test as needed to ensure that the test sufficiently duplicates the vehicle's in-use experience.

Revise 40 CFR 86.133-90 to read as follows:

A. Revise section (a)(1) to read: Upon completion of the hot soak test, the test vehicle shall be soaked for no less than 6 hours nor more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65°F ± 3°F. The diurnal breathing loss test shall consist of three 24-hour test cycles.

B. Omit section (f).

C. Omit section (i).

D. Revise section (j) to read: Prior to initiating the emission sampling:

E. Revise section (k) to read: Emission sampling shall begin within 10 minutes of closing and sealing the doors, as follows:

F. Revise section (k)(3) to read: Start diurnal heat build and record time. This commences the 24 hour ± 2 minute test cycle.

G. Revise section (l) to read: For each 24-hour cycle of the diurnal breathing loss test, the ambient temperature in the enclosure shall be changed in real time as specified in the following table:

Hour	Temperature (°F)	Hour	Temperature (°F)
0	65.0	12	104.2
1	66.6	13	101.1
2	72.6	14	95.3
3	80.3	15	88.8
4	86.1	16	84.4
5	90.6	17	80.8
6	94.6	18	77.8
7	98.1	19	75.3
8	101.2	20	72.0
9	103.4	21	70.0
10	104.9	22	68.2
11	105.0	23	66.5
		24	65.0

H. Omit section (m).

I. Revise section (n) to read: The end of the first 24-hour cycle of the diurnal test occurs 24 hours ± 2 minutes after the heat build begins. Analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the final hydrocarbon concentration, C_{HCe2}, and the final alcohol concentration, $C_{CH3OHe2}$, in paragraph 4.g.xi.C.2.III. which modifies §86.143-90, for this test cycle. The time (or elapsed time) of this analysis shall be recorded. The procedure, commencing with paragraph (k)(1) shall be repeated until three consecutive 24-hour tests are completed. The data from the test cycle yielding the highest diurnal hydrocarbon mass shall be used in evaporative emissions calculations as required by paragraph 4.g.xi.C.2.III. which modifies §86.143-90.

J. Revise section (q) to read: Upon completion of the final 24-hour test cycle, and after the final alcohol sample has been collected, the enclosure doors shall be unsealed and opened.

K. Omit section (r).

L. Add section (t) to read: For certification purposes, I if background emissions of the test vehicle adversely affect test accuracy, a manufacturer may submit data to the Executive Officer demonstrating the problem. If, based on the information provided by the manufacturer, the Executive Officer determines that background emissions do adversely affect test accuracy, the manufacturer shall submit for Executive Officer approval some means to compensate for the problem the identification of the suspected source of emissions, the methodology for quantification of the emissions, the amount of emissions, and the estimated decay rate for these emissions. The Executive Officer shall approve the use of correction factors to minimize the effects of the problem if supported by experimental data submitted by the manufacturer.

M. Add section (u) to read: For hybrid electric vehicles, the manufacturer shall specify the working capacity of the evaporative emission control canister, and shall specify the number of 24-hour diurnals that can elapse before the auxiliary power unit will activate solely for the purposes of purging the canister of hydrocarbon vapor.

N. Add section (v) to read: In order to determine that the working capacity of the canister is sufficient to store the hydrocarbon vapor generated over the manufacturer specified number of days between auxiliary power unit activation events for the purposes of purging the evaporative canister, the evaporative canister shall be weighed after completion of the three-day diurnal period. The weight of the vapor contained in the canister shall not exceed the working capacity of the canister multiplied by three days and divided by the manufacturer specified number of days between auxiliary power unit activation events.

O. Add section (w) to read: The manufacturer shall specify the time interval of auxiliary power unit operation necessary to purge the evaporative emission control canister, and shall submit an engineering analysis to demonstrate that the canister will be purged to within five percent of its working capacity over the time interval.

The two-day diurnal test shall be performed in an enclosure, described in paragraph 4.d.i. of this test procedure. The test consists of two 24-hour cycles. The test procedure shall be conducted according to §86.133-90, revised by (A) through (O) of this paragraph except that only two consecutive 24-hour cycles will be performed. For the purposes of this diurnal breathing loss test, all references to methanol shall be applicable to alcohol.

xi. Calculations; evaporative emissions.

~~For purposes of this section, all references to methanol shall also be applicalbe to alcohol.~~

Revise 40 CFR 86.143-90 as follows:

A. Revise section (a) to read: The calculation of the net hydrocarbon plus methanol mass change in the enclosure is used to determine the diurnal, hot soak, and running loss mass emissions. If the emissions also include ethanol and other alcohol components, the manufacturer shall determine an appropriate calculation(s) which reflect characteristics of the alcohol component similar to the equations below, subject to the Executive Officer approval. The mass changes are calculated from initial and final hydrocarbon and methanol concentrations in ppm carbon, initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the following equations:

B. Revise section (a)(1) to read:

Methanol calculations shall be conducted according to §86.143-96 (b)(1)(i)<u>, as amended March 24, 1993.</u>

C. Revise section (a)(2) to read:

(2) For hydrocarbons:

(I) Hot soak HC mass. For fixed volume enclosures, T the hot soak enclosure mass is determined as:

$$M_{HChs} = [2.97x(V_n - 50)x10^{-4}x\{P_f(C_{HCe2} - rC_{CH3OHe2})/T_f - P_i(C_{HCe1} - rC_{CH3OHe1})/T_i\}]$$

where: M_{HChs} is the hot soak HC mass emissions (grams)

V_n is the enclosure nominal volume if the running loss enclosure is used or the enclosure volume at 105^oF if the diurnal enclosure is used. (ft^3)

P_i is the initial barometric pressure (inches Hg)

P_f is the final barometric pressure (inches Hg)

C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

$C_{CH3OHe2}$ is the final methanol concentration calculated according to §86.143-90 (a)(2)(iii) (ppm C equivalent)

$C_{CH3OHe1}$ is the initial methanol concentration calculated according to §86.143-90 (a)(2)(iii) (ppm C equivalent)

r is the FID response factor to methanol

T_i is the initial enclosure temperature (^oR)

T_f is the final enclosure temperature (^oR)

For variable volume enclosures, calculate the hot soak enclosure mass (M_{HChs}) according to the equation used above except that P_f and T_f shall equal P_i and T_i.

(II) Running loss HC mass. The running loss HC mass per distance traveled is defined as:

$$M_{HCrlt} = (M_{HCrl(1)} + M_{HCrl(2)} + M_{HCrl(3)})/(D_{rl(1)} + D_{rl(2)} + D_{rl(3)})$$

where: M_{HCrlt} is the total running loss HC mass per distance traveled (grams HC per mile)

$M_{HCrl(n)}$ is the running loss HC mass for phase n of the test (grams HC)

$D_{rl(n)}$ is the actual distance traveled over the driving cycle for phase n of the test (miles)

For the point-source method:

Hydrocarbon emissions:

$$M_{HCrl(n)} = (C_{HCs(n)} - C_{HCa(n)}) \times 16.88 \times V_{mix} \times 10^{-6}$$

where: $C_{HCs(n)}$ is the sample bag HC concentration for phase n of the test (ppm C)

$C_{HCa(n)}$ is the background bag concentration for phase n of the test (ppm C)

16.88 is the density of pure vapor at 68°F (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per §86.144-90

Methanol emissions:

$$M_{CH3OHrl(n)} = (C_{CH3OHs(n)} - C_{CH3OHa(n)}) \times 37.74 \times V_{mix}$$

where: $C_{CH3OHs(n)}$ is the sample bag methanol concentration for phase n of the test (ppm C equivalent)

$C_{Ch3OHa(n)}$ is the background bag concentration for phase n of the test (ppm C equivalent)

37.71 4 is the density of pure vapor at 68°F (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per §86.144-90

For the enclosure method:

$M_{HCrl(n)}$ shall be determined by the same method as the hot soak hydrocarbon mass emissions determination specified in paragraph 4.g.xi.C.2.I.

(III) Diurnal mass. For fixed volume enclosures, ~~T~~ the HC mass for each of the three diurnals is defined for an enclosure as:

$$M_{HCd} = [2.97x(V - 50)x10^{-4}x\{P_f(C_{HCe2} - rC_{CH3OHe2})/T_f - P_i(C_{HCe1} - rC_{CH3OHe1})/T_i\}] + M_{HC,out} - M_{HC,in}$$

where:

M_{HCd} is the diurnal HC mass emissions (grams)

V is the enclosure volume at 65°F (ft^3)

P_i is the initial barometric pressure (inches Hg)

P_f is the final barometric pressure (inches Hg)

C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)

$C_{CH3OHe2}$ is the final methanol concentration calculated according to §86.143-90 (a)(2)(iii)

$C_{CH3OHe1}$ is the initial methanol concentration calculated according to §86.143-90 (a)(2)(iii)

r is the FID response factor to methanol

T_i is the initial enclosure temperature (°R)

T_f is the final enclosure temperature (°F)

$M_{HC,out}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle~~, in the case of fixed volume enclosures,~~ (grams)

$M_{HC,in}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle~~, in the case of fixed volume enclosure,~~ (grams)

For variable volume enclosures, calculate the HC mass for each of the three diurnals (M_{HCd}) according to the equation used above except that P_f and T_f shall equal P_i and T_i and $M_{HC,out}$ and $M_{HC,in}$ shall equal zero.

D. Revise section (a)(3) to read:

The total mass emissions shall be adjusted as follows:

(1) $M_{hs} = M_{HChs} + (14.2284/32.042) \times 10^{-6} M_{CH3OH}$

(2) $M_{di} = M_{HCd} + (14.3594/32.042) \times 10^{-6} M_{CH3OH}$

(3) $M_{rl} = M_{HCrlt} + (14.2284/32.042) \times 10^{-6} M_{CH3OH}$

E. Revise section (b) to read: The final evaporative emission test results reported shall be computed by summing the adjusted evaporative emission result determined for the hot soak test (M_{hs}) and the highest 24-hour result determined for the diurnal breathing loss test (M_{di}). The final reported result for the running loss test shall be the adjusted emission result (M_{rl}), expressed on a grams per mile basis.

h. For 1983 and subsequent model-year LPG-fueled motor vehicles, the introduction of 40 percent by volume of chilled fuel and the heating of the fuel tank under the diurnal part of the evaporative test procedures shall be eliminated.

i. Evaporative emission test fuel shall be the fuel specified for exhaust emission testing in the applicable exhaust emission test procedures except as specified in section 4.j. of these test procedures.

Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that vehicle performance will be adversely affected without the use of the fuel additive.

j. With respect to 1996 and subsequent model vehicles and engines, if a manufacturer uses for evaporative and exhaust emission testing a gasoline test fuel meeting a the specifications set forth in §86.113-94(a)(1), the manufacturer may use the evaporative emission test procedures set forth in §§86.107-96 through 86.143-96 in place of the test procedures set forth in this California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles.

For the 1996 model year, a manufacturer may carry-across federal evaporative emissions data conducted in accordance to §86.107-96 through 86.143-96 and a gasoline test fuel meeting the specifications in §86.113-94(a)(1) to determine compliance with the standards set forth in section 1 of these test procedures. If a manufacturer uses this option, the manufacturer may submit exhaust emissions data conducted with the fuel specified in section 9.a.1. of the California Exhaust Emission Standards and

Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

- Manufacturers may use an alternative set of test procedures to demonstrate compliance with the standards set forth in section 1 of these test procedures with advance Executive Officer approval if the alternative procedure is demonstrated to yield test results more stringent than those resulting from the use of the test procedures set forth in section 4.g. of these test procedures.

If the manufacturer uses for certification a test procedure other than section 4.g., the Executive Officer has the option to conduct confirmatory and in-use compliance testing with the test procedures set forth in section 4.g of this California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles.

k. Upon prior written approval of the Executive Officer, a manufacturer may use the comparable federal requirements in Title 40, CFR, Part 86 in lieu of the carry-across specifications of paragraph 4.c. of these test procedures, ~~the multiple canister loading requirements of paragraph 4.g.iii.D.,~~ and the running loss road profile correction factors of paragraph 4.f. The Executive Officer shall approve a manufacturer's request if the manufacturer demonstrates to the Executive Officer that the alternative methodology will not adversely affect in-use evaporative emissions.

5. Approval of heavy-duty vehicles over 14,000 lbs GVWR and incomplete medium-duty vehicles shall be based on an engineering evaluation of the system and data submitted by the applicant. Such evaluation may include successful public usage on light-duty or medium-duty vehicles, adequate capacity of storage containers, routing of lines to prevent siphoning, and other emissions-related factors deemed appropriate by the Executive Officer. For LPG systems, this engineering evaluation shall include: emissions from pressure relief valves, carburetion systems and other sources of leakage; emissions due to fuel system wear and aging; and evaporative emission test data from light-duty or medium-duty vehicles with comparable fuel systems.

6. For the 1980 model year, the measured evaporative emissions from all test vehicles, except vehicles tested pursuant to paragraph 4. above and motorcycles, shall be corrected for background emissions by subtracting 1.0 gram per test. This correction for background emissions may be extended to include the 1981 model year, on a case-by-case basis, if the Executive Officer finds that a manufacturer has had insufficient lead-time to comply with the April 23, 1980 amendment to this procedure.

7. For the purposes of these test procedures, the following references in 40 CFR, Part 86, Subpart B, to light-duty vehicle evaporative testing

shall also apply to motorcycles: §§86.117-78, 86.117-90, 86.121-82, and 86.121-90. In addition, 40 CFR, Part 86, Subparts E, F, and other cited sections of Subpart B are incorporated into this test procedure by reference.

8. Certification of a motorcycle evaporative emission control system requires that the manufacturer demonstrate the durability of each evaporative emission control system family.

a. The motorcycle manufacturer can satisfy the vehicle durability testing requirement by performing an evaporative emission test at each scheduled exhaust emission test (§86.427-78) during the motorcycle exhaust emissions certification test (§86.425-78) for each evaporative emission family. The minimum mileage accumulated shall be the total distance (one-half the useful life distance), although the manufacturer may choose to extend the durability test to the useful life distance (§86.436-78). The displacement classes and test distances are shown below:

Displacement Class	Engine Displacement Range (CC)	Total Test Distance (km)	Useful Life Distance (km)
I	50-169	6,000	12,000
II	170-279	9,000	18,000
III	280 and greater	15,000	30,000

i. All durability vehicles shall be built at least one month before the evaporative emissions test, or the manufacturer must demonstrate that the non-fuel related evaporative emissions have stabilized.

ii. Testing at more frequent intervals than the scheduled exhaust emissions tests may be performed only when authorized in writing by the Executive Officer.

iii. The DF shall be determined by calculating a least-squares linear regression of the evaporative emissions data with respect to mileage. The DF is defined as the extrapolated (from the regression) value at the useful life distance minus the interpolated value at the total test distance, where these distances are taken from the table in paragraph 8.a.

iv. The extrapolated useful life and total test distance emissions shall be less than the applicable evaporative emission standards of paragraph 1. or the data will not be acceptable for use in the calculation of a DF and demonstration of compliance.

v. Motorcycle manufacturers may use the ARB Component Bench Test Procedures or propose in their application a method for durability bench testing and determination of a DF for each evaporative emission engine family. The Executive Officer shall review the method, and shall approve it if it is similar to the requirements specified in paragraph 4.a.ii. Any reference to 4,000 miles and 50,000 miles in paragraph 4.a.ii. shall mean total test distance and useful life distance, respectively, as defined in paragraph 8.a. for the appropriate engine displacement class.

vi. The DF determined under paragraph 8.a.iii. shall be averaged with the DF determined under paragraph 8.a.v. to determine a single evaporative emission DF for each evaporative emission engine family. For those motorcycles which do not require exhaust emission control system durability testing, the evaporative emission control system DF shall be determined under paragraph 8.a.v. only. Compliance with the standard shall be demonstrated by performing an evaporative emission test on a stabilized motorcycle. The motorcycle shall have accumulated at least the minimum test distance. The extrapolated useful life distance emissions after applying the bench test-derived DF shall be less than the applicable evaporative emission standards of paragraph 1.

vii. (A) Manufacturers of Class III motorcycles may elect to use an assigned evaporative emission control system DF, provided they meet the following requirements:

- Annual California motorcycle sales do not exceed 500 units, and

- The evaporative emission control system has been previously certified to meet the emission standards specified in these procedures, or the manufacturer provides test data from previous certification demonstrating that the system complies with the durability requirements set forth in this paragraph.

(B) Manufacturers of Class III motorcycles using an assigned evaporative emission control system DF pursuant to paragraph 8.a.vii.A. may submit a written request for a waiver of evaporative emission testing. The waiver shall be granted if the Executive Officer determines that the motorcycles will comply with the evaporative emission standard. The determination shall be based on the performance of the evaporative emission control system on other motorcycles, the capacity of vapor storage containers, the routing of lines to prevent siphoning, and other emission-related factors determined by the Executive Officer to be relevant to evaluation of the waiver request.

(C) Nothing in this paragraph shall be construed as an exemption from the exhaust emission standards and test procedures applicable pursuant to section 1958, Title 13, California Code of Regulations, or paragraph 8.c.ii. of these procedures.

viii. The emission label (§86.413-78) shall identify the evaporative emission family.

ix. Preconditioning shall be performed in accordance with §86.532-78. The provisions of §86.132-78 which prohibit abnormal loading of the evaporative emission control system during fueling and setting the dynamometer horsepower using a test vehicle shall be observed. Additional preconditioning (§86.132-82(a)(3) and §86.132-90(a)(3)) may be allowed by the Executive Officer under unusual circumstances.

b. Instrumentation

The instrumentation necessary to perform the motorcycle evaporative emission test is described in 40 CFR 86.107-78 and 86.107-90, with the following changes:

i. Revise section (a)(4) to read: Tank fuel heating system. The tank fuel heating system shall consist of two separate heat sources with two temperature controllers. A typical heat source is a pair of heating strips. Other sources may be used as required by circumstances and the Executive Officer may allow manufacturers to provide the heating apparatus for compliance testing. The temperature controllers may be manual, such as variable transformers, or they may be automated. Since vapor and fuel temperature are to be controlled independently, an automatic controller is recommended for the fuel. The heating system must not cause hot spots on the tank wetted surface which could cause local overheating of the fuel or vapor. Heating strips for the fuel, if used, should be located as low as practicable on the tank and should cover at least 10 percent of the wetted surface. The centerline of the fuel heating strips, if used, shall be below 30 percent of the fuel depth as measured from the bottom of the fuel tank and approximately parallel to the fuel level in the tank. The centerline of the vapor heating strips, if used, should be located at the approximate height of the center of the vapor volume. The temperature controller must be capable of controlling the fuel and vapor temperatures to the diurnal heating profile within the specified tolerance.

ii. Revise section (a)(5) (Temperature Recording System) to read: In addition to the specifications in this section, the vapor temperature in the fuel tank shall be measured. When the fuel or vapor temperature sensors cannot be located in the fuel tank to measure the temperature of the prescribed test fuel or vapor at the approximate mid-volume, sensors shall be located at the approximate mid-volume of each fuel or vapor containing cavity. The average of the readings from these sensors shall constitute the fuel or vapor temperature. The fuel and vapor temperature sensors shall be located at least one inch away from any heated tank surface. The Executive Officer may approve alternate sensor locations where the specifications above cannot be met or where tank symmetry provides redundant measurements.

iii. Calibration shall be performed in accordance with 40 CFR 86.516-78 or 86.516-90.

c. Test Procedure

i. The motorcycle exhaust emission test sequence is described in 40 CFR 86.530-78 through 86.540-78. The SHED test shall be accomplished by performing the diurnal portion of the SHED test (§86.133-78 except subsections a(1), k, and p; §86.133-90 except subsections a(1), l, and s; and neglecting references to windows and luggage compartments in these sections) after preconditioning and soak but prior to the "cold" start test. The fuel will be cooled to below 30°C after the diurnal test. The "cold" and "hot" start exhaust emission tests shall then be run. The motorcycle will then be returned for the hot soak portion of the SHED test. This general sequence is shown in Figure E78-10, under §86.130-78. The specified time limits shall be followed with the exception of soak times which are specified in §86.532-78 for motorcycles.

Running loss tests, when necessary, will be performed in accordance with §86.134-78, except references to §§86.135-82 through 86.137-82 and §§86.135-90 through 86.137-90 shall mean §§86.535-78 through 86.537-78.

ii. Manufacturers of Class III motorcycles with annual California sales of less than 500 units using an assigned evaporative emission control system DF pursuant to paragraph 8.a.vii. shall measure and report to the Executive Officer exhaust emissions from the CVS test between the diurnal and the hot soak tests even if the test is being conducted for evaporative emissions only. The exhaust emission levels projected for the motorcycle's useful life utilizing the exhaust emission DF determined during previous federal or California certification testing shall not exceed the standards set forth in section 1958, Title 13, California Code of Regulations.

iii. The fuel and vapor temperatures for the diurnal portion of the evaporative emission test shall conform to the following functions within ± 1.7°C with the tank filled to 50 percent ± 2.5 of its actual capacity, and with the motorcycle resting on its center kickstand (or a similar support) in the vertical position.

$$T_f = (1/3)\ t + 15.5^{\circ}C$$

$$T_v = (1/3)\ t + 21.0^{\circ}C$$

Where: T_f = fuel temperature, °C

T_v = vapor temperature, °C

t = time since the start of the diurnal temperature rise, minutes.

The test duration shall be 60 ± 2 minutes, giving a fuel and vapor temperature rise of 20°C. The final fuel temperature shall be 35.5°C ± .5°C.

An initial vapor temperature up to 5°C above 21°C may be used. For this condition, the vapor shall not be heated at the beginning of the diurnal test. When the fuel temperature has been raised to 5.5°C below the vapor temperature by following the T_f function, the remainder of the vapor heating profile shall be followed.

iv. An alternate temperature rise for the diurnal test may be approved by the Executive Officer. If a manufacturer has information which shows that a particular fuel tank design will change the temperature rise significantly from the function above, the manufacturer may present the information to the Executive Officer for evaluation and consideration.

v. The hot soak evaporative emission test shall be performed immediately following the "hot" start exhaust emission test. This test is described in §§86.138-78 and 86.138-90, except for §§86.138-78(d) and 86.138-90(e) which are revised to require that the motorcycle be pushed with the engine off rather than driven at minimum throttle from the dynamometer to the SHED.

vi. Calculations shall be performed in accordance with §86.143-78 or 86.143-90, except the standard volume for a motorcycle shall be 5 ft^3 instead of 50 ft^3.

d. Motorcycle manufacturers with annual sales of less than 2,000 units for the three displacement classes in California are not required to submit the information specified by these test procedures to the Executive Officer. However, all information required by these test procedures must be retained on file and be made available upon request to the Executive Officer for inspection. These manufacturers shall submit the following information for evaporative emission certification:

i. A brief description of the vehicles to be covered by the Executive Order. (The manufacturer's sales data book or advertising, including specifications, will satisfy this requirement for most manufacturers.)

ii. A statement signed by an authorized representative of the manufacturer stating "The vehicles described herein have been tested in accordance with the provisions of the 'California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles', and on the basis of those tests, are in conformance with the aforementioned standards and test procedures."

9. The evaporative emissions for LPG systems shall be calculated in accordance with §86.143-78 or 86.143-90 except that a H/C ratio of 2.658 shall be used for both the diurnal and hot soak emissions.

Definitions:

Motorcycle Evaporative Emission Family: The group of motorcycle models which meet the criteria of EPA's MSAPC Advisory Circular No. 59, section D.

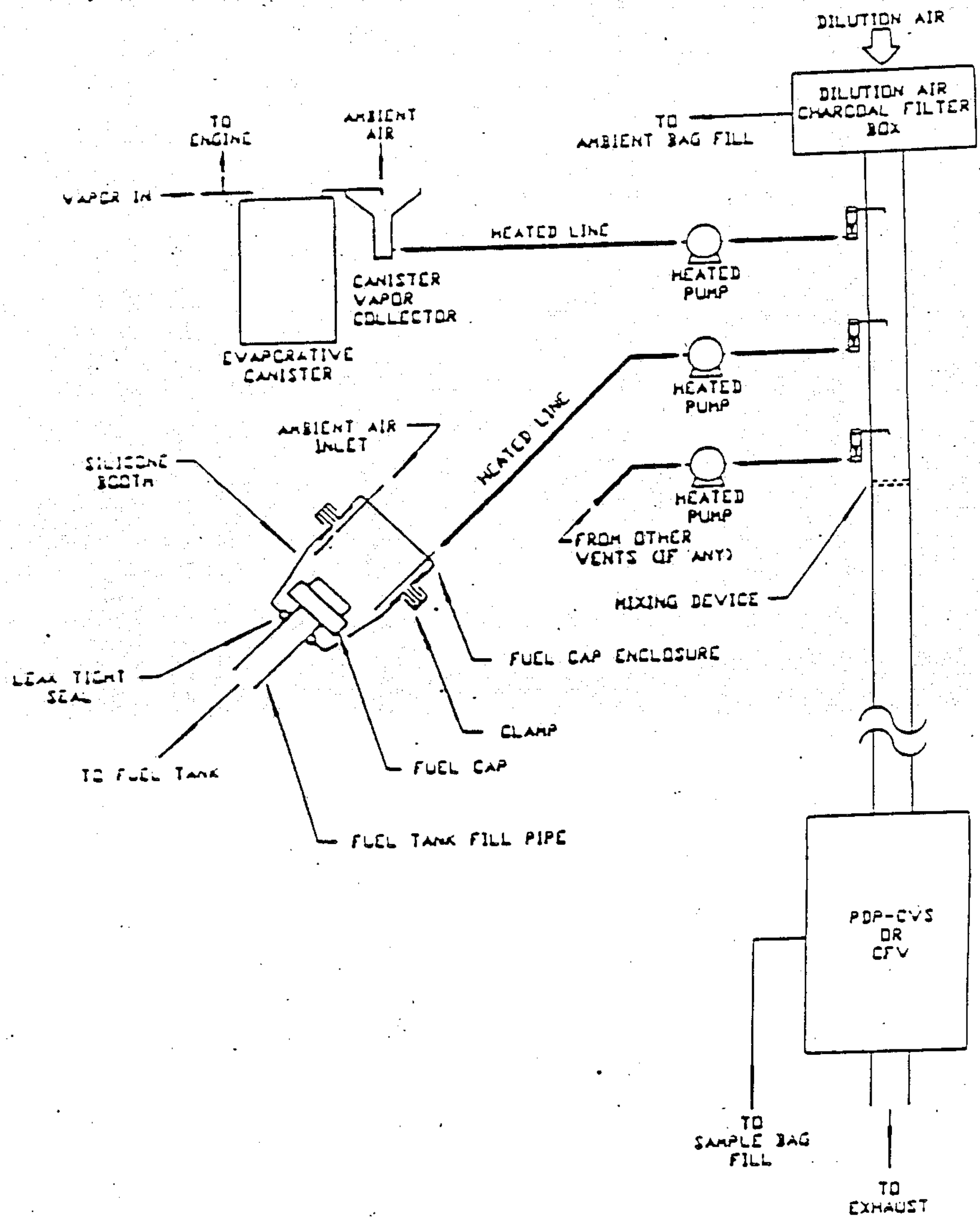

Figure 1. Running Loss Vapor Vent Collection System

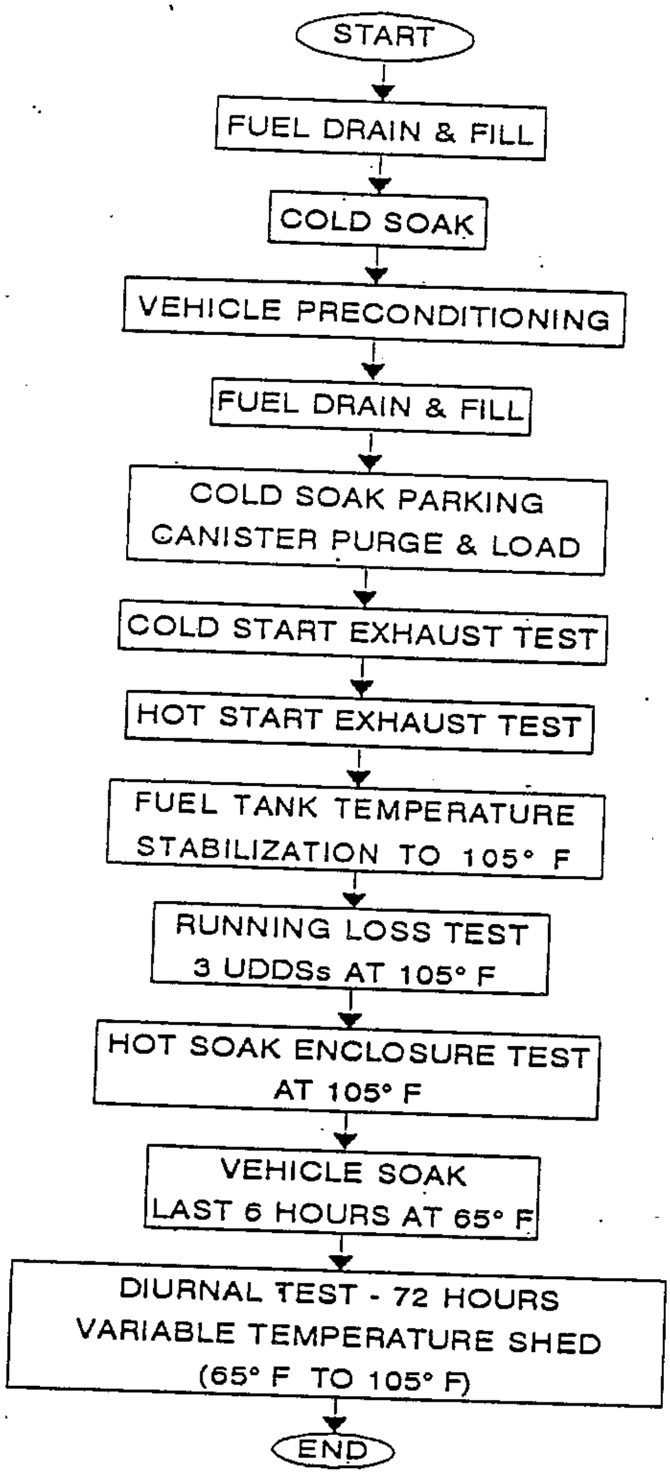

FIGURE 2. TEST PROCEDURES FOR 1995 MODEL MOTOR VEHICLES

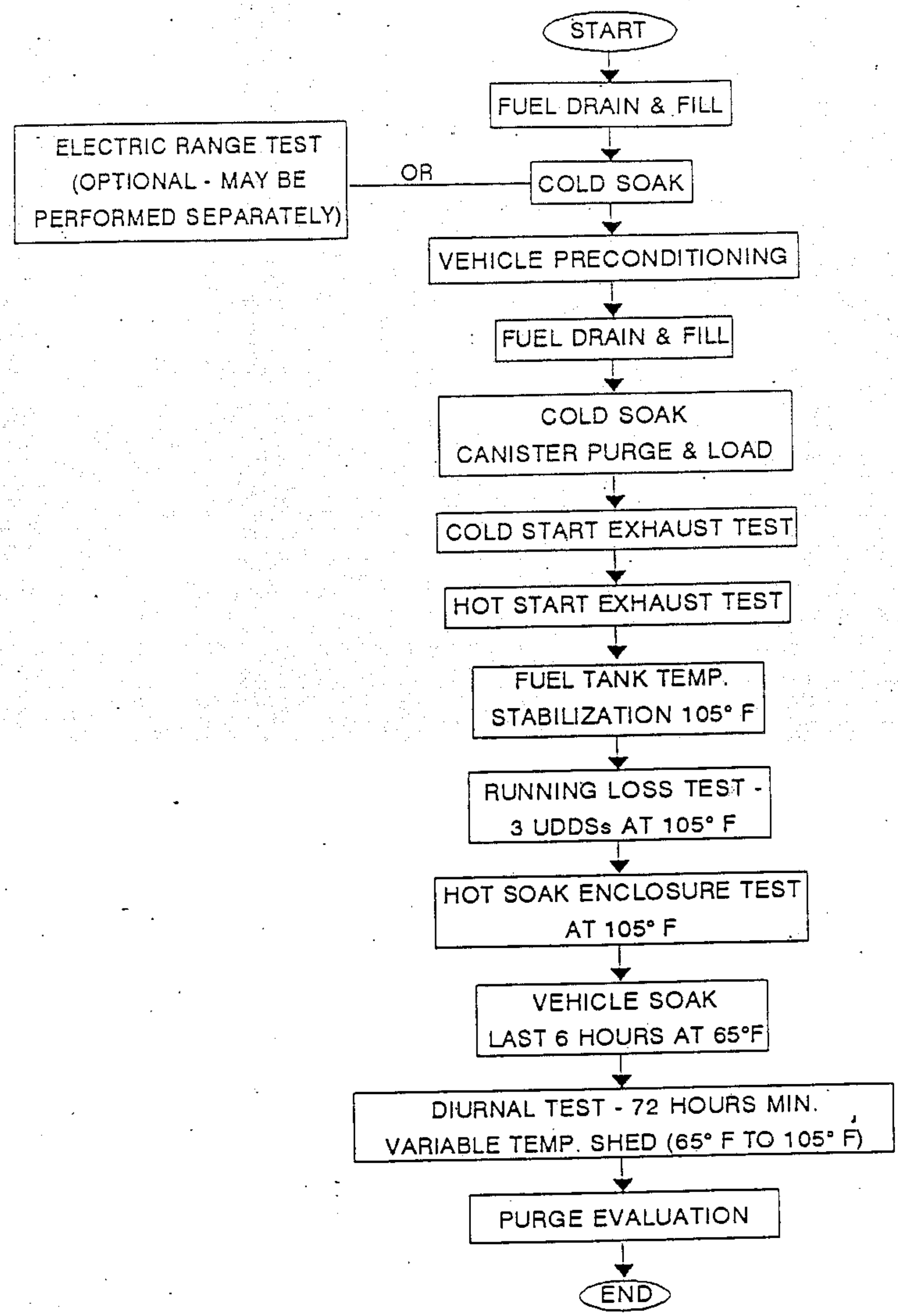

FIGURE 3. TEST PROCEDURES FOR 1993 TO 1995 MODEL HYBRID ELECTRIC VEHICLES

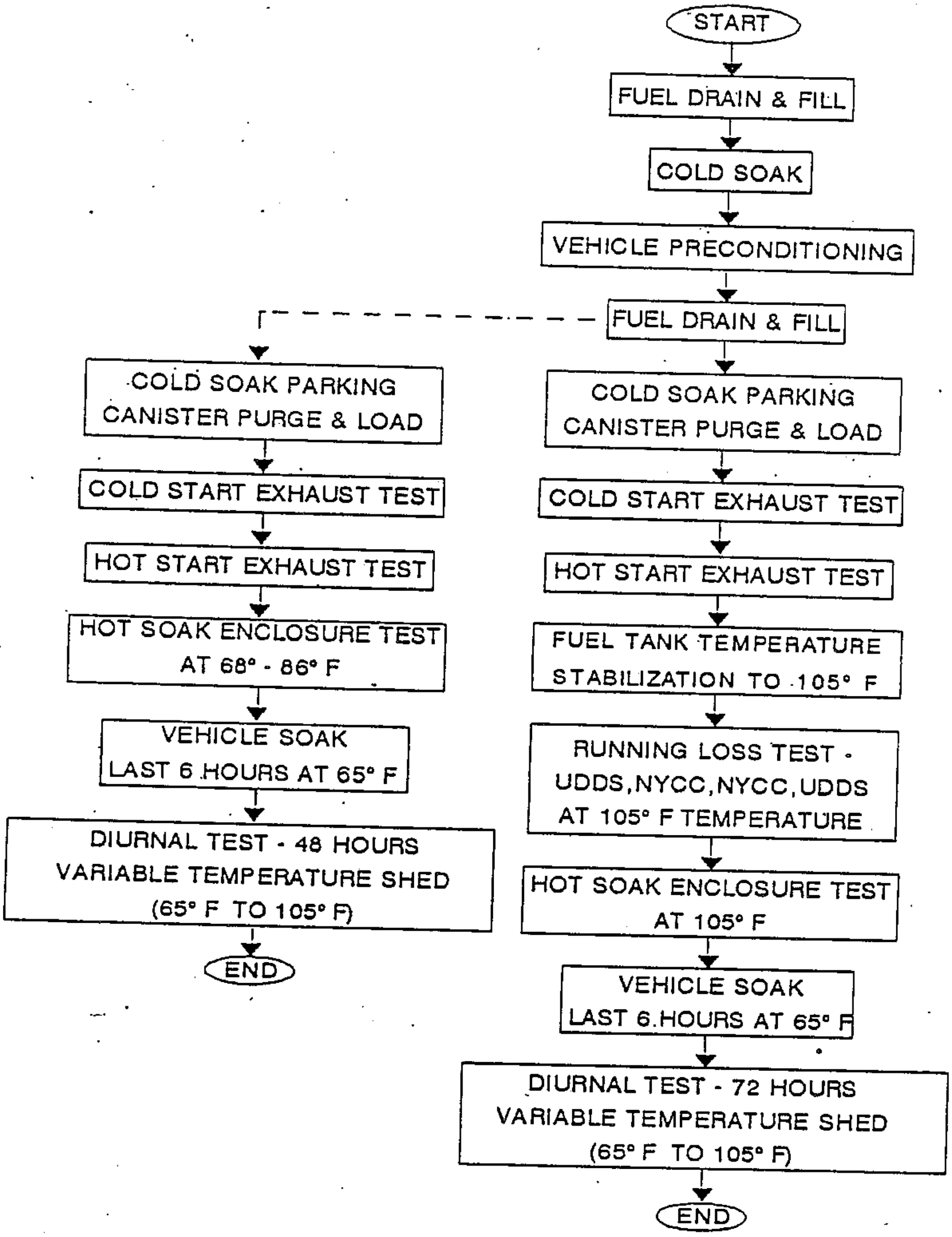

FIGURE 4. TEST PROCEDURES FOR 1996 AND SUBSEQUENT MODEL MOTOR VEHICLES

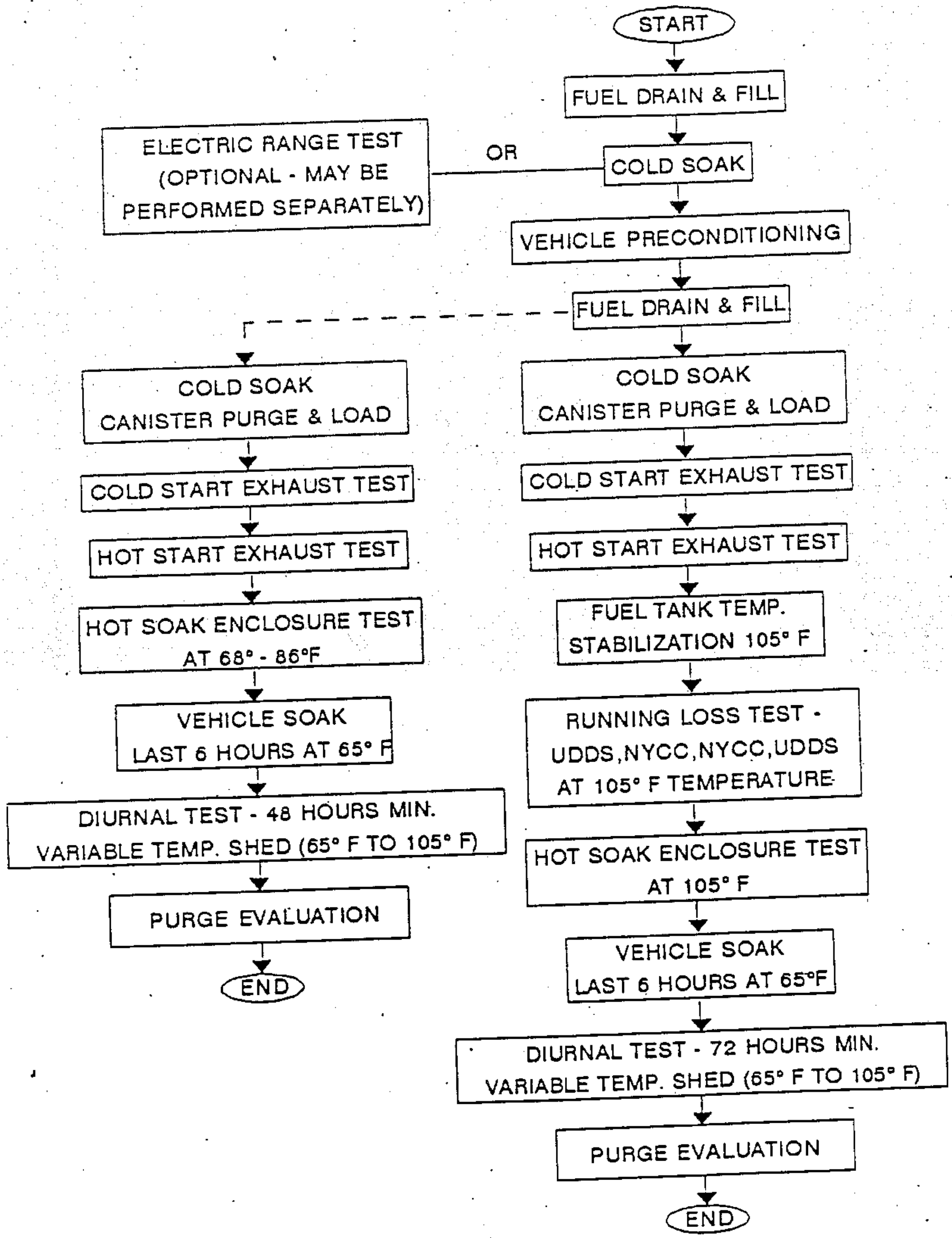

FIGURE 5. TEST PROCEDURES FOR 1996 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES