July 16, 2008 D R A F T

State of California
AIR RESOURCES BOARD

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

Adopted: August 5, 1999
Amended: June 22, 2006
Amended: October 17, 2007
Amended: [insert amended date]

Note: Proposed amendments to this document are shown in underline to indicate additions and ~~strikeouts~~ to indicate deletions compared to the test procedures as last amended October 17, 2007. Existing intervening text that is not amended is indicated by a row of asterisks (* * * *).

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45-Day Notice: 09/05/08
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NOTE: This document is incorporated by reference in section 1976(c), title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of motor vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

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

2. "California Exhaust Emission Standards and Test Procedures for 2005 – 2009 Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962(e), title 13, CCR);

3. "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962(h), title 13, CCR);

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

5. "California Exhaust Emission Standards and Test Procedures for 1987 through 2003 Model Heavy-Duty Otto-Cycle Engines and Vehicles," as incorporated by reference in section 1956.8(d), title 13, CCR;

6. "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," as incorporated by reference in section 1956.8(d), title 13, CCR.

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CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

The provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts A and B (as adopted or amended as of July 1, 1989); Subpart S (as adopted or amended on May 4, 1999); and, such sections of these Subparts as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, insofar as those subparts pertain to evaporative emission standards and test procedures, are hereby adopted as the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Years," with the following exceptions and additions:

PART I. GENERAL CERTIFICATION REQUIREMENTS FOR EVAPORATIVE EMISSIONS

A. 40 CFR §86.1801-01 Applicability.

1.1 These evaporative standards and test procedures are applicable to all new 2001 and subsequent model gasoline-, liquefied petroleum- and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, hybrid electric vehicles (including fuel-flexible, dual fuel and bi-fuel vehicles) and motorcycles. These standards and test procedures do not apply to motor vehicles that are exempt from exhaust emission certification, dedicated petroleum-fueled diesel vehicles, and dedicated compressed natural gas-fueled vehicles.~~, or hybrid electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions.~~ In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section or paragraph.

1.2. For general certification purposes, and except as otherwise noted in these test procedures, the requirements set forth in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," ~~as incorporated by reference in section 1961(d), title 13, California Code of Regulations (CCR),~~ the "California Exhaust Emission Standards and Test Procedures for 2005 – 2010 Model Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," shall apply to light- and medium-duty vehicles; the "California Exhaust Emission Standards and Test Procedures for 1987 ~~and Subsequent~~through 2003 Model Heavy-Duty Otto-Cycle Engines and Vehicles,"~~ as incorporated by reference in section 1956.8(d), title 13, CCR,~~ the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," shall apply to heavy-duty vehicles;

and, section 1958, title 13, CCR shall apply to motorcycles~~, except as otherwise noted in these test procedures~~.

1.3 Approval of vehicles that are not exhaust emission tested using a chassis dynamometer pursuant to section 1961, title 13, CCR shall be based on an engineering evaluation of the system and data submitted by the applicant.

1.4. Reference to light-duty trucks in the federal CFR shall mean light-duty trucks and medium-duty vehicles. Regulations concerning methanol in the Title 40, CFR Part 86, shall mean methanol and ethanol, except as otherwise indicated in these test procedures.

1.5 The term "[no change]" means that these test procedures do not modify the applicable federal requirement.

1.6 In those instances where the testing conditions or parameters are not practical or feasible for vehicles operating on LPG fuel, 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.

B. Definitions, Acronyms, Terminology

These test procedures incorporate by reference the definitions set forth in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" and, the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," ~~as incorporated by reference in section 1961(d), title 13, CCR,~~ including the incorporated definitions from the Code of Federal Regulations.

C. Useful Life

1. §86.1805-01. Delete. For vehicles certified to the emission standards in section E.1.(a), "useful life" shall have the same meaning as provided in section 2112, title 13, CCR. For vehicles certified to the emission standards in sections E.1.(c) and (d), the "useful life" shall be 15 years or 150,000 miles, whichever first occurs.

D. General Standards; increase in emissions; unsafe conditions; waivers

1. Light- and Medium-Duty Vehicles.

1.1 Amend §86.1810-01 (December 8, 2005) as follows:

(a) through (g). [The provisions of these paragraphs are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent

Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles.”~~ adopted August 5, 1999, as last amended June 22, 2006.]~~

(h) For alcohol vehicles, hydrocarbon evaporative emissions shall be expressed as OMHCE.

(i) [No change.]

(j) Evaporative Emissions general provisions.

(1) The evaporative standards in section E. of this part apply equally to certification and in-use vehicles and trucks.

(2) For certification testing only, a manufacturer may conduct testing to quantify a level of stabilized non-fuel evaporative emissions for an individual certification test vehicle. Testing may be conducted on a representative vehicle to determine the non-fuel evaporative emission characteristics of the certification test vehicle. The demonstration must be submitted for advance approval by the Executive Officer and include a description of the sources of vehicle non-fuel evaporative emissions, the methodology for the quantification of the non-fuel emissions, an estimated non-fuel emission decay rate, and the stabilized non-fuel emission level. The demonstrated stabilized level of non-fuel evaporative emissions may be used in place of the test vehicle non-fuel evaporative emissions and be combined with the vehicle fuel evaporative emissions to determine compliance with the evaporative emission standard.

(3) [No change.]

(4) [No change.]

(k) through (n) [The provisions of these paragraphs are contained in the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Year Motor Vehicles~~,~~.~~" adopted August 5, 1999, as last amended October 17, 2007.~~]

(o) through (p). [The provisions of these paragraphs are contained in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles~~,~~.”~~ adopted August 5, 1999, as last amended June 22, 2006.~~]

2. Heavy-Duty Vehicles. 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 systems.

E. Emission Standards

1. Evaporative Emission Standards for 2001 and Subsequent Model Year Vehicles Other Than Motorcycles.

(a) For the 2001 through 2005 model year vehicles identified below, tested in accordance with the test procedure sequence set forth in Part III, the maximum projected total hydrocarbon evaporative emissions are:

Class of Vehicle	Running Loss (grams per mile)	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)
Passenger Cars, Light-Duty Trucks	0.05	2.0	2.5
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)			
with fuel tanks < 30 gallons	0.05	2.0	2.5
with fuel tanks ≥ 30 gallons	0.05	2.5	3.0
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	0.05	3.0 (1)	3.5
	0.05	2.0 (2)	3.5
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	2.0	4.5
Hybrid Electric PCs, LDTs and MDVs	0.05	2.0	2.5

(1) The standards in this row apply to medium-duty vehicles certified according to the exhaust standards in section 1961, title 13, CCR.

(2) The standards in this row apply to incomplete medium-duty vehicles certifying to the exhaust standards in section 1956.8, title 13, CCR.

(b) Zero emission vehicles shall produce zero fuel evaporative emissions under any and all possible operational modes and conditions.

(c) The optional zero-fuel evaporative emission standards for the three-day and two-day diurnal-plus-hot-soak tests are 0.35 grams per test for passenger cars, 0.50 grams per test for light-duty trucks 6,000 lbs. GVWR and under, and 0.75 grams per test for light-duty trucks from 6,001 to 8,500 lbs. GVWR, to account for vehicle non-fuel evaporative emissions (resulting from paints, upholstery, tires, and other vehicle sources). Vehicles demonstrating compliance with these evaporative emission standards shall also have zero (0.0) grams of fuel evaporative emissions per test for the three-day and two-day diurnal-plus-hot-soak tests. The "useful life" shall be 15 years or 150,000 miles, whichever occurs first. In lieu of demonstrating compliance with the zero (0.0) grams of fuel evaporative emissions per test over the three-day and two-day diurnal-plus-hot-soak tests, the manufacturer may submit for advance Executive Officer approval a test plan to demonstrate that the vehicle has zero (0.0) grams of fuel evaporative emissions throughout its useful life.

Additionally, in the case of a SULEV vehicle for which a manufacturer is seeking a partial ZEV credit, the manufacturer may prior to certification elect to have measured fuel evaporative emissions reduced by a specified value in all certification and in-use testing of the vehicle as long as measured mass exhaust emissions of NMOG for the vehicle are increased in all certification and in-use testing. The measured fuel evaporative emissions shall be reduced in increments of 0.1 gram per test, and the measured mass exhaust emissions of NMOG from the vehicle shall be increased by a gram per mile factor, to be determined by the Executive Officer, for every 0.1 gram per test by which the measured fuel evaporative emissions are reduced. For the purpose of this calculation, the evaporative emissions shall be measured, in grams per test, to a minimum of three significant figures.

(d) For the 2004 and subsequent model motor vehicles identified below, tested in accordance with the test procedure sequence set forth in Part III, the maximum projected total hydrocarbon evaporative emissions are:

Vehicle Type	Hydrocarbon Standards(1)(2)		
	Running Loss (grams per mile)	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)
Passenger Cars	0.05	0.50	0.65
Light-Duty Trucks (under 8,501 lbs. GVWR)			
6,000 lbs. GVWR and under	0.05	0.65	0.85
6,001 - 8,500 lbs. GVWR	0.05	0.90	1.15
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	0.05	1.00	1.25
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	1.00	1.25

(1) (a) These evaporative emission standards shall be phased-in beginning with the 2004 model year. Each manufacturer, except small volume manufacturers, shall certify at a minimum the specified percentage of its vehicle fleet to the evaporative emission standards in this table or the optional zero-evaporative emission standards in section E.1.(c) according to the schedule set forth below. For purposes of this paragraph (a), each manufacturer's vehicle fleet consists of the total projected California sales of the manufacturer's gasoline-fueled, liquefied petroleum-fueled and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles.

Model Year	*Minimum Percentage of Vehicles Certified to the Standards in Sections E.1.(c) and E.1.(d)*
2004	40
2005	80
2006 and subsequent	100

A small volume manufacturer shall certify 100 percent of its 2006 and subsequent model vehicle fleet to the evaporative emission standards in the table or the optional zero-evaporative emission standards in section E.1.(c).

All 2004 through 2005 model-year motor vehicles which are not subject to these standards or the standards in section E.1.(c) pursuant to the phase-in schedule shall comply with the requirements of ~~sections~~ section E.1.(a).

(b) A manufacturer may use an "Alternative or Equivalent Phase-in Schedule" to comply with the phase-in requirements. An "Alternative Phase-in" is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The "cumulative total" is the summation of the model-year emission reductions (e.g., the three model-year 40/80/100 percent phase-in schedule would be calculated as: (40%*3 years) + (80%*2 years) + (100%*1 year) =380). The required cumulative total for the phase-in of these standards is 380 emission reductions. Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by the Executive Officer only if all vehicles subject to the phase-in comply with the respective requirements in the last model year of the required phase-in schedule. A manufacturer shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as: (10%*4 years)=40) and added to the cumulative total.

(c) These evaporative emission standards do not apply to zero-emission vehicles.

(2) In-use compliance whole vehicle testing shall not begin until the motor vehicle is at least one year from the production date and has accumulated a minimum of 10,000 miles. For vehicles introduced prior to the 2007 model year, in-use compliance standards of 1.75 times the "Three-Day Diurnal + Hot-Soak" and "Two-Day Diurnal + Hot-Soak" gram per test standards shall apply for only the first three model years of an evaporative family certified to a new standard.

2. Evaporative Emission Standards for 2001 and Subsequent Model Year Motorcycles. The maximum projected evaporative emission standards for 2001 and subsequent model gasoline-fueled motorcycles are:

Motorcycle Class	Hydrocarbons (grams per test)
Class I and Class II (50-279 cc)	2.0
Class III (280 cc and greater)	2.0

PART II. DURABILITY DEMONSTRATION

A. Light- and Medium-Duty Vehicles

1. Evaporative/refueling emission family determination. §86.1821-01 [No change.]

2. Durability Demonstration Procedures for Evaporative Emissions

2.0. Beginning with 2010 model-year vehicles or engines, at the time of certification manufacturers shall state, based on good engineering judgment and available information, that the emission control devices on their vehicles or engines are durable and are designed and will be manufactured to operate properly and in compliance with all applicable requirements for the full useful life (or allowable maintenance interval) of the vehicles or engines. Also, vehicles and engines tested for certification shall be, in all material respects, substantially the same as production vehicles and engines. If it is determined pursuant to title 13 CCR, Division 3, Chapter 2, Article 5, sections 2166 through 2174 that any emission control component or device experiences a systemic failure because valid failures for that component or device meet or exceed four percent or 50 vehicles (whichever is greater) in a California-certified engine family or test group, it constitutes a violation of the foregoing test procedures and the Executive Officer of the Air Resources Board may require that the vehicles or engines be recalled or subjected to corrective action as set forth in title 13 CCR, Division 3, Chapter 2, Article 5, sections 2166 through 2174. Certification applications may not be denied based on the foregoing information provided that the manufacturer commits to correct the violation.

2.1. §86.1824-01 Amend as follows:

(a) and (b) Delete.
(c) [No change.]
(d) Delete.
(e) [No change.]

2.2. For all passenger cars, light-duty trucks and chassis-certified medium-duty vehicles subject to the standards specified in section I.E. of these test procedures, demonstration of system durability and determination of three-day diurnal plus hot soak, two-day diurnal plus hot soak, and running loss emission deterioration factors ("evaporative DFs") for each evaporative/refueling 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.

2.3. Prior to commencement of a durability program, the manufacturer shall propose a method for durability testing and for determination of evaporative DFs for each evaporative/refueling family. The 4,000 and full useful life mile test points (or their equivalent) used in determining a DF must be within the standards of section I.E. or data will not be acceptable for use in the calculation of a DF. A manufacturer is not required to obtain a new approval to use a previously approved evaporative emission durability procedure. The Executive Officer shall review the method, and shall approve it if it meets the following requirements:

2.3.1. 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.

2.3.2. 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.

2.3.3. 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.

2.4. (a) In addition to the requirements of ~~subparagraph~~section II.A.2.3. above, for evaporative/refueling families subject to testing for exhaust emission durability, at least one evaporative emission test shall be conducted at 5,000, 40,000, 70,000, and 100,000 mile test points for all passenger car, and light-duty truck durability vehicles and at 5,000, 40,000, 70,000, 90,000, and 120,000 mile test points for all medium-duty durability vehicles. 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 different intervals as determined by the manufacturer using good engineering judgment. Evaporative emission testing may be performed at corresponding exhaust emission mileage points as set forth in ~~S~~section F.4. (40 CFR §86.1823) of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles~~,~~." ~~as incorporated by reference in §1961(d), title 13, CCR.~~ The 4,000 and full useful life mile test points (or their equivalent) used in determining a DF must be within the standards of section I.E. or data will not be acceptable for use in the calculation of a DF.

(b) For evaporative families subject to the requirements of ~~subparagraph~~section II.A.2.4.(a), manufacturers may demonstrate compliance by conducting an exhaust and evaporative emission test sequence at the end of the useful life of the exhaust durability data vehicle if the procedure set forth in ~~subparagraph~~section II.A.2.3. includes on-road, useful life deterioration on the evaporative test vehicle. The evaporative test vehicle used to meet the criteria in

~~subparagraph~~section II.A.2.3. must be deteriorated based on typical customer use throughout the applicable useful life. The manufacturer may perform unscheduled maintenance on the evaporative test vehicle at the final test point only upon prior Executive Officer approval, which shall be granted if the Executive Officer determines that the exhaust emission control system will not be affected, and the manufacturer demonstrates that the effectiveness of the evaporative emission control system is not diminished. The unscheduled maintenance must be conducted in accordance with 40 CFR §86.1834-01 as amended by the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles~~,~~." ~~as incorporated by reference in §1961(d), title 13, CCR.~~

2.5. The evaporative DFs determined under ~~subparagraph~~section II.A.2.4., if any, shall be averaged with the evaporative DFs determined under ~~subparagraph~~section II.A.2.3. to determine a single evaporative DF for each evaporative/refueling family. Evaporative 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.

3. Assigned DFs

3.1. §86.1826-01. [No change.]

3.2. Any manufacturer may request to certify evaporative/refueling families using assigned DFs for a combined total of 4,500 projected annual California sales of passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines per manufacturer regardless of total sales.

3.3. Assigned DFs shall be used only where specific evaporative durability data do not exist. 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 that evaporative emission control system(s) developed or adapted for the particular vehicle will be durable and comply with the applicable emission standards for the vehicle's useful life. In evaluating any information provided, all relevant test data and design factors shall be considered, including but not limited to: canister nominal working capacity and location, purge strategy, method of purge control, fuel tank capacity, variables affecting fuel temperature (use of fuel return, material, shape of fuel tank, distance of fuel tank from road surface and distance from exhaust pipe, total underbody airflow), fuel and vapor hose materials, use of sensors and auxiliary control devices, technical comparison to an evaporative emission control system and the

durability of any evaporative emission control system components that may have been used in other vehicle applications. The assigned DFs shall be applied only to entire evaporative/refueling 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. Evaporative emission control durability may include special in-house specifications.

3.4. The criteria for evaluating assigned DFs for evaporative/refueling families are the same as those for exhaust families. However, in determining evaporative/refueling family DFs these test procedures 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, the Executive Officer may grant assigned DFs for either (or both) the durability vehicle DF or the bench DF.

3.5. Assigned DFs for bench test requirements do not depend upon the 4,500 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 1998 or later model-year vehicles and where an evaporative DF was determined.

4. Emission Data Vehicle Selection

4.1. §86.1828-01 [No change.]

4.2. 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.

5. Durability and Emission Testing Requirements; waivers

5.1. §86.1829-01 (December 8, 2005). [No change, except as otherwise noted.]

5.2. References to the “EPA” shall mean the Executive Officer of the Air Resources Board.

5.3. The optional provision for a manufacturer to provide a statement of compliance in lieu of a demonstration of compliance with the supplemental two-day diurnal plus hot soak emission standard for certification purposes, as contained in §86.1829-01(b)(2)(iii), shall be applicable to gasoline- and ethanol-fueled passenger cars, light-duty trucks, and medium-duty vehicles, including hybrid electric, fuel-flexible, dual fuel, and bi-fuel vehicles. Heavy-duty vehicles over 14,000 lbs. GVWR and incomplete medium-duty vehicles shall comply with the requirements of section I.D.2.

B. Motorcycles

1. Durability Requirements. Certification of a motorcycle evaporative emission control system requires that the manufacturer demonstrate the durability of each evaporative emission control system family.

1.1. The motorcycle manufacturer can satisfy the vehicle durability testing requirements by performing an evaporative emission test at each scheduled exhaust emission test (40 CFR §86.427-78) during the motorcycle exhaust emission certification test (40 CFR §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 (40 CFR §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~~section II.B.1.1., above.

(iv) The extrapolated useful life and total test distance emissions shall be less than the applicable evaporative emission standards of section I.E.2. 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 family. The Executive Officer shall review the method, and shall approve it if it is similar to the requirements specified below. Any reference to 4,000 miles and 50,000 miles shall mean total test distance and useful life distance, respectively, as defined in ~~paragraph~~section II.B.1.1. for the appropriate engine displacement class.

The manufacturer shall propose in its preliminary application for certification a method for durability testing and for determination of a DF for each evaporative family. The 4,000 and 50,000 mile test points (or their equivalent) used in determining the DF must be within the standards of section II.B1.1. 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.

(vi) The DF determined under ~~paragraph~~section II.B.1.1.(iii) shall be averaged with the DF determined under ~~paragraph~~section II.B.1.1.(v) to determine a single evaporative emission DF for each evaporative family. For those motorcycles that do not require exhaust emission control system durability testing, the evaporative emission control system DF shall be determined under ~~paragraph~~section II.B.1.1.(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~~section I.E.2.

(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~~section.

(B) Manufacturers of Class III motorcycles using an assigned evaporative emission control system DF pursuant to ~~paragraph~~section II.B.1.1.(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~~section shall be construed as an exemption from the exhaust emission standards and test procedures applicable pursuant to section 1958, title 13, CCR or ~~paragraph~~section IV.4.(ii) of these test procedures.

(viii) The emission label (40 CFR §86.413-78) shall identify the evaporative emission family.

1.2 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 on 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 2001 and Subsequent Model Motor Vehicles," and on the basis of those tests, are in conformance with the aforementioned standards and test procedures."

1.3 The definitions for motorcycle evaporative emission families as set forth in EPA's MSAPC Advisory Circular No. 59, section D shall apply.

PART III. EVAPORATIVE EMISSION TEST PROCEDURES FOR LIGHT- AND MEDIUM-DUTY VEHICLES

A. Instrumentation

The instrumentation necessary to perform evaporative emission testing is described in 40 CFR 86.107-90. The following language is applicable in lieu of 40 CFR §86.107-90(a)(1):

1. Diurnal Evaporative Emission Measurement Enclosure

1.1 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. The blower(s) shall provide a nominal total flow rate of 0.8 ± 0.2 ft^3/min per ft^3 of the nominal enclosure volume, 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~~section III.D.10. (diurnal breathing loss test) of these procedures within an instantaneous tolerance of ± 3.0°F and an average tolerance of ± 2.0°F 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.

1.2 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 minimum surface temperatures in the enclosure no less than 25.0^{o}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.

1.3 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.

1.3.1 The variable volume enclosure shall have the capability of latching or otherwise constraining the enclosed volume to a known, fixed value, V_n. The V_n 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, V_n 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.

1.3.2 The fixed volume enclosure shall be constructed with rigid panels that maintain a fixed enclosure volume, which shall be referred to as 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.

1.4. 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 40 CFR §86.133-90 as modified in ~~paragraph~~section III.D.10. (diurnal breathing loss test).
-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.

1.5 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.

2. Running Loss Measurement Facility

2.1. For all types of running loss measurement test facilities, the following shall apply:

2.1.1. 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^{o}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 §86.108-00 with the following addition to §86.108-00(d):

Another dynamometer configuration may be used for running loss testing if approved in advance by the Executive Officer based on a demonstration that measured running loss emissions are equivalent to the emissions using the single-roll electric dynamometer described in 86.108-00(b)(2).

-A fuel tank temperature management system which meets the requirements specified in section III.A.2.1.3. ~~of this paragraph.~~

-A running loss fuel vapor hydrocarbon analyzer which meets the requirements specified in 40 CFR §86.107-90(a)(2)(i) and a running loss fuel vapor alcohol analyzer which meets the requirements specified in 40 CFR §86.107-90(a)(2)(ii).

-A running loss test data recording system which meets the requirements specified in section III.A.2.1.4. ~~of this paragraph.~~

2.1.2. 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^{o}F, where the cooling system set point refers to the internal test facility air temperature.

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

2.1.3. 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°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~~section III.C.1. (40 CFR §86.129-80) 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 section III.C.1. (40 CFR §86.129-80). 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 advance Executive Officer approval, the system may provide a discharge airflow with a maximum of 6,000 cfm.

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 $-V_n$. 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 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.

2.1.4. 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~~section III.C.1. (40 CFR §86.129-80)
-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

2.2. If an enclosure, or atmospheric sampling, running loss facility is used, the following requirements (in addition to those in ~~subparagraph~~section III.A.2.1. above) shall also be applicable:

2.2.1. 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.

2.2.2. 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^{o}F.

2.2.3. 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.

2.3. If a point source running loss measurement facility (cell) is used, the following requirements (in addition to those in ~~subparagraph~~section III.A.2.1. above) shall also be applicable:

2.3.1. 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^{o}F and 200.0^{o}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 vapors emitted from the source.

2.3.2. 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.

2.3.3. The on-line computer system or strip-chart recorder specified in <u>section III.A.</u>2.1.4<u>.</u> ~~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

2.4. 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.

3. Hot Soak Evaporative Emission 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 $105^{o}F \pm 5^{o}F$ maximum and $\pm 2^{o}F$ 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 $105^{o}F \pm 10^{o}F$. 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 V_n. 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 set point of the cooling system adjusted to a value not lower than $105.0^{o}F$, where the cooling system set point 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 $70.0^{o}F$.

The requirements in 40 CFR §86.107-90(a)(4) shall not apply.

B. Calibrations

1. 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. Amend 40 CFR §86.117-90 to include an additional ~~sub~~section III.B.1.1., to read:

1.1. 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.

1.1.1. 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^{o}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 40 CFR §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.

1.1.2. The initial determination of enclosure internal volume shall be performed according to the procedures specified in ~~paragraph~~section III.A.1.3. If the enclosure will be used for hot soak determination, the determination of enclosure internal volume shall also be performed based on 105°F.

1.1.3. The HC and methanol measurement and retention checks shall evaluate the accuracy of enclosure HC and methanol mass measurements and the ability of the enclosure to retain trapped HC and 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~~section III.D.10.1.7. of these procedures (revising 40 CFR §86.133-90(l)) for a 24 hour period. The temperature cycle shall begin at 105ºF (hour 11) and continue according to the schedule until a full 24-hour cycle is completed. 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^{o}F and a programmed temperature profile covering one diurnal cycle over a 24 hour period according to the profile specified in ~~paragraph~~section III.D.10.1.7. of these procedures (revising 40 CFR §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^{o}F ± 3.0^{o}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/or a known quantity of methanol in gaseous form between 2 to 6 grams. For evaporative emission enclosures that will be used for testing motor vehicles certified to the reduced evaporative standards in Part I, sections E.1.(c) and (d), use a known amount of propane or gaseous methanol between 0.5 to 1.0 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}) and/or the enclosure methanol concentration (C_{CH3OH2}). 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, 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_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 40 CFR §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 (^{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 40 CFR §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°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 40 CFR §86.117-90 (d)(2)(iii) (ppm C)
r is the FID response factor to methanol
T_1 is the enclosure initial temperature (^oR)
T_3 is the enclosure final temperature (^oR)
$M_{HC,out}$ 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 40 CFR §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.

1.2. The running loss equipment shall be calibrated as follows:

1.2.1. 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 $75^oF \pm 5^oF$.

1.2.2. The running loss HC analyzer shall be calibrated according to the requirements of 40 CFR §86.121- 90.

1.2.3. 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 Appendix I. The propane injection shall be conducted at a typical ambient temperature of $75^oF \pm 5^oF$.

1.2.4. 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 40 CFR §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0^{o}F throughout the four hour period. The allowable enclosure background emissions as calculated according to 40 CFR §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 40 CFR §86.117-90 (b).

(c) The enclosure shall meet the calibration and retention requirements of 40 CFR §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.

1.2.5. 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 section III.B.1.1. with a retention check of 4 hours at 105°F or the method specified in section III.B.1.2.4. If the hot soak enclosure is also for diurnal testing, the 4 hour retention check at 105°F may be replaced by the 24 hour diurnal retention check.

1.2.6. 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 40 CFR §86.121-90.

1.2.7. 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.

C. Road Load Power, Test Weight, Inertia Weight Class, and Running Loss Fuel Tank Temperature Profile Determination

Amend 40 CFR §86.129-80 to include an additional ~~sub~~section III.C.1. to read:

1. 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. 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. 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:

1.1. 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^{o}F, and ± 1.0 inches H_2O. The temperature and pressure signals may be recorded at intervals of up to 30 seconds.

1.2. 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 30°F above T_{amb} or at least 135°F, whichever is less

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^{o}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 105°F before the profile generation begins. If the allowance for a lower initial fuel temperature established in section III.D.7. 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.

1.3. The vehicle fuel tank shall be drained and filled to 40 percent of the nominal tank capacity with fuel meeting the requirements of ~~paragraph~~section III.D.1. of these procedures. For all hybrid electric vehicles, the battery state-of-charge shall be set at a level such that the auxiliary power unit would be activated by the vehicle's control strategy within 30 seconds of starting the first UDDS of the fuel tank temperature profile determination test sequence. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning

of and operating throughout the fuel tank temperature profile determination. 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 one UDDS cycle, then two NYCCs, and another UDDS cycle. The end of each UDDS cycle and the end of the two NYCCs 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 40 CFR §86.128-79 except for the following:

> Revise ~~section~~subparagph (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.

1.4. 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})

1.5. 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:

1.5.1. Revise subparagraph (v) to read: When conducted to meet the requirements of 40 CFR §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.

1.5.2. Add subparagraph (vi) to read: When conducted to meet the requirements of 40 CFR §86.129 and §86.132, the speed tolerance shall be as specified above, except that the upper and lower limits shall be 4 mph.

1.6. The following temperature conditions shall be verified:

$(T_{amb1}) \geq 95.0^{o}F$
$(T_{amb2}) \geq (T_{amb1} - 2.0^{o}F)$
$(T_{sur(n)} - T_{amb\,(n)}) \geq 30.0^{o}F$

where n is the incremental measurements in time.

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

1.7. 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 section III.C.1.3. ~~of this subparagraph.~~

1.8. 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 (^{o}F) or vapor fuel temperature (^{o}F) during the drive where i is the incremental measurements in time.

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

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.

1.9. 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.

D. Test Procedure

The test sequence described in 40 CFR §86.130 through §86.140 shall be performed with the following modifications:

1. General Requirements

The following language shall be applicable in lieu of 40 CFR §86.130-78:

1.1. The test sequence shown in Figure 2 (Figure 3A or 3B 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.

1.2. 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.

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

~~1.1.~~1.4. The fuel tank shall be initially drained and filled to the prescribed tank fuel volume of 40 percent of the manufacturer's nominal fuel tank capacity, as specified in 40 CFR §86.1803-01, in preparation for the vehicle preconditioning. ~~For hybrid electric vehicles only, the manufacturer may elect to perform the All-Electric Range Test pursuant to the "California Exhaust Emission Standards and Test Procedures for 2003and Subsequent Model Zero-Emission Vehicles, and 2001 and~~

~~Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," as incorporated by reference in §1962(e), title 13, CCR, prior to fuel drain and fill.~~

1.4.1. For 2001 through 2010 model-year hybrid electric vehicles, the manufacturer may elect to perform the All-Electric Range Test (as indicated in Figure 3A or 3B, as applicable) pursuant to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2010 Model Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," prior to the initial fuel drain and fill step in this test sequence.

1.4.2. For 2011 and subsequent model-year hybrid electric vehicles, a manufacturer may elect to perform the All-Electric Range Tests separately from the test sequences specified under these evaporative emission test procedures, and pursuant to the "California Exhaust Emission Standards and Test Procedures for 2010 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes,"

~~1.2.~~1.5. The vehicle preconditioning drive shall be performed in accordance with 40 CFR §86.132-90, except that following the initial fuel drain and fill step in this test sequence ~~vehicle fueling step at~~ , as specified in 40 CFR §86.132-90(a)(1), an initial preconditioning ~~minimum~~ soak period of a minimum 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 both the initial fuel drain and fill and vehicle soak. In such cases, each subsequent test shall begin with the preconditioning drive.

1.5.1. For a 2011 and subsequent model-year off-vehicle charge capable hybrid electric vehicle, the vehicle preconditioning drive shall include two complete UDDSs performed entirely under a charge-sustaining mode of operation, The battery state-of-charge net change tolerance provisions specified in section F.9., of the “California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” shall apply.

~~1.3~~1.6. Following the vehicle preconditioning drive, a second fuel drain and fill step shall be performed, in accordance with 40 CFR §86.132-90(a)(1), The fuel tank shall be filled to the prescribed tank fuel volume of 40 percent of the manufacturer’s nominal fuel tank capacity, as specified in 40 CFR §86.1803-01.~~the fuel tank shall be drained and then filled to 40 percent capacity.~~

~~1.4.~~1.7. ~~The vehicle shall be allowed to soak for 12 to 36 hours prior to the exhaust emissions test.~~A second preconditioning soak period of not less than 12 hours and not more than 36 hours shall be performed prior to the exhaust emission test.

~~1.5.~~1.8. During the 12-to-36 hour soak specified in ~~subparagraph 1.4~~section III.D.1.7. above, the vehicle's evaporative control canister shall be purged with a volume of air equivalent to 300 carbon canister ~~charcoal~~ bed volumes at a flow rate of 48 SCFH (22.7 slpm).

~~1.6.~~1.9. The evaporative control canister shall then be loaded using a butane-nitrogen mixture.

~~1.7.~~1.10. Perform exhaust emission tests in accordance with procedures as provided in "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and these procedures.

~~1.7.1.~~1.11. For 2001 through 2010 model-year hybrid electric vehicles, a four-phase exhaust test shall be performed as shown in Figure 3A pursuant to the "California Exhaust Emission Standards and Test Procedures for ~~2003~~2005 – 2010~~and Subsequent~~ Model Zero-Emission Vehicles, and ~~2001 and Subsequent~~ 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes." ~~as incorporated by reference in §1962(e), title 13, CCR. Following the four phase exhaust test, the test sequence shall repeat from step 1.3 of this section to conduct the evaporative test using the standard cold start test and hot start test (standard three phase test) without emission sampling. Battery state-of-charge setting prior to the standard three phase test shall be performed pursuant to section 6.1.6 of the "California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" as incorporated by reference in §1962(e), title 13, CCR. Four phase exhaust testing may be performed in conjunction with evaporative testing as shown in Figure 3B with advance Executive Officer approval if the manufacturer is able to provide data demonstrating compliance with evaporative emission standards using the standard three phase test.~~

1.11.1. For 2011 and subsequent model-year hybrid electric vehicles, a manufacturer may elect to perform the four-phase exhaust emission test separately from the test sequence specified under these evaporative emission test procedures, and pursuant to the "California Exhaust Emission Standards and Test Procedures for 2010 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.11.2. When a four-phase exhaust test is performed with the evaporative emission test sequence as shown in Figure 3A, the evaporative emission test sequence shall begin, at section III.D.1.6., after the four-phase exhaust test is completed. The ensuing standard three-phase exhaust test shall then be performed without exhaust emission sampling.

1.11.3. For 2001 through 2010 model-year hybrid electric vehicles, the four-phase exhaust testing may be performed in conjunction with evaporative testing, as shown in Figure 3B, with advance Executive Officer approval if the manufacturer is able to provide data demonstrating compliance with evaporative emission standards using the standard three-phase test.

1.11.4. For 2001 through 2010 model-year hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be performed pursuant to the supplemental requirements specified in section E.6.1.6. of the "California Exhaust Emission Standards and Test Procedures for 2005 – 2010 Model Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.11.5. For 2011 and subsequent model-year hybrid electric vehicles, except for off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be performed pursuant to the supplemental requirements specified in section E.6.1.5 of the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.11.6. For 2011 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be at the highest level allowed by the manufacturer in order to eliminate or minimize the cumulative amount of the auxiliary power unit activation during either of the ensuing three-phase exhaust or running loss tests. This requirement shall be applicable regardless of a vehicle's ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the 12-to-36 hour soak period. The battery state-of-charge net change tolerance provisions specified in section F.9., of the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

~~1.8.~~1.12. 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.

~~1.9.~~1.13. 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.

~~1.10.~~1.14. The hot soak enclosure test shall then be performed at an enclosure ambient temperature of 105°F.

~~1.11.~~1.15. Upon completion of the hot soak enclosure test, the vehicle shall be soaked for not less than 6 hours and not~~r~~ more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65°F.

~~1.12.~~1.16. A three-day diurnal test shall be performed in a variable temperature enclosure.

1.17. The supplemental two-day diurnal sequence in Figure 2 (and Figure 3A or 3B for hybrid electric vehicles) shall be conducted according to sections III.D.1.4. through III.D.1.16., with the following exceptions:~~the steps described in 1.1 through 1.4, 1.6, 1.7, followed by 1.10 through 1.12 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. Emission sampling is not required for the standard cold start test and hot start test (standard three phase test) in the supplemental two-day diurnal sequence as shown in Figure 3A.~~

1.17.1 Sections III.D.1.8., III.D.1.11., III.D.1.12., and III.D.1.13., shall not apply,

1.17.1 In section III.D.1.14., the ambient temperature of the hot soak test is conducted at an ambient temperature between 68°F and 86°F at all times.

1.17.2. In section III.D.1.16., the diurnal test will consist of a two-day test.

1.17.3. For 2001 through 2010 model-year hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase exhaust test in the supplemental two-day diurnal test sequence shall be performed pursuant to the supplemental requirements specified in section E.6.1.6. of the "California Exhaust Emission Standards and Test Procedures for 2005 – 2010 Model Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.17.4. For 2011 and subsequent model-year hybrid electric vehicles, except for off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test in the supplemental two-day diurnal test sequence shall be performed pursuant to the supplemental requirements specified in section E.6.1.5 of the "California Exhaust Emission Standards and Test Procedures for 2005 – 2010 Model Zero-Emission Vehicles, and 2001 – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.17.5. For 2011 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase exhaust test in the supplemental two-day diurnal sequence shall be at the highest level allowed by the manufacturer in order to eliminate or minimize the cumulative amount of the auxiliary power unit activation during either of the ensuing three-phase exhaust or running loss tests. This requirement shall be applicable regardless of a vehicle's ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the 12-to-36 hour soak period. The battery state-of-charge net change tolerance provisions specified in section F.9., of the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

1.17.6. Emission sampling is not required for the standard three-phase exhaust test performed in the supplemental two-day diurnal test sequence shown in Figure 3A.

1.18. The Executive Officer may conduct certification confirmatory tests and in-use compliance tests of 2010 and subsequent off-vehicle charge capable hybrid electric vehicles using any of the following battery state-of-charge levels:

1.18.1. As specified in sections III.D.1.11.6. or III.D.1.17.5., as applicable.

1.18.2. At the lowest level allowed by the manufacturer.

1.18.3. At any level in-between the levels indicated by sections III.D.1.18.1. and II.B.1.18.2., above, if applicable.

2. Vehicle Preparation

Amend 40 CFR §86.131-90 to read:

2.1. 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~~section III.C.1.1. (40 CFR §86.129-80). Measurement of the fuel vapor temperature is optional. If vapor temperature is not measured, the measurement of the fuel tank pressure is not required.

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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.

3. Vehicle Preconditioning

3.1.1. For supplemental vehicle preconditioning requirements for 2001 through 2010 model-year hybrid electric vehicles, refer to the "California Exhaust Emission Standards and Test Procedures for ~~2003~~2005 – 2010 ~~and Subsequent~~ Model Zero-Emission Vehicles, and 2001~~and Subsequent~~ – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."~~as incorporated by reference in §1962(e), title 13, CCR.~~

3.1.2. For supplemental vehicle preconditioning requirements for 2011 and subsequent model-year hybrid electric vehicles, refer to the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

3.2. The following language shall be applicable in lieu of 40 CFR §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.

3.3. The following language shall be applicable in lieu of 40 CFR §86.132-90(b):

3.3.1. Within five minutes of completion of preconditioning, the vehicle shall be driven off the dynamometer to a work area. For hybrid electric vehicles following battery state-of-charge setting, the vehicle shall only be pushed or towed to avoid disturbing battery state-of-charge setting.

3.3.2. The fuel tank(s) of the prepared vehicle shall undergo the second fuel drain and fill step of the test sequence, ~~be drained and refilled~~ with the applicable test fuel, as specified in ~~paragraph~~section III.F. of these procedures, to the prescribed tank fuel volume of 40 percent of the manufacturer's nominal fuel tank capacity, as defined

in 40 CFR §86.1803-01. The vehicle shall be refueled within 1 hour of completion of the preconditioning drive.

3.3.3. Following the second fuel drain and fill described in ~~subparagraph~~section III.D.3.3.2. above, the test vehicle shall be allowed to soak for a period of not less than 12 ~~or~~and- not 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 section III.D.3.3.4. below for the three-day diurnal sequence and in section III.D.3.3.5. below for the supplemental two-day diurnal sequence. For all vehicles subjected to exhaust emissions testing only, the canister loading procedure as set forth in ~~paragraph~~section III.D. 3.3.4. below shall be used.

For methanol-fueled and flexible-fueled vehicles, canister preconditioning shall be performed with a fuel vapor composition representative of that which the vehicle would generate with the fuel mixture used for the current test. 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 section III.D.3.3.4. below for the three-day diurnal sequence and in section III.D.3.3.5. below for the supplemental two-day diurnal sequence and shall be approved in advance by the Executive Officer.

3.3.4. 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. For vehicles equipped with a non-integrated refueling emission control system, the non-integrated canisters shall be preconditioned for the three-day diurnal test sequence according to the procedure in section III.D.3.3.5.(a) 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~~2-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:

(a) 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 carbon canister ~~charcoal~~ bed volume exchanges.

(b) 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~~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.

(c) Reconnect the evaporative emission canister(s), if applicable.

3.3.5. For the supplemental two-day diurnal sequence, the evaporative emission storage canister(s) shall be loaded to the point of breakthrough using either (a) or (b) 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. For vehicles equipped with a non-integrated refueling emission control system, the non-integrated canisters shall be preconditioned for the supplemental two-diurnal test sequence according to the procedure in section III.D.3.3.5.(a). 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.

(a) 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 ± 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.

(b) 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 ± 12°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 40 CFR §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, ^{o}F

T_o is the initial temperature, ^oF
t is the time since beginning of test, minutes

3. As soon as breakthrough occurs or when the fuel temperature reaches 105^oF, 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^oF, 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~~section III.F. of these procedures, to the "tank fuel volume" defined in 40 CFR §86.1803-01. The fuel shall be stabilized to a temperature within ± 3^oF of the lab ambient before beginning the driving cycle for the exhaust emission test.

3.4. As allowed under the provisions of section III.G. of these test procedures, a manufacturer may propose, for Executive Officer approval, the use of an alternative method to precondition canisters in lieu of the methods required under sections III.D.3.3.4.; III.D.3.3.5.(a); and, III.D.3.3.5.(b). The Executive Officer may conduct certification confirmatory tests and in-use compliance tests with the either the alternative canister loading method or the methods specified in sections III.D.3.3.4; III.D.3.3.5.(a); and, III.D.3.3.5.(b), as applicable.

4. Dynamometer Procedure.

4.1. To be conducted according to 40 CFR §86.135-90 (December 8, 2005).

4.2. For 2001 through 2010 model-year hybrid electric vehicles, the dynamometer procedure shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for ~~2003~~2005 – 2010 ~~and Subsequent~~ Model Zero-Emission Vehicles, and 2001 ~~and Subsequent~~ – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes." ~~as incorporated by reference in §1962(e), title 13, CCR.~~

4.3. For 2011 and subsequent model-year hybrid electric vehicles, the dynamometer procedure shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2011 Subsequent Model Zero-Emission Vehicles and Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

5. Engine Starting and Restarting.

Amend 40 CFR §86.136-90 to read as follows:

Revise ~~section~~subparagraph (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.

6. Dynamometer Test Run, Gaseous and Particulate Emissions.

6.1. To be conducted according to 40 CFR §86.137-90.

6.2. For 2001 through 2010 model-year hybrid electric vehicles, the dynamometer test run, gaseous and particulate emissions shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for ~~2003~~2005 – 2010 ~~and Subsequent~~ Model Zero-Emission Vehicles, and 2001 ~~and Subsequent~~ – 2010 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes." ~~as incorporated by reference in §1962(e), title 13, CCR.~~

6.3. For 2011 and subsequent model-year hybrid electric vehicles, the dynamometer test run, gaseous and particulate emissions shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2011 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

7. 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 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 III.C.1.2., except the ambient temperature must be at least 105°F. During the profile generation, the temperature offset shall apply.

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.

8. 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. Control of the vapor temperature throughout the test to follow the vapor temperature profile generated according to the procedures in section III.C. 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 sections III.D.8.1.10. and III.D.8.2.5. 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. If the vehicle has more than one fuel tank, the fuel temperature in each tank shall follow the profile generated in ~~paragraph~~section III.C. If a warning light or gauge indicates that the vehicle's engine coolant has overheated, the test run may be stopped.

8.1. If running loss testing is conducted using an enclosure which incorporates atmospheric sampling equipment, the manufacturer shall perform the following steps for each test:

8.1.1. 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.

8.1.2. Place the drive wheels of the vehicle on the dynamometer without starting the engine.

8.1.3. Attach the exhaust tube to the vehicle tailpipe(s).

8.1.4. The test vehicle windows and the luggage compartments shall be closed.

8.1.5. 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~~section III.C. (§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.

8.1.6. Close and seal enclosure doors.

8.1.7. When the ambient temperature is $105^{o}F \pm 5^{o}F$, the running loss test shall begin. 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.

8.1.8. The vehicle shall be driven through one UDDS, then two NYCCs and followed by one UDDS. Each UDDS and the NYCC driving trace shall be verified to meet the speed tolerance requirements of 40 CFR §86.115-78 (b) as modified by III.C. The end of each UDDS cycle and the two NYCCs 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~~section III.C.1.3.

The fuel tank liquid temperature during the dynamometer drive shall be controlled within $\pm 3^{o}F$ of the fuel tank temperature profile obtained on the road according to the procedures in ~~paragraph~~section III.C. (40 CFR §86.129-80) for the same vehicle platform/powertrain/fuel tank configuration. If applicable, the fuel tank vapor temperature throughout the running loss test shall agree with the corresponding vapor temperature with a tolerance of $\pm 5^{o}F$. A running loss test with a fuel tank vapor temperature that exceeded the corresponding vapor temperature profile by more than the $\pm 5^{o}F$ tolerance may be considered valid if test results comply with the applicable

running loss evaporative emission standards. In addition, 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°F. For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results. The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

8.1.9. 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 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 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 40 CFR §86.1830-01), 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.

8.1.10. Tank pressure shall not exceed 10 inches of water 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.

8.1.11. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the end of each phase of the test.

8.1.12. 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 72 ± 2 minutes after the test begins. The elapsed time of this analysis shall be recorded.

8.1.13. 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.

8.1.14. 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.

8.2. 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:

8.2.1. The running loss test shall be conducted in a test cell meeting the specifications of 40 CFR §86.107-90 (a)(1) as modified by ~~paragraph~~section III.A.2. 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^{o}F of the initial liquid fuel temperature calculated according to ~~paragraph~~section III.C.1.5. (40 CFR §86.129-80) before the running loss test may proceed.

8.2.2. 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~~section III.C.1.3. (40 CFR §86.129-80). Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s).

8.2.3. 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 40 CFR §86.115-78 (b) as modified by ~~paragraph~~section III.C. 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 40 CFR §86.128-79 as modified by ~~paragraph~~section III.C.1.3. Engine starting and restarting shall be conducted according to ~~paragraph~~section III.D.8.1.9.

8.2.4. The fuel tank liquid temperature during the dynamometer drive shall be controlled within ± 3°F of the fuel tank liquid temperature profile obtained on the road according to the procedures in ~~paragraph~~section III.C. (40 CFR §86.129-80) for the same vehicle platform/powertrain/fuel tank configuration. If applicable, 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. In addition, 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°F. For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results. The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

8.2.5. Tank pressure shall not exceed 10 inches of water 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.

8.2.6. 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 ~~f~~Figure 1. Other designated places, if any, where fuel vapor can escape, shall also be included.

8.2.7. 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).

8.2.8. 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.

8.2.9. The sample bags shall be analyzed within 20 minutes of their respective sample collection phases, as described in 40 CFR §86.137-90(b)(15).

8.2.10. After the completion of the final 120 seconds, turn off the vehicle cooling fan and the vehicle underbody fan if used.

8.3. Manufacturers may use an alternative running loss test procedure if it provides an equivalent demonstration of compliance. The use of an alternative procedure also requires the prior approval of the Executive Officer. The Executive

Officer may conduct confirmatory testing or in-use compliance testing using either the running loss measurement enclosure incorporating atmospheric sampling equipment or in a test cell utilizing point source sampling equipment, as specified in ~~paragraph~~section III.A.2. (40 CFR §86.107-90(a)(1)), in conjunction with the procedures as outlined in either ~~paragraph~~section III.D.8.1. or III.D.8.2. of this test procedure, or using the manufacturer's approved alternative running loss test procedure for a specific evaporative family.

9. Hot Soak Test

9.1. Amend the first paragraph of 40 CFR §86.138-90 as follows: 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.

9.2. Revise ~~section~~subparagraph (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~~section III.D.11.3.1.(b), 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 III.D.9.3. through III.D.9.7., as modified below, shall be conducted.

9.3. Revise ~~section~~subparagraph (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~~section III.D.11.3.1.(a).

9.4. Revise ~~section~~subparagraph (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.

9.5. Revise ~~section~~subparagraph (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 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.

9.6. Revise ~~section~~subparagraph (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.

9.7. 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 40 CFR §86.138-90, revised by sections III.D.9.2. through III.D.9.7. ~~of this paragraph.~~

10. Diurnal Breathing Loss Test

10.1. A three-day diurnal test shall be performed in a variable temperature enclosure, described in ~~paragraph~~section III.A.1. 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.

10.2. 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.

~~10.1.~~10.3. Revise 40 CFR §86.133-90 to read as follows:

~~10.1.1.~~10.3.1. Revise ~~section~~subparagraph (a)(1) to read: Upon completion of the hot soak test, the test vehicle shall be soaked for not less than 6 hours and not~~r~~ 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.

~~10.1.2.~~10.3.2. Omit ~~section~~subparagraph (f).

~~10.1.3.~~10.3.3. Omit ~~section~~subparagraph (i).

~~10.1.4.~~10.3.4. Revise ~~section~~subparagraph (j) to read: Prior to initiating the emission sampling:

~~10.1.5.~~10.3.5. Revise ~~section~~subparagraph (k) to read: Emission sampling shall begin within 10 minutes of closing and sealing the doors, as follows:

~~10.1.6.~~10.3.6. Revise ~~section~~subparagraph (k)(3) to read: Start diurnal heat build and record time. This commences the 24 hour ± 2 minute test cycle.

~~10.1.7.~~10.3.7. Revise ~~section~~subparagraph (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	0	1	2	3	4	5	6	7	8	9	10	11	12
(^oF)	65.0	66.6	72.6	80.3	86.1	90.6	94.6	98.1	101.2	103.4	104.9	105.0	104.2
Hour	13	14	15	16	17	18	19	20	21	22	23	24	--
(^oF)	101.1	95.3	88.8	84.4	80.8	77.8	75.3	72.0	70.0	68.2	66.5	65.0	--

~~10.1.8.~~10.3.8. Omit ~~section~~subparagraph (m).

~~10.1.9.~~10.3.9. Revise ~~section~~subparagraph (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~~section III.D.11.3.1.(c) which modifies 40 CFR §86.143-90, for this test cycle. The time (or elapsed time) of this analysis shall be recorded. The procedure, commencing with subparagraph (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~~section III.D.11.3.1.(c). which modifies 40 CFR §86.143-90.

~~10.1.10.~~10.3.10. Revise ~~section~~subparagraph (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.

~~10.1.11.~~10.3.11. Omit ~~section~~subparagraph (r).

~~10.1.12.~~10.3.12. Add ~~section~~subparagraph (t) 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.

~~10.1.13.~~10.3.13. Add ~~section~~subparagraph (u) 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.

~~10.1.14.~~10.3.14. Add ~~section~~subparagraph (v) 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.

10.15. The two-day diurnal test shall be performed in an enclosure, described in ~~paragraph~~section III.A.1. of this test procedure. The test consists of two 24-hour ~~cycles~~diurnals. The test procedure shall be conducted according to 40 CFR §86.133-90, revised by sections III.D.10.3.1. through III.D.10.3.14.,~~10.1.1 through 10.1.15 of this paragraph~~ except that only two consecutive 24-hour ~~cycles~~diurnals shall~~will~~ be performed. For the purposes of this diurnal breathing loss test, all references to methanol shall be applicable to alcohol.

11. Calculations: Evaporative Emissions

Revise 40 CFR §86.143-90 as follows:

11.1. Revise ~~section~~subparagraph (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:

11.2. Revise ~~section~~subparagraph (a)(1) to read:

Methanol calculations shall be conducted according to 40 CFR §86.143-96(b)(1)(i), as amended March 24, 1993.

11.3. Revise ~~section~~subparagraph (a)(2) to read:

11.3.1. For hydrocarbons:

(a) Hot soak HC mass. For fixed volume enclosures, 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°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 (^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 .

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

$$M_{HCrlt} = (M_{HCrl(1)} + M_{HCrl(2)} + M_{HCr1(3)})/(D_{rl(1)} + D_{rl(2)} + D_{rl(3)})$$

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 40 CFR §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 40 CFR §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~~section III.D.11.3.1.(a).

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

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

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 40 CFR §86.143-90 (a)(2)(iii)

$C_{CH3OHe1}$ is the initial methanol concentration calculated according to 40 CFR §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 entering 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.

11.3.2. Revise ~~section~~<u>subparagraph</u> (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) $M_{rl} = M_{HCrlt} + (14.2284/32.042) \times 10^{-6} M_{CH3OH}$

11.3.3. Revise ~~section~~subparagraph (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_{r1}), expressed on a grams per mile basis.

E. Liquefied Petroleum Gas-fueled Vehicles

1. 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.

2. Calculation of LPG Emissions. The evaporative emissions for LPG systems shall be calculated in accordance with 40 CFR §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.

F. Fuel Specifications

Evaporative emission test fuel shall be the fuel specified for exhaust emission testing as specified in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," except as provided in section III.G. of these test procedures.

G. Alternative Test Procedures

If a manufacturer uses for evaporative and exhaust emission testing a gasoline test fuel meeting the specifications set forth in 40 CFR §86.113-94(a)(1), the manufacturer may use the evaporative emission test procedures set forth in 40 CFR §§86.107-96 through 86.143-96 in place of the test procedures set forth in these test procedures.

Manufacturers may use an alternative set of test procedures to demonstrate compliance with the standards set forth in section I.E. of these test procedures with advance Executive Officer approval if the alternative procedure is demonstrated to yield test results equivalent to, or more stringent than, those resulting from the use of the test procedures set forth in section III.D. of these test procedures.

If the manufacturer uses for certification a test procedure other than section III.D., the Executive Officer has the option to conduct confirmatory and in-use compliance testing with the test procedures set forth in section III.D. of this California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.

H. Use of Comparable Federal Requirements for Carry-across Specifications and Road Profile Correction Factors

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~~section II.A. of these test procedures and the running loss road profile correction factors of ~~paragraph~~section III.C. 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.

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PART IV. EVAPORATIVE EMISSION TEST PROCEDURES FOR MOTORCYCLES

1. For the purposes of these procedures, the following references in 40 CFR, Part 86, Subpart B to light-duty vehicle evaporative testing shall also apply to motorcycles: 40 CFR §§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.

2. Preconditioning shall be performed in accordance with 40 CFR §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 (40 CFR §86.132-82(a)(3) and §86.132-90(a)(3)) may be allowed by the Executive Officer under unusual circumstances.

3. 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~~subparagraph (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~~subparagraph (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

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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.

4. 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 (40 CFR §86.133-78 except ~~subsection~~subparagraphs a(1), k, and p; §86.133-90 except ~~subsection~~subparagraphs 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 4-CFR §86.130-78. The specified time limits shall be followed with the exception of soak times which are specified in 40 CFR §86.532-78 for motorcycles.

Running loss tests, when necessary, will be performed in accordance with 40 CFR §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) A manufacturer of Class III motorcycles with annual California sales of less than 500 units using an assigned evaporative emission control system DF pursuant to ~~paragraph~~section II.B.2.1.1.(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, CCR.

(iii) The fuel and vapor temperatures for the diurnal portion of the evaporative emission test shall conform to the following functions within ± 1.7^{o}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.

$$T_f = (1/3)t + 15.5^{o}C$$

$$T_v = (1/3)t + 21.0^{o}C$$

where T_f = fuel temperature, ^{o}C
T_v = vapor temperature, ^{o}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 $20^{o}C$. The final fuel temperature shall be $35.5^{o}C \pm 0.5\ ^{o}C$.

An initial vapor temperature up to $5^{o}C$ above $21^{o}C$ 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 $5.5^{o}C$ 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 40 CFR §§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 a minimum throttle from the dynamometer to the SHED.

(vi) Calculations shall be performed in accordance with 40 CFR §86.143-78 or 86.143-90, except the standard volume for a motorcycle shall be $5ft^3$ instead of $50\ ft^3$.

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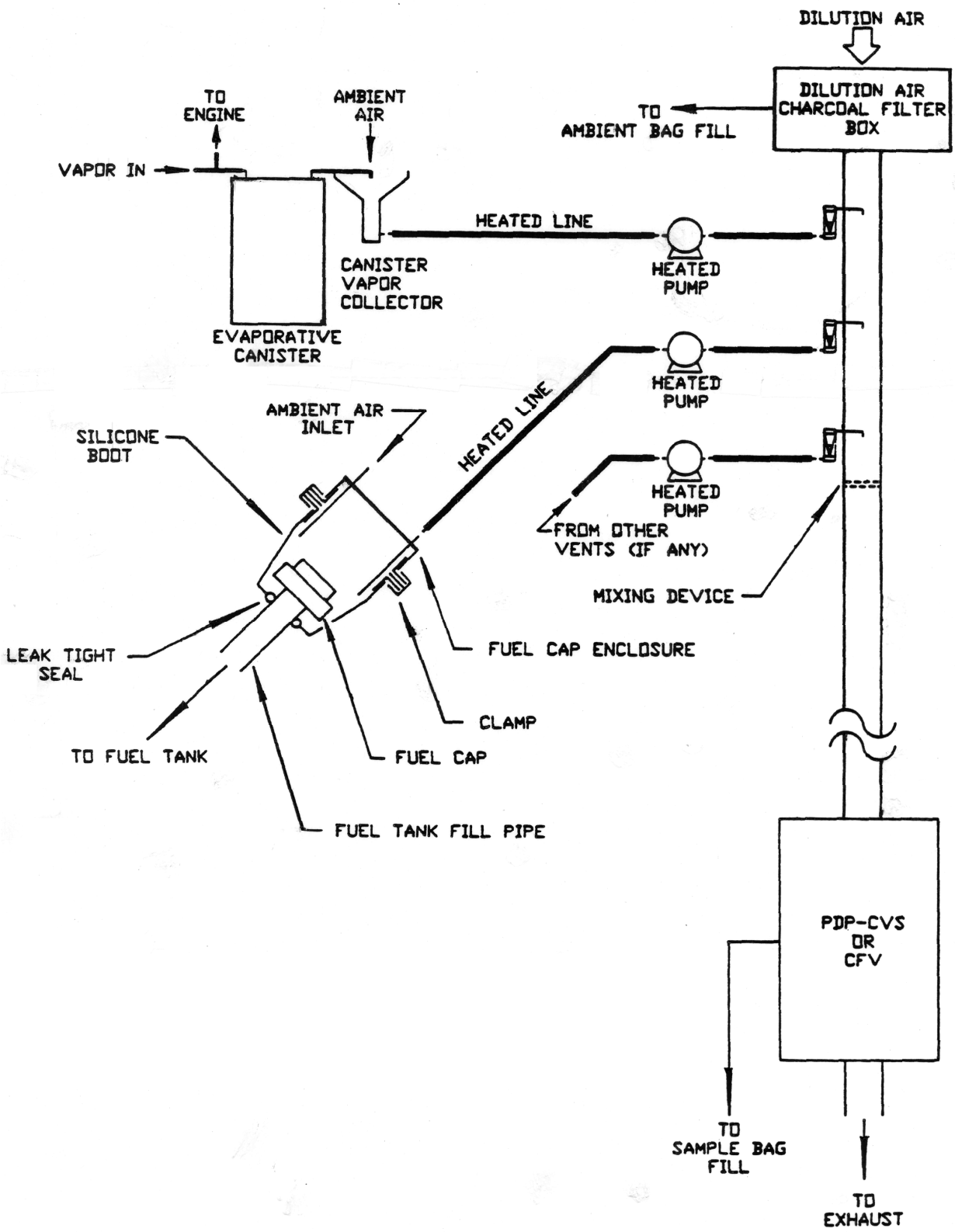
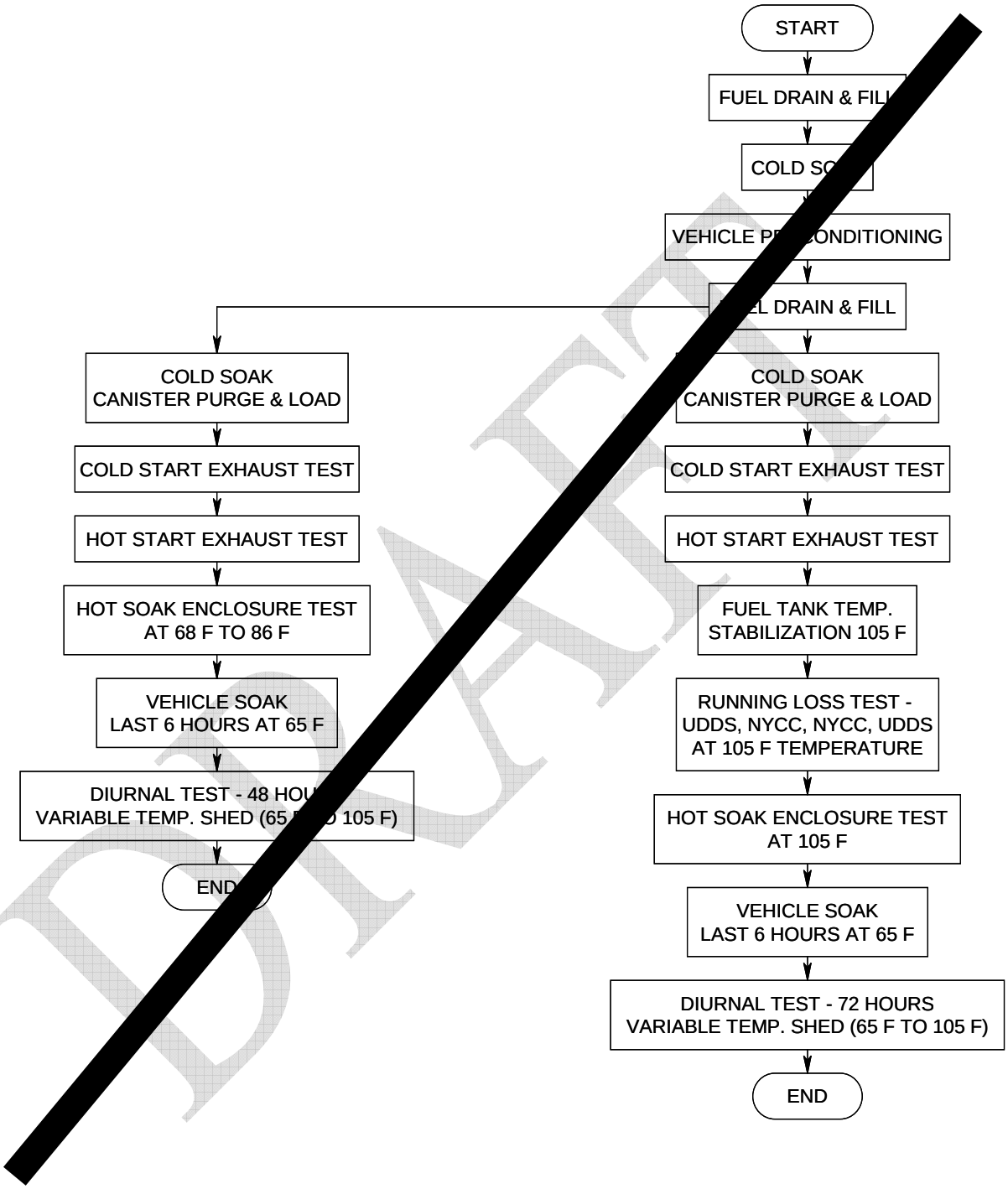
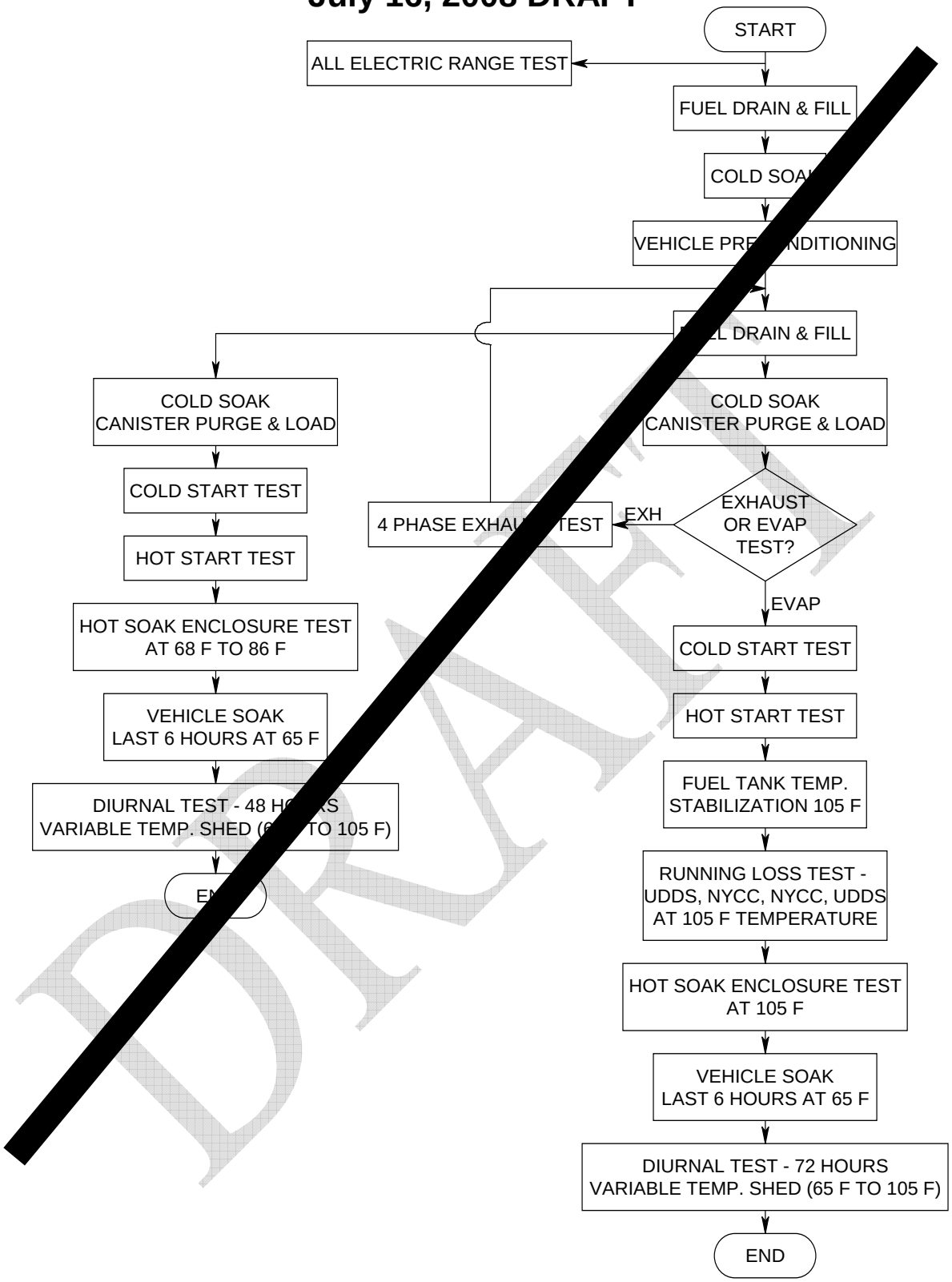


Figure 1: Running Loss Vapor Vent Collection System



~~Figure 2: Test Procedure for 2001 and Subsequent Model Motor~~



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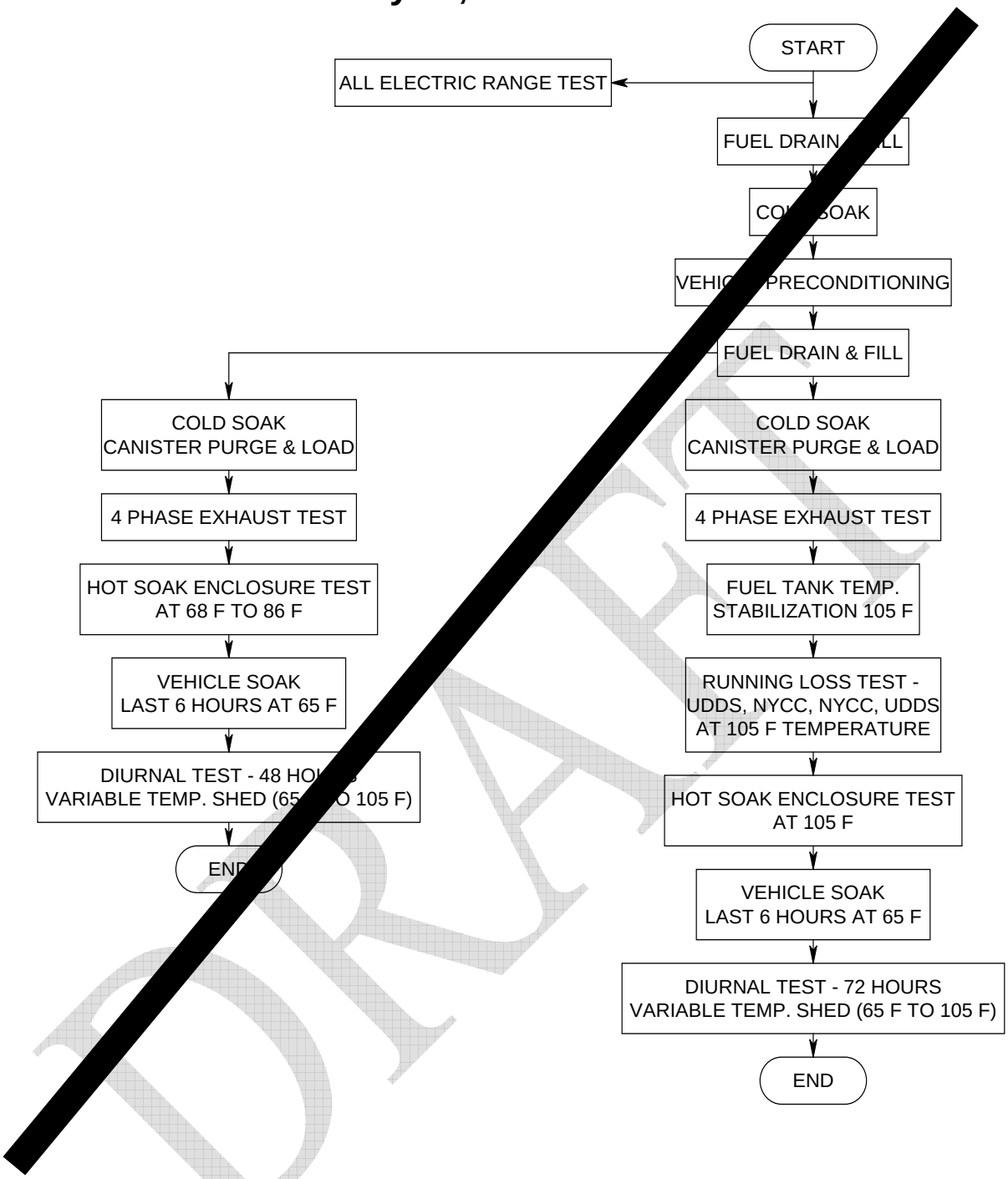
~~Figure 3A: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles~~



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~~Figure 3B: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles~~

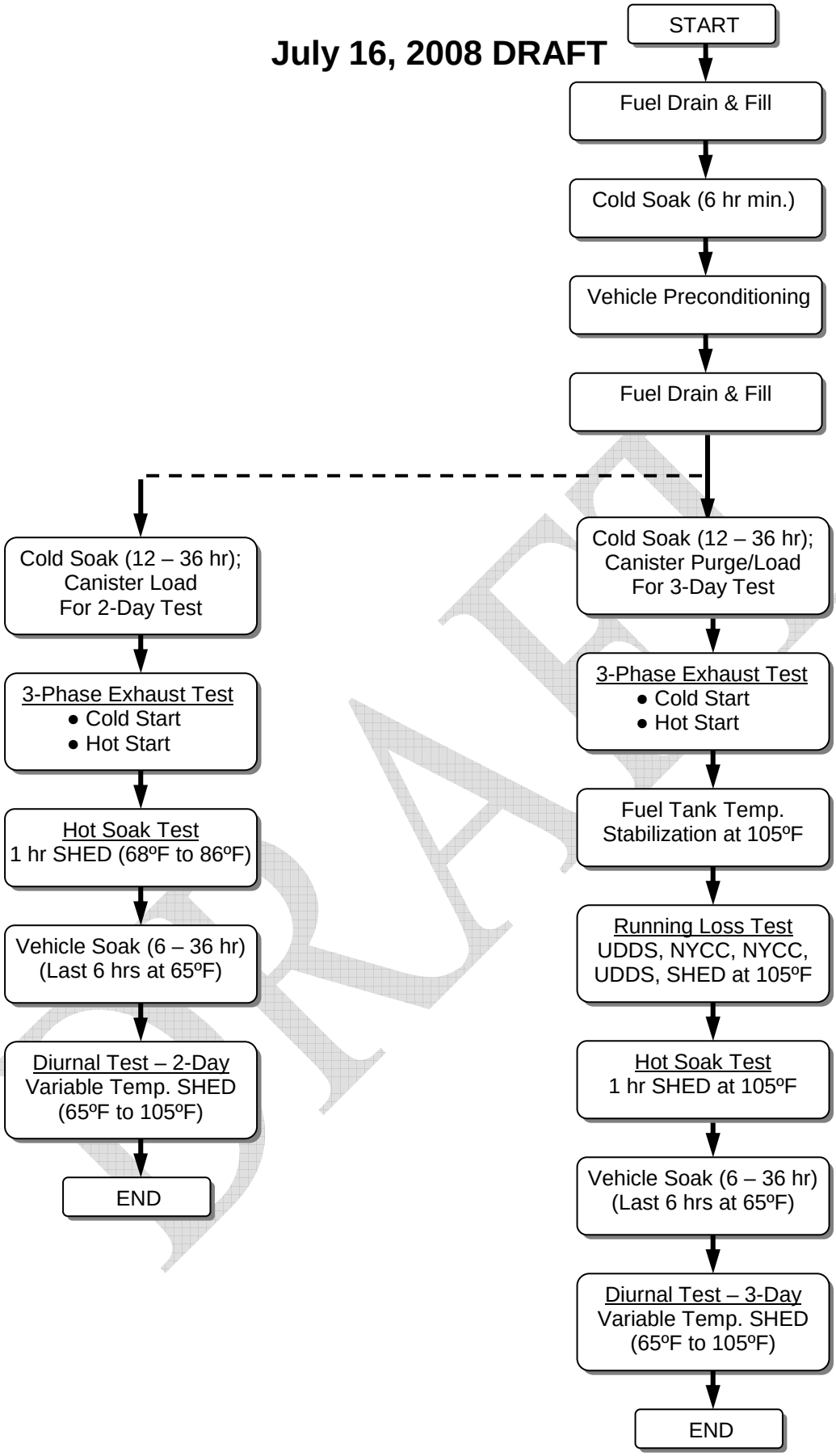

Figure 2: Test Procedure for 2001 and Subsequent Model Motor Vehicles

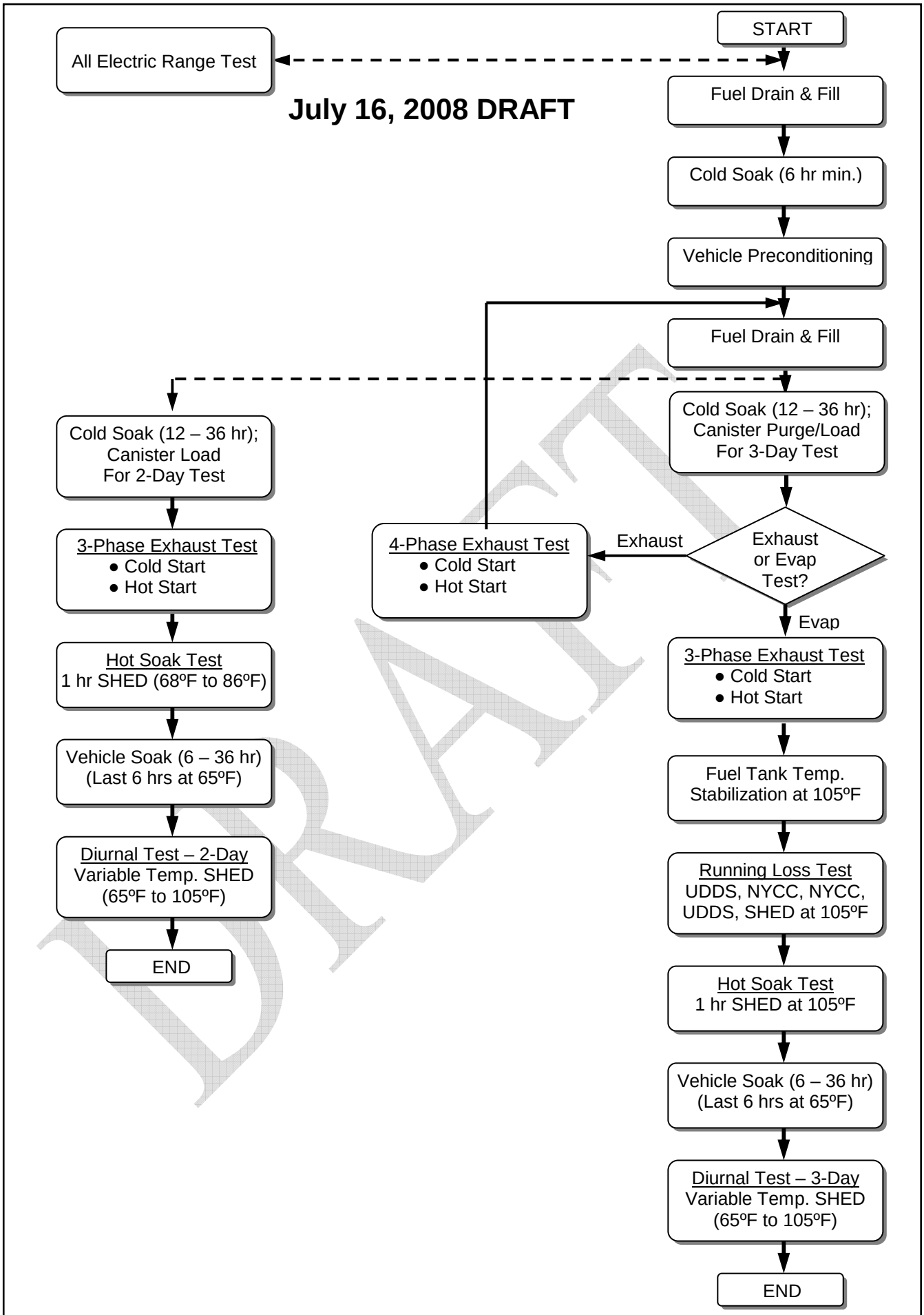

Figure 3A: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles

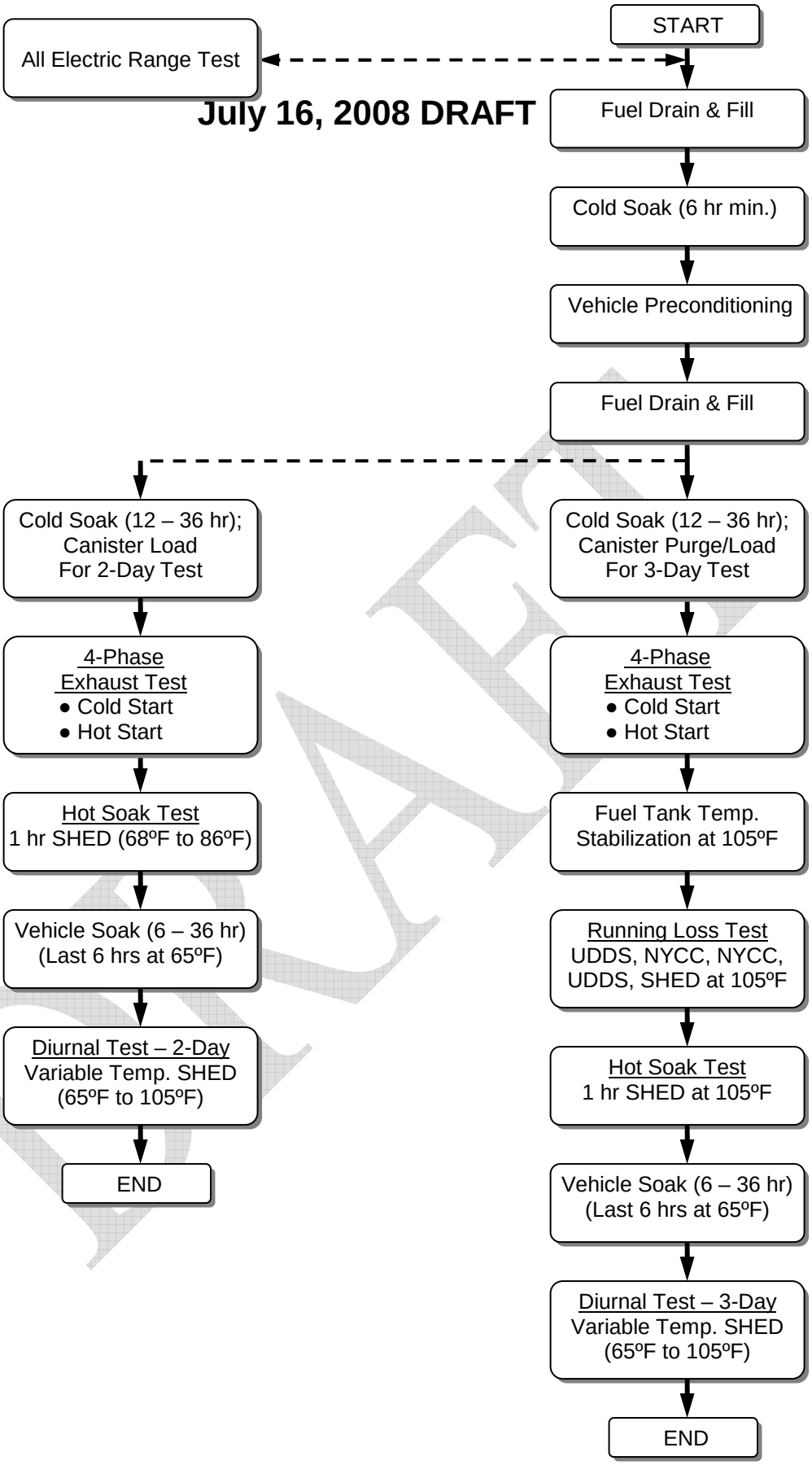

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Figure 3B: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles