OUTDOOR POWER EQUIPMENT INSTITUTE

June 23, 2013

via electronic mail: pmader@arb.ca.gov
via electronic submission: http://www.arb.ca.gov/lispub/comm/bclist.php

To: Pippin Mader, Project Lead
Evaporative Control, Engineering, and Regulatory Development Section
California Air Resources Board

RE: OPEI comments to ARB's regulatory proposal to determine and control evaporative emissions from Off-Highway Recreational Vehicles (OHRV's)

Dear Mr. Mader,

The Outdoor Power Equipment Institute (OPEI) is a major international trade association representing the manufacturers and their suppliers of consumer and commercial outdoor power equipment such as lawnmowers, garden tractors, utility vehicles, trimmers, edgers, chain saws, snow throwers, tillers, leaf blowers and other related products. These include all of the major suppliers and manufacturers of engines used by this industry.

OPEI is pleased to provide comments on ARB's May 2013 proposed regulation order and test procedure for determining evaporative emissions from OHRV's. Please see the comment dated 23Jul13 in the proposed regulation and test procedure immediately following this letter.

- Draft Regulations, see section/subsection: (d)(4), (d)(8) and (h)(7)
- TP-933 Test Procedure, see section/subsection: 1.1.9, 2, 6.4.2.5

In addition to the July 25, 2013 workshop, OPEI and representatives of member companies are available to discuss these comments with the ARB at your convenience.

Thank you for the opportunity to review and provide input.

Kind regards,

Greg Knott
Director Industry Affairs
Outdoor Power Equipment Institute

OPEI Comments, 23Jul13
See Subsections 2419.2 (d)(4) & (d)(8) and 2419.5 (h)(7)

Attachment A:

Proposed Regulation Order

Off-Highway Recreational Vehicles: Evaporative Emission Control

Title 13, California Code of Regulations

May 2013

California Air Resources Board

Monitoring and Laboratory Division

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PROPOSED REGULATION ORDER

Chapter 9. Off-Road Vehicles and Engines
Pollution Control Devices

Article 3. Off-Highway Recreational Vehicles and Engines

Adopt Article 3, Chapter 9, Division 3, Title 13, California Code of Regulations, to read as follows:

Note: The entire text below is new language proposed to be added to the California Code of Regulations.

§ 2416. Applicability.

(a)(1) This article applies to all new model year 2018 or later off-highway recreational vehicles (OHRV), for sale, lease, use, or offered for sale, lease or use, or otherwise introduced into commerce in California (hereinafter collectively referred to as "sold or offered for sale").

(2) New OHRVs, subject to any of the standards set forth in Article 3, shall be certified by the Air Resources Board and covered by an Executive Order of Certification, pursuant to section 2419.5 of this Article before being sold or offered for sale in California.

(b) The following OHRVs are exempted from the requirements of this regulation:

(1) OHRVs certified solely to operate on diesel fuel,

(2) Snowmobiles, and

(3) Zero emission vehicles; except when optionally certified to generate advanced fuel system credits, pursuant to section 2419.5.

(c) Each part of this article is severable, and in the event that any part of this chapter or article is held to be invalid, the remainder of this article continues in full force and effect.

(d) This article includes provisions for certification, labeling requirements, emissions standard enforcement, recall, and use restrictions.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43106, 43107, 43204, 43205, 43205.5, 43210, 44004, 44010, 44011, 44012, 44014, 44015 and 44017, Health and Safety Code.

§ 2417. Definitions.

(a) The definitions in Cal. Code Regs., tit.13, § 1900(b), apply as well as the following additions:

(1) "Abuse" as defined in Cal. Code Regs., tit.13, § 2441(a).

(2) "All-Terrain Vehicle (ATV)" as defined in Cal. Code Regs., tit.13, § 2411(a).

(3) "Compliance Testing" as defined in Cal. Code Regs., tit.13, § 2421(a).

(4) "Conventional Tool" is any of the following: a blade or Phillips screwdriver, open-end or box wrench, adjustable wrench, standard hexagonal socket, hands, pliers, or Torx bit.

(5) "Diurnal Emissions" means evaporative emissions resulting from the daily cycling of ambient temperatures and include resting losses, and permeation emissions, as measured according to test procedures incorporated in this Article.

(6) "Emission Control System" as defined in Cal. Code Regs., tit.13, § 2411(a).

(7) "End of the Assembly-Line" as defined in Cal. Code Regs., tit.13, § 2411(a).

(8) "Evaporative Emissions" as defined in Cal. Code Regs., tit.13, § 2752(a).

(9) "Evaporative Family" as defined in Cal. Code Regs., tit.13, § 2752(a).

(10) "Evaporative Family Emissions Limit (EFEL)" is defined as the numerical value selected by the manufacturer to serve in the advanced fuel system credit program. The EFEL serves as the evaporative family's emission standard for emission compliance efforts. If the manufacturer does not declare an EFEL for an evaporative family, the applicable emissions standard must be treated as that evaporative family's EFEL for the purposes of any provision in this Article. In addition, the EFEL must be set in increments of 0.025 grams per test.

(11) "Executive Order of Certification" as defined in Cal. Code Regs., tit.13, § 2752(a).

(12) "Fuel Injection" is defined as any mechanical or electrical fuel system in which pressurized fuel is sprayed or injected, only when the engine is starting or running, into the intake system or cylinder of an internal combustion engine.

(13) "Golf Cart" as defined in Cal. Code Regs., tit.13, § 2411(a).

(14) "Manufacturer" as defined in Cal. Code Regs., tit.13, § 2411(a).

(15) “Nominal Capacity” as defined in Cal. Code Regs., tit. 13, § 2752(a).

(16) “Nonconformity” or “Noncompliance” as defined in Cal. Code Regs., tit.13, § 2112(h).

(17) “Off-Highway Recreational Vehicle (OHRV)” means any vehicle powered by an off-highway recreational vehicle engine

(18) “Off-Highway Recreational Vehicle Engines ” or “Engines” as defined in Cal. Code Regs., tit. 13, § 2411(a).

(19) “Off-Road Motorcycle” as defined in Cal. Code Regs., tit. 13, § 2411(a).

(20) “Off-Road Sport Vehicle” as defined in Cal. Code Regs., tit. 13, § 2411(a).

(21) “Off-Road Utility Vehicle” as defined in Cal. Code Regs., tit. 13, § 2411(a).

(22) “Owner” as defined in Cal. Code Regs., tit.13, § 2180.1(a).

(23) “Permeation emissions” or “Permeation” means evaporative emissions that result from reactive organic gas molecules penetrating through the walls of fuel system components and evaporating on outside surfaces. Permeation emissions are a component of diurnal emissions.

(24) “SAE J1737” means Society of Automotive Engineers “Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation,” revised November 2004, which is incorporated by reference herein.

(25) “Sand Car” as defined in Cal. Code Regs., tit. 13, § 2411(a).

(26) “Scheduled Maintenance” as defined in Cal. Code Regs., tit.13, § 2411(a).

(27) “Small Volume Off-Highway Recreational Vehicle Manufacturer” means any off-highway recreational vehicle manufacturer with three-year average California sales less than or equal to a total of 50 new off-highway recreational vehicles per model year in California.

(28) “Tampering” means removing, modifying, or disconnecting emissions-related parts, or, as it applies to emission control labels, in a manner that voids equipment certification.

(29) “Total Organic Gases” or “TOG” means all gases containing carbon, except carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate.

(30) “Vehicle or Engine Manufacturer” as defined in Cal. Code Regs., tit.13, § 2035(c).

(31) “Warranty Period” as defined in Cal. Code Regs., tit.13, § 2035(c).

(32) “Warranty Station” as defined in Cal. Code Regs., tit.13, § 2035(c).

(33) “Zero Emission Vehicle” or “electric motorcycle” as defined in Cal. Code Regs., tit.13, § 2411(a).

(34) “TP-902” means “Test Procedure for Determining Diurnal Evaporative Emissions from Small Off-Road Engines,” adopted July 26, 2004, which is incorporated by reference herein.

(35) “TP-933” means “Test Procedure for Determining Evaporative Emissions from Off-Highway Recreational Vehicles,” adopted [INSERT ADOPTION DATE], which is incorporated by reference herein.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43106, 43107, 43204, 43205, 43205.5, 43210, 44004, 44010, 44011, 44012, 44014, 44015 and 44017, Health and Safety Code.

§ 2418. Evaporative Emission Standards and Test Procedures.

(a) Manufacturers of OHRVs must comply with the following evaporative emission standards for new OHRVs sold or offered for sale in California.

(1) Evaporative emissions from an OHRV may not exceed the following limitations:

(A) The applicable emission standards outlined in Table 1 for either the 72 hour diurnal standard or the steady state diurnal standard. All OHRVs certified to the emission standards below are presumed to demonstrate compliance with federal permeation standards specified in Cal. Code Regs., tit.13, § 2412(b)(2).

Table 1

Vehicle and Model Year	*Required Tests*	*72-Hour Diurnal Standard(1)*	*Steady State Diurnal Standard(2)*
OHRVs 2018 and later model years	Diurnal	1 gram TOG/day	1 gram TOG/day
	Fuel System Leakage Tip Test	No visible liquid leakage	

(1) Highest 24-hour diurnal test result over three consecutive 24-hour diurnal test periods.
(2) 24-hour diurnal test result plus calculated vented emissions.

(B) All-Terrain Vehicle (ATV) Filler Neck Compatibility Standard.

Beginning with model year 2018, ATVs with fuel tanks that are re-designed to be geometrically different from fuel tanks of 2017 and earlier model years, and have a nominal capacity of greater than 3.5 gallons must meet the filler pipe sealing surface requirements in Figure 1 of the International Standards Organization 13331:1995(E), published June 1, 1995, which is incorporated by reference herein. Perpendicularly down from the mating surface there must be a minimum of 120 mm (90 mm for nozzle, 5 mm for bellows compression and 25 mm for extra space fuel flow) to the bottom of the tank.

(2) Zero emission vehicles shall produce zero fuel evaporative emissions under any and all possible operational modes and conditions, and are therefore not required to perform evaporative emissions testing to certify in accordance with section 2419.5.

(b) Small Volume OHRV Manufacturer Design-Based Standard.

(1) In lieu of certifying to the emission standards in subdivision (a), a small volume OHRV manufacturer may certify OHRVs to the design-based standards set out in Table 2, in addition to performing a tip-test as specified in subsection (a)(1).

Table 2

Effective Date Model Year	*Fuel Tank Permeation Grams/m^2/day*	*Fuel Hose Permeation Grams/m^2/day*	*Carbon Canister Working Capacity Grams/Liter of Nominal Fuel Tank Volume*	*Fuel Injection*
2018 and later model years	1.5 @ 28°C (82°F)(1)	5.0 @ 35°C (95°F)	1.0(2)	Required

(1) Fuel tank permeation standards specified in Cal. Code Regs., tit.13, § 2412(b)(2).
(2) The carbon canister must be actively purged during engine operation.

(c) The test procedures for determining compliance with the standards in:

(1) subdivision (a) are set forth in TP-933, and incorporated by reference herein.

(2) subdivision (b) for,

(A) fuel hose permeation, are set forth in SAE J1737, and incorporated by reference herein.

(B) fuel tank permeation, are set forth in part 1060.520, Title 40, Code of Federal Regulations, as amended on April 30, 2010, and incorporated by reference herein.

(C) the carbon canister, are set forth in TP-902, and incorporated by reference herein.

(d) Phase-in Schedule.

(1) For model years 2018 through 2021, OHRV manufacturers may phase-in evaporative emission standards specified in subdivision (a) so that 75 percent of all OHRVs sold in model years 2018 through 2021 are compliant with the requirements in section 2419.5.

(2) All 2018 through 2021 model year OHRVs that are not subject to these standards pursuant to the phase-in schedule shall comply with the evaporative permeation requirements for 2008 and later model year OHRVs, as described in Cal. Code Regs., tit.13, § 2412(b)(2).

(3) The percentage of OHRV fleet averaged across model years 2018 through 2021 must be used to determine compliance with this requirement.

(4) For the purpose of calculating the fleet average, a manufacturer shall use the percentage of OHRVs sold or offered for sale in California for model years 2018 through 2021. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

(5) For the purpose of this section, any OHRV manufacturer that participates in the phase-in period must comply with the administrative requirements in section 2419.5(d).

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43106, 43107, 43204, 43205, 43205.5, 43210, 44004, 44010, 44011, 44012, 44014, 44015 and 44017, Health and Safety Code.

§ 2419.1 Evaporative Emission Control Labels – New Off-Highway Recreational Vehicles.

(a) Purpose. An evaporative emissions label (or labels) must be affixed to every certified OHRV to provide proper vehicle identification and maintenance information for emissions-related parts. The maintenance information on the label may be omitted if such information is included in the owner's manual.

(b) The manufacturer granted certification is responsible for compliance with this section.

(c) Evaporative Emissions Label Content and Location.

(1) An evaporative emissions label made of a permanent material must be welded, riveted or otherwise permanently attached to an area on the OHRV in such a manner that the label will be readily visible to the average person with the engine installed.

(A) The label must be readable from a distance of 18 inches (46 centimeters) without any obstructions from vehicle or engine parts (including all manufacturer available optional equipment) except for flexible parts (e.g., vacuum hoses, ignition wires) that can be moved out of the way without disconnection.

(B) Specifications to be printed on the label must be no smaller than 8 point type size (2 millimeters in height) .

(2) In selecting an acceptable location, the manufacturer must consider the possibility of accidental damage (e.g., possibility of tools or sharp instruments coming in contact with the label). Each label must be affixed in such a manner that it cannot be removed without destroying or defacing the label, and must not be affixed to any part that is likely to be replaced during the OHRV's useful life.

(3) The evaporative emissions label must be in the English language, and use block letters and numerals, which must be of a color that contrasts with the background color of the label.

(4) The evaporative emissions label must contain the following information:

(A) A label heading that must read: "Vehicle Evaporative Emission Control Information,"

(B) The complete corporate name and trademark of the manufacturer,

(C) Evaporative family name and model name,

(D) Identification of the Evaporative Emission Control System. Abbreviations may be used and must conform to the nomenclature and abbreviations found in the Society of Automotive Engineers' procedure J1930, “Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations and Acronyms,” October 2008, which is incorporated by reference herein;

(E) The tune-up specifications and adjustments recommended by the manufacturer. These specifications must indicate the proper transmission position during tune-up and what accessories, if any, should be in operation, and what systems, if any (e.g., vacuum advance, air pump), should be disconnected during the tune-up. Any tune-up specifications or adjustment instructions that appear on labels must be sufficiently clear and complete so as to preclude the need for a mechanic or OHRV owner to consult other references in order to correctly perform the adjustments. The manufacturer must include the single statement: “No other adjustments needed,” in lieu of any tune-up adjustment instruction, when the manufacturer does not recommend a tune-up specification or an adjustment;

(F) An unconditional statement of compliance with the appropriate model year California regulations. For example, “This (specify off-road motorcycle, all-terrain vehicle, off-road sport vehicle, off-road utility vehicle, or sand car, as applicable) conforms to California evaporative emissions regulations applicable to (specify applicable model year) model-year new (specify off-road motorcycles, all-terrain vehicles, off-road sport vehicles, off-road utility vehicles, or sand cars, as applicable).” The statement must also include the phrase, “is certified to (specify applicable ROG designated standard in grams per day) evaporative emission standard in California;” and

(G) Statements such as those in (F) must not appear on labels placed on OHRVs that do not comply with all applicable California regulations.

(5) A manufacturer may elect to use a supplemental label when the original label lacks sufficient space to include all the required information. A supplemental label must conform to all of the specifications as the original label. The original label must be indicated as “1 of 2” and the supplemental label must be indicated as “2 of 2” whenever a supplemental label is utilized.

(6) The provisions of this section must not prevent a manufacturer from also reciting on the label that such OHRV comply with any applicable federal emission standards for new OHRVs, or any other information that such manufacturer deems necessary for, or useful to, the proper operation and satisfactory maintenance of such OHRVs.

(7) The labels and any adhesives used must be designed to withstand, for the OHRV's total expected life, typical OHRV environmental conditions at the location where a label has been attached. Typical OHRV environmental conditions include, but are not limited to, exposure to engine fuels, lubricants and coolants (e.g., gasoline, motor oil, brake fluids, ethylene glycol), engine operating temperatures, steam cleaning, and paints or paint solvents. The manufacturer must submit, with its certification application, a statement attesting that its labels comply with this requirement.

(8) Approval of Emission Control Label.

(A) The manufacturer must obtain approval from the Executive Officer for all emission control label formats and locations prior to certification. Approval of the specific tune-up specifications and adjustments is not required; however, the format for all such specifications and adjustments, if any, is subject to review. If the Executive Officer finds that the information on the label is vague or subject to misinterpretation, or that the location does not comply with these specifications, the Executive Officer may require that the label or its location be modified accordingly.

(B) Samples of all actual production emission control labels used within an evaporative family must be submitted to the Executive Officer of the Air Resources Board within thirty days after the start of production.

(C) The Executive Officer may approve alternate label locations or may, upon request and when the Executive Officer determines warranted, waive or modify one or more of the label content requirements, provided that the intent of this section is satisfied.

(D) If the Executive Officer finds any OHRV using emission control labels that are different from those approved or that do not substantially comply with the readability or durability requirements set forth in this section, the Executive Officer may invoke Cal. Code Regs., tit.13, § 2109.

(d) Integrated Emissions Label.

(1) A manufacturer must obtain approval from the Executive Officer, as set forth in subdivision (c)(8), to use an integrated emissions label for OHRVs certified to this article, and subject to exhaust emissions labeling requirements by Cal. Code Regs., tit.13, § 2413(b).

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43106, 43107, 43204, 43205, 43205.5, 43210, 44004, 44010, 44011, 44012, 44014, 44015 and 44017, Health and Safety Code.

§ 2419.2 Defects Warranty Requirements for Evaporative Emission Systems of 2018 and Later Model Year Off-Highway Recreational Vehicles.

(a) The warranty period shall begin on the date the OHRV is delivered to an ultimate purchaser.

(b) General Emissions Warranty Coverage.

The manufacturer of an OHRV shall warrant to the ultimate purchaser and each subsequent purchaser that the OHRV is:

(1) Designed, built, and equipped so as to conform, at the time of sale, with all applicable laws, rules and regulations; and

(2) Free from defects in materials and workmanship that may cause the failure of a warranted part to be identical in all material respects to that part as described in the OHRV manufacturer's application for certification.

(c) Warranty Period.

The warranty period applicable to this section shall be a period of use of 30 months, or 2500 miles, or 250 hours, whichever comes first, except for “high-priced” warranty parts, which are covered for 60 months, or 5000 miles, or 500 hours, whichever comes first.

(1) Each manufacturer shall identify in its application for certification the “high-priced” warranted parts which are:

(A) OHRV parts included on the Air Resources Board "Emissions Warranty Parts List," as last amended February 22, 1985, which is incorporated herein by reference, and;

(B) Have an individual replacement cost at the time of certification exceeding the cost limit defined in subdivision (c)(3);

(2) The replacement cost shall be the retail cost to an OHRV owner and include the cost of the part, labor, and standard diagnosis. The costs shall be those of the highest-cost metropolitan area of California.

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

$\text{Cost limit}_n = \$200 \times (\text{CPI}_{n-2} / 118.3)$

Where,

- Cost limit_n = the cost limit for the applicable model year of the OHRV rounded to the nearest ten dollars
- n = model year of the new OHRVs

- n-2 = calendar year two years prior to the model year of the new OHRVs
- CPI = annual average nationwide urban consumer price index published by the United States Bureau of Labor Statistics

The $200 is based on calendar year 2018 dollars.

(4) The cost limit shall be revised annually by the Executive Officer. The highest-cost metropolitan area in California shall be identified by the Executive Officer for use in this section. If a manufacturer seeks certification of an OHRV before the applicable annual average CPI is available, the cost limit shall be calculated using the average of the monthly nationwide urban CPI figures for the most recent twelve month period for which figures have been published by the United States Bureau of Labor Statistics.

(5) Each manufacturer shall submit to the Executive Officer the documentation used to identify the “high-priced” warranted parts required in this section. The documentation shall include the estimated retail parts costs, labor rates in dollars per hour, and the labor hours necessary to diagnose and replace the parts.

(6) The Executive Officer may reject or require modification of the manufacturer's list of “high-priced” warranted parts to ensure that such list includes all emission-related parts whose replacement cost exceeds the cost limit defined in subdivision (c)(3).

(d) Subject to the conditions and exclusions of subdivision (i), the warranty on emissions-related parts shall function as follows:

(1) Any warranted part which is not scheduled for replacement as part of maintenance in the written instructions pursuant to subdivision (e) shall be warranted for the warranty period defined in subdivision (c). If any such part fails during the warranty period, it shall be repaired or replaced by the OHRV manufacturer according to subdivision (d)(4). Any such part repaired or replaced under warranty shall be fully warranted.

(2) Any warranted part which is scheduled only for regular inspection in the written instructions required by subdivision (e) shall be warranted for the warranty period defined in subdivision (c). A statement in such written instructions to the effect of "repair or replace as necessary" shall not reduce the period of warranty coverage. Any such part repaired or replaced under warranty shall be warranted for the remaining warranty period.

(3) Any warranted part which is scheduled for replacement as part of maintenance in the written instructions pursuant to subdivision (e) shall be warranted for the period of time prior to the first scheduled replacement point

Change to "In the event a temporary repair is permitted according to subdivision (d)(8), . . ."

for that part. If the part fails before the first scheduled replacement point, the part shall be repaired or replaced by the OHRV manufacturer according to subdivision (d)(4). Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.

(4) Repair or replacement of any warranted part under the warranty provisions of this article shall be performed at no charge to the OHRV owner, at a warranty station, except in the case of a~~n emergency~~ when a warranted part or a warranty station is not reasonably available to the OHRV owner. ~~In an emergency~~, repairs may be performed at any available service establishment, or by the owner, using any replacement part. The manufacturer shall reimburse the owner for his or her expenses including diagnostic charges for such ~~emergency~~ repair or replacement, not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate.

Change "emergency repair" to "temporary repair".

(5) Notwithstanding the provisions of subdivision (d)(4), warranty services or repairs shall be provided at all manufacturer dealerships that are owned by the manufacturer or franchised to service the subject OHRVs.

(6) The OHRV owner shall not be charged for diagnostic labor which leads to the determination that a warranted part is, in fact, defective, provided that such diagnostic work is performed at a warranty station.

(7) The OHRV manufacturer shall be liable for damages to other vehicle components proximately caused by a failure, under warranty, of any warranted part.

Change to "...qualify the need for a temporary repair..."

(8) Throughout the OHRV's warranty period defined in subdivision (c), the OHRV manufacturer shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts. The lack of availability of such parts or the incompleteness of repairs within a reasonable time period, not to exceed 30 days from the time the OHRV is initially presented to the warranty station for repair, shall ~~constitute an emergency~~ for purposes of subdivision (d)(4).

(9) Any replacement part designated by a manufacturer may be used in warranty repairs provided without charge to the OHRV owner. Such use shall not reduce the warranty obligations of the OHRV manufacturer, except that the OHRV manufacturer shall not be liable under this article for repair or replacement of any replacement part which is not a warranted part (except as provided under subdivision (d)(7)).

(10) Any add-on or modified part exempted by the Air Resources Board from the prohibitions of Vehicle Code section 27156 may be used on an OHRV. Such use, in and of itself, shall not be grounds for disallowing a warranty claim made in accordance with this article. The OHRV manufacturer shall not be liable under this article to warrant failures of warranted parts caused by the use of an add-on or modified part unless such parts are also warranted.

(11) Upon a request of the Executive Officer, the OHRV manufacturer must provide any documents that describe the manufacturer's warranty procedures or policies.

(12) Any replacement part must not reduce the effectiveness of the OHRV emission control system. A manufacturer must demonstrate that the applicable emission standards are being met when the replacement part(s) are installed on the OHRV. The demonstration of equivalence to applicable emission standards can be achieved through replacing the part(s) with the evaporative emission components the OHRV emissions family was certified with; or, if unavailable, alternative parts may be installed if the manufacturer can provide testing data to verify the evaporative control system meets, at least, the OHRV EFEL.

(e) Commencing with the 2018 model year, each manufacturer shall furnish with each new OHRV written instructions for the maintenance and use of the OHRV by the owner.

(f) Commencing with 2018 model year, the manufacturer shall furnish with each new OHRV, a list of the warranted parts installed on that vehicle. The list shall include those parts included on the Air Resources Board "Emissions Warranty Parts List," incorporated by reference in subdivision (c)(1)(A).

(g) Each manufacturer shall submit the documents required by subdivisions (e) and (f), with the manufacturer's preliminary application for new OHRV certification for approval by the Executive Officer. The Executive Officer may reject or require modification of the manufacturer's list of warranted parts to ensure that each such list is of proper scope. The Executive Officer may also reject or require modification of any of the documents required by subdivision (e). Approval by the Executive Officer of the documents required by subdivisions (e) and (f), shall be a condition of certification. The Executive Officer must approve or disapprove the documents required by subdivisions (e) and (f), within 90 days of the date such documents are received from the manufacturer or the application is deemed disapproved. If approved, an Executive Order of Certification will be granted by the Executive Officer. If disapproved, an Executive Order of Certification will not be granted by the Executive Officer. A statement of the reasons shall accompany any disapproval. In the event of disapproval, the manufacturer may request a review of the Executive Officers' decision by the Board.

(h) Notwithstanding subdivision (f), the Executive Officer may delete any part from a manufacturer's list of warranted parts provided if the manufacturer demonstrates to the Executive Officer that:

(1) Failure of such part will not increase the emissions of any OHRV on which it is installed, and

(2) Any deterioration of drivability or performance which results from failure of the part could not be corrected by adjustments or modifications to other OHRV components.

(i) Exclusions.

The repair or replacement of any warranted part otherwise eligible for warranty coverage under subdivision (d), shall be excluded from such warranty coverage if the OHRV manufacturer can provide evidence to the Executive Officer, to the Executive Officer's satisfaction, that the OHRV has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for the repair or replacement of the part.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43106, 43107, 43204, 43205, 43205.5, 43210, 44004, 44010, 44011, 44012, 44014, 44015 and 44017, Health and Safety Code.

§ 2419.3 Evaporative Emissions Control System Warranty Statement.

(a) A manufacturer shall furnish a copy of the following statement with each new 2018 and later model year vehicle, using those portions of the statement applicable to the vehicle, unless otherwise authorized by the Executive Officer. The warranty statement shall generally describe the obligations and rights of vehicle manufacturers and owners under this article.

CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board (and manufacturer's name, optional) is pleased to explain the emission control system warranty on your (model year) (OHRV). In California, new off-highway recreational vehicles must be designated, built and equipped to meet the State's stringent anti-smog standards. (Manufacturer's name) must warrant the emission control system on your (OHRV) for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your (OHRV).

Your emission control system may include parts such as the carburetor or fuel-injection system, fuel tank, fuel hoses, carbon canister, and engine computer. Also included may be hoses, belts, connectors and other emission-related assemblies. Where a warrantable condition exists, (manufacturer's name) will repair your (OHRV) at no cost to you including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE:

[For 2018 and later model year OHRVs.]

For 30 months, or 2500 miles, or 250 hours, whichever comes first, except for evaporative components over the OHRV high-priced warranty value, which is covered for 60 months, or 5000 miles, or 500 hours, whichever comes first.

If any emission-related part on your (OHRV) is defective, the part will be repaired or replaced by (manufacturer's name).

OWNER'S WARRANTY RESPONSIBILITIES:

As the (OHRV) owner, you are responsible for the performance of the required maintenance listed in your owner's manual. (Manufacturer's name) recommends that you retain all receipts covering maintenance on your (OHRV), but (manufacturer's name) cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of a scheduled maintenance.

As an owner you are responsible for presenting your (OHRV) to a (manufacturer's name) dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

As an (OHRV) owner, you should also be aware that (manufacturer's name) may deny you warranty coverage if your (OHRV) or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, you should contact (Insert chosen manufacturer's contact) at 1-XXX-XXX-XXXX or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

(b) Each manufacturer shall submit the documents required by the section with the manufacturer's preliminary application for new OHRV certification for approval by the Executive Officer. The Executive Officer may reject or require modification of the documents to the extent the submitted

documents do not satisfy the requirements of this section. Approval by the Executive Officer of the documents required by this section shall be a condition of certification. The Executive Officer must approve or disapprove the documents required by this section within 90 days of the date such documents are received from the manufacturer. Any disapproval shall be accompanied by a statement of the reasons therefore. In the event of disapproval, the manufacturer may petition the Board to review the decision of the Executive Officer.

NOTE; Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106, 43204, 43205, 44004, 44010, 44011, 44012, 44014 and 44015, Health and Safety Code.

§ 2419.4. New Off-Highway Recreational Vehicle Evaporative Emission Standards, Enforcement and Recall Provisions, Warranty, Quality Audit, and New Engine Testing.

Commencing with model year 2018, an OHRV is subject to Cal. Code Regs., tit.13, § 2111-2140, and the incorporated Appendix A, "California In-Use Vehicle Emission-Related Recall Procedures, Enforcement Test Procedures, and Failure Reporting Procedures for 1982 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Engines, and Motorcycles," which are incorporated by reference herein.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code. Reference: Sections 43013, 43018, 43105, 43107, 43205.5 and 43210, Health and Safety Code.

§2419.5 Evaporative System Testing and Certification Requirement.

(a) Requirement to Comply with All Other Applicable Codes and Regulations.

Certification or approval of any equipment or evaporative emission control system by the Executive Officer does not exempt the equipment or evaporative emission control system from compliance with other laws, rules or regulations including state and federal safety codes and regulations.

(b) Certification Requirements.

(1) For model years 2018 and later, OHRVs must be tested with the entire emissions control system as a complete vehicle. To obtain an Executive Order of Certification for OHRVs, a manufacturer must:

(A) Perform OHRV testing in accordance with section 2418(c). Measured emissions must be at or below the applicable emission standards listed section 2418(a), or;

(B) Evaporative families that do not meet the emission standards outlined above must comply by offsetting any shortfall with emissions credits generated with the same model year, as specified in subdivision (c).

(C) Comply with all administrative requirements in subdivision (d).

(D) Meet the applicable warranty requirements of Sections 2419.2 and 2419.3.

(E) Meet the evaporative emissions labeling requirements of Section 2419.1.

(F) Submit an OHRV certification application to the Mobile Source Operations Division (MSOD) Chief, Air Resources Board, electronically as specified by the MSOD Chief.

(G) Within 30 days of receipt of the application, the Executive Officer must determine whether an application is complete.

(H) Within 90 days after an application has been deemed complete, the Executive Officer must approve or disapprove of the required documents. If approved, an Executive Order of Certification will be granted by the Executive Officer. If disapproved, an Executive Order of Certification will not be granted by the Executive Officer. The applicant and the Executive Officer may mutually agree to a longer time for reaching a decision. An applicant may submit additional supporting documentation before a decision has been reached.

(2) In order to facilitate OHRV design certification, ARB will certify emissions-related parts relating to fuel hoses, fuel tanks, and venting control devices to the emission standards in section 2418(b). To obtain an Executive Order of Certification for the design-based evaporative emissions standard, a small volume OHRV manufacturer must:

(A) Have measured emissions at or below the emission standards listed section 2418(b), in accordance with the testing requirements in section 2418(c).

(B) Comply with all administrative requirements in subdivision (d)

(C) Meet the applicable warranty requirements of sections 2419.2 and 2419.3.

(D) Meet the evaporative emissions labeling requirements of section 2419.1.

(E) Complete the installation as directed by the fuel hose, fuel tank, and carbon canister component or other venting component manufacturer and verify adherence to specifications contained within the referenced component Executive Order.

(F) Submit a design-based certification application to the Mobile Source Operations Division Chief, Air Resources Board, electronically as specified by the MSOD Chief.

1. The application must include the approved component Executive Order number or compliant emissions data for the emissions-related parts and any test data required for venting control.

2. Component Executive Orders can be obtained by following the procedures outlined in Cal. Code Regs., tit.13, § 2767.1, replacing all references to “section 2754” with “Cal. Code Regs., tit. 13, § 2418(b).”

3. The manufacturer must document all emissions-related parts installed in the OHRV and record the component Executive Order number or compliant emissions data for each part.

(G) Within 30 days of receipt of the application, the Executive Officer must determine whether an application is complete, if no determination is made the application is assumed to be incomplete.

(H) Within 90 days after an application has been deemed complete, the Executive Officer must approve or disapprove of the required documents. If approved, a component Executive Order of Certification will be granted by the Executive Officer. If disapproved, a component Executive Order of Certification will not be granted by the Executive Officer. The applicant and the Executive Officer may mutually agree to a longer time for reaching a decision. An applicant may submit additional supporting documentation before a decision has been reached.

(3) If the Executive Officer determines that a part for which an "approval" has been granted no longer meets the applicable emission standards, the Executive Officer may deny, suspend or revoke the component Executive Order following provisions in this Article.

(c) Advanced Fuel System Credits.

(1) A manufacturer is eligible to use advanced fuel system credits to certify OHRV evaporative families with the following requirements:

(A) OHRVs must be tested to the diurnal standards in section 2418(a); or, must be certified as a zero-emissions vehicle.

(B) In order to generate credits, zero emission vehicles must follow the administrative requirements in subdivision (d), to obtain an Executive Order of Certification.

(C) Certified zero emission vehicles will be awarded a 0.75 TOG diurnal credit by the Air Resources Board.

(D) Advanced fuel system credits may only be applied to emissions families of the same model year.

(E) A manufacturer may not sell or trade advanced fuel system credits.

(F) No evaporative family can be certified for sale in California that emits over 300 percent of the diurnal standard in section 2418(a).

(G) Results are to be calculated with consistent arithmetic units and rounded to the nearest tenth of a gram.

(H) Zero emission golf carts are not eligible to participate.

(I) A manufacturer shall offset TOG debits with TOG credits for each model year, so that the sum of total TOG credits is greater than or equal to the sum of TOG debits.

(2) For each model year, a manufacturer electing to certify with credits shall calculate TOG credits and debits separately for each evaporative family. For each evaporative family, the manufacturer must subtract the diurnal EFEL from the diurnal standard in Section 2418(a). A negative result is a TOG debit. A positive result is a TOG credit. For certified zero emission vehicles, the TOG credit is 0.75 g TOG/day for each vehicle certified. The result, or per zero emission vehicle credit, is multiplied by the number of projected sales for each evaporative family for the model year to calculate the total TOG credits or debits.

(3) The manufacturer bears the burden of establishing, to the satisfaction of the Executive Officer, that the conditions upon which the Executive Order of Certification was issued were satisfied. Evaporative family certification based on credits may be revoked based on review of end-of-year reports, follow-up audits, actual sales volumes, and any other verification steps considered appropriate by the Executive Officer. If any evaporative family is found to exceed the OHRV EFEL all vehicles sold under that Executive Order of Certification will be considered non-compliant with this regulation.

(d) Administrative Requirements.

(1) Maintenance of records.

(A) The manufacturer shall establish, maintain, and retain the following organized records for each evaporative family:

(i) ARB evaporative family identification code,

(ii) Model number and engine size,

(iii) Make and model name,

(iv) Projected sales volume for the model year,

(v) Certification test results,

(vi) Actual sales volume for the model year,

(vii) Phase-in calculation, and

(viii) Advanced fuel system credit calculations.

(B) For the purpose of this article, actual sales are defined as shipments to distributors of OHRV sold or offered for sale in California. The manufacturer must submit California actual sales data as it becomes available for each model sold or offered for sale in California, but no later than 90 days after the end of the model year.

(C) Records appropriate to establish the quantities of OHRVs that constitute actual sales for each evaporative family.

(D) The manufacturer shall retain all records required to be maintained under this section for a period of eight years from the due date for the end-of-model year report. Records may be retained as hard copy, CD-ROM, diskettes, and so forth, depending on the manufacturer's record retention procedure; provided, that in every case all information contained in the hard copy is retained. A manufacturer shall submit all information requested by the Executive Officer within 30 days of the date of such request.

(E) The Executive Officer may revoke or suspend the Executive Order of Certification for an evaporative family for which the manufacturer fails to retain the records required in this section or to provide such information to the Executive Officer upon request. No new Executive Orders of Certification will be issued to the manufacturer until the requested records are made available and/or a plan that describes the records to be retained as required by this section is approved by the Executive Officer.

(e) Final report.

(1) All manufacturers that certify OHRVs to subdivision (c) must generate a final report for each evaporative family that includes the OHRV projected sales volume, actual sales volume, and EFELs. Additionally, the following items must be included in the final report:

(A) Manufacturers that certify OHRVs using advanced fuel system credits, described in subdivision (c), must include a calculation to show that the total TOG credits are equal to or greater than TOG debits .

(B) At the end of the four year phase-in period, manufacturers that must submit a calculation to show at least 75 percent compliance with emission standards over the 4 year period, as described in section 2418(d).

(2) Unless otherwise approved by the Executive Officer, final reports must be submitted within 90 days of the end of the model year to: *Chief, Mobile Source Operations Division, Air Resources Board, 9528 Telstar Avenue, El Monte, CA 91731.*

(3) Failure by a manufacturer to submit any final reports in the specified time for any OHRV subject to regulation under this section is a violation.

(f) Evaporative Testing Requirements.

(1) Compliance Test Procedures.

(A) The Executive Officer may order an OHRV or evaporative system builder to make available for compliance testing and/or inspection one OHRV. Unless otherwise directed by the Executive Office, the OHRV(s) shall be delivered to: Haagen-Smit Laboratory Air Resources Board, 9528 Telstar Avenue, El Monte, CA 91731. The OHRV must be selected at random from sources specified by the Executive Officer according to a method approved by the Executive Officer which, insofar as practical, must exclude an OHRV that would result in an unreasonable disruption of the manufacturer's distribution system.

(B) Air Resources Board personnel shall have access to OHRV assembly plants, or distribution facilities for the purposes of OHRV selection and testing. Scheduling of access shall be arranged with the representative designated in the application for certification.

(C) All testing must be conducted in accordance with the applicable model year evaporative emission test procedures. Any evaporative emission control system parameters must be set to values or positions that are within the range available to the ultimate purchaser as determined by ARB. No break-in or modifications, adjustments, or special preparation or maintenance will be allowed on OHRVs chosen for compliance testing without the written consent of the Executive Officer. If the Executive Officer consents to break-in or modifications, adjustments, or special preparation or maintenance, they will be performed by the OHRV manufacturer under the supervision of ARB personnel.

(D) Correction of damage or maladjustment that may reasonably be found to have resulted from shipment of the OHRV is permitted only after an initial test of the OHRV, unless the damage prevents the test from being completed safely. The OHRV manufacturer may request that the OHRV be repaired from shipping damage. If the Executive Officer concurs, the OHRV may be retested, and the original test results may be replaced by the after-repair test results.

(E) The OHRV(s) must be randomly chosen from the selected evaporative families according to the criteria specified herein.

1. The OHRV must be representative of the OHRV manufacturer's California sales.

2. The OHRV will be selected from the end of the assembly line.

3. The selected OHRV must pass a visual inspection test, to verify the OHRV has the appropriate emission control systems as documented in the approved Executive Order of Certification for the evaporative family.

(F) OHRVs scheduled for compliance testing shall be selected, tested, and evaluated in accordance with TP-933, Test Procedure for Determining Evaporative Emissions from Off-Highway Recreational Vehicles, adopted [INSERT ADOPTION DATE]. The evaporative family will be deemed to have failed the compliance testing if the measured emissions are above the applicable EFEL.

(G) If the OHRV selected for inspection fails the requirements of this section, or fails to conform to the labeling requirements of section 2419.1, the Executive Officer shall notify the manufacturer in accordance with subdivision (f)(2).

(2) Notification of Failure.

If compliance testing identifies OHRVs that do not meet the evaporative emission standards set out in Section 2418, or that do not conform to the certification requirements in subdivision (b), the Executive Officer will notify the OHRV manufacturer. The Executive Officer shall also notify the OHRV manufacturer that the Executive Order of Certification may be suspended or revoked. The OHRV manufacturer shall have 30 calendar days in which to notify the Executive Officer of their intent to provide additional information and/or independent test results for five tanks, engines, or equipment that document compliance of the evaporative family. The Executive Officer will consider all relevant information provided by the manufacturer, and other interested parties, including, but not limited to corrective actions applied to the noncompliant evaporative family.

(g) Suspension and Revocation of Executive Orders of Certification.

(1) The Executive Officer shall not revoke or suspend the Executive Order of Certification, without considering any information provided by the OHRV manufacturer of such certification pursuant to subdivision (b).

(2) If the results of the compliance testing indicate that the failed OHRV of a particular evaporative family are produced at one plant, the Executive Officer may suspend the Executive Order of Certification with respect to the OHRVs manufactured at that plant only.

(3) Notwithstanding the foregoing, the Executive Officer may suspend an

OHRV or component Executive Order of Certification effective upon written notice to the OHRV manufacturer if the Executive Officer finds that:

(A) the OHRV manufacturer has refused to comply with any of the requirements of this section;

(B) the OHRV manufacturer has submitted false or incomplete information in any report or information provided to the Executive Officer under this section;

(C) the OHRV manufacturer has rendered inaccurate any test data submitted under this section; or

(D) ARB personnel have been denied the opportunity to conduct activities authorized under this section by the OHRV manufacturer.

(4) The Executive Officer may revoke an Executive Order of Certification for an evaporative family after the Executive Order of Certification has been suspended pursuant to subdivision (f)(1) or (f)(2) of this section if the proposed remedy for the nonconformity, as reported by the OHRV manufacturer to the Executive Officer, is one requiring a design change or changes to the evaporative emission control system as described in the application for certification of the affected evaporative family.

(5) Once an Executive Order of Certification has been suspended pursuant to subdivision (f) of this section, the OHRV manufacturer must take the following actions before the Executive Officer will consider reinstating the Executive Order of Certification:

(A) Submit a written report to the Executive Officer that identifies the reason for the noncompliance of the OHRV, describes the proposed remedy, including a description of any proposed quality control and/or quality assurance measures to be taken by the OHRV manufacturer to prevent future occurrences of the problem, and states the date on which the remedies will be implemented; and

(B) Demonstrate that the evaporative family for which the Executive Order of Certification has been suspended does in fact comply with the regulations of this part by testing an OHRV. The results must meet the criteria required for certification in subdivision (b). Such testing must comply with the provisions of this section.

(6) Once the Executive Order of Certification has been revoked for an evaporative family, if the OHRV manufacturer desires to continue introduction into commerce of a modified version of that evaporative family, then the OHRV manufacturer must, after implementing the change or changes

intended to remedy the nonconformity, demonstrate that the modified evaporative family does in fact conform to the applicable standards of section 2418 of this Article by having five OHRVs from the modified evaporative family tested following TP-933, unless such testing is waived by the Executive Officer.

(h) Tampering/Tamper Resistance.

(1) Manufacturers must design OHRV evaporative emissions control systems in such a way that they are resistant to tampering or removal.

(2) Any canister used to capture evaporative emissions from an off-road motorcycle must be mounted so it does not protrude from the OHRV such that it is prone to damage in a tip over.

(3) If the canister installed on an off-road motorcycle is outside what would otherwise be the cross-sectional profile of the OHRV (with the hoods closed and cargo boxes in the position required for operation), or if the canister installed on an OHRV, except off-road motorcycles, is visible to someone standing next to the OHRV when the OHRV is completely assembled, then the canister must be mounted such that non-conventional tools are required to remove it and the vapor line connections to the canister. Otherwise, fasteners requiring conventional tools may be used.

(4) The evaporative system must be designed in such a way that tampering/disassembling is not needed to conduct normal functions. Normal functions include routine maintenance and refueling of the OHRV.

(5) OHRV owners are responsible for confirming all add-on or modified parts installed on OHRVs are compliant with evaporative emissions standards.

(6) Manufacturers must publish the following statement in the owner's manual to inform OHRV owners of California regulations that prohibit tampering with emission control systems: "An add-on or modified part must be compliant with applicable CARB emission control standards. A violation of this requirement is punishable by civil and/or criminal punishment."

(7) Manufacturers must include an OHRV tampering statement for all new OHRVs certified to a standard set out in this Article informing OHRV owners of laws that prohibit tampering. This may be accomplished by attaching a tag to the OHRV or printing on the front cover of the owner's manual.

Add: "or on the first page"

(A) The OHRV tampering statement text must be printed in the English language, and use block letters and numerals, which shall be of a color that contrasts with the background.

(B) The OHRV tampering statement text must be large enough to be clearly legible.

(C) The OHRV tampering statement shall include a warning statement that reads “The removal or modification of emission-related parts on this OHRV is illegal. Violators may be subject to civil and/or criminal penalties as provided under California and federal law.”

(D) If a removable tag is used the OHRV tampering statement must be fastened in a way that it is destroyed upon removal. The tag must also include an additional statement that reads “This tag may not be removed under penalty of law except by the vehicle owner.”

(8) Any tampering, removal or modifications of the evaporative emissions control system is prohibited under part 1068.101(b)(1), Title 40, Code of Federal Regulations.

(A) Peace officers are given the authority to enforce illegal vehicle tampering by section 27156 of the California Vehicle Code.

(B) Section 27156 of the California Vehicle Code prohibits the installation of any add-on or modified emission-related part on any pollution-controlled OHRV, unless the part has been exempted by ARB. ARB exempts an OHRV part from the prohibition of VC 27156 if the part is found to do either of the following: 1) not reduce the effectiveness of any required emission control device on the OHRV or 2) demonstrate that the applicable emission standards are being met when the part(s) are installed on the OHRV. Sale or installation of any aftermarket part or parts, which could potentially affect the evaporative system, in California without an ARB approved Anti-Tampering Exemption is prohibited as stated in Cal. Code Regs., tit.13, § 2470 – 2476.

(i) Inspection.

The Executive Officer, or an authorized representative of the Executive Officer, may periodically inspect any facility which sells or offers for sale or manufactures OHRVs, sells or offers for sale or manufactures engines, or sells or offers for sale or manufactures evaporative emission control components, technology, or systems subject to this Article as deemed necessary to ensure compliance with these regulations. Failure of a manufacturer, distributor, retailer or other person subject to this Article to allow access for inspection purposes may be grounds for suspension or revocation of an Executive Order of Certification.

NOTE: Authority cited: Sections 39600, 39601 and 43013, Health and Safety Code. Reference: Section 43013, Health and Safety Code. Section 27156, Vehicle Code.

OPEI Comments 23Jul13
See Subsection 1.1.9, Section 2
and Subsection 6.4.2.5

Attachment B:

TP-933

Test Procedure for Determining Evaporative Emissions from Off-Highway Recreational Vehicles

May 2013

Adopted: [insert adopted date]

California Air Resources Board

Monitoring and Laboratory Division

Note: This is a Newly Adopted Test Procedure shown without underline as permitted by California Code of Regulations.

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TP-933
TABLE OF CONTENTS

TP-933

Test Procedure for Determining Evaporative Emissions from Off-Highway Recreational Vehicles (OHRVs)

1 APPLICABILITY

Test Procedure 933 (TP-933) is used by the Air Resources Board (ARB) to determine OHRV evaporative emissions. This test procedure is proposed pursuant to Section 43824 of the California Health and Safety Code (CH&SC).

1.1 Terms and Definitions

This test procedure incorporates by reference the definitions set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as amended March 22, 2012, and Title 13, California Code of Regulations (CCR) Section 2417. In addition, the following definitions apply:

1.1.1 For the purpose of this procedure, when the term "Administrator" is used in any federal regulations referenced within this document, it shall mean the ARB Executive Officer or his or her authorized representative or designate.

1.1.2 For the purpose of this procedure, the term "ARB" refers to the California Air Resources Board.

1.1.3 For the purpose of this procedure, the term “Deterioration factor” means the ratio of emissions after and before durability testing.

1.1.4 For the purpose of this procedure, the term "Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

1.1.5 For the purpose of this procedure, the term "horizontal plane" shall mean:

1.1.5.1 For vehicles with two wheels, the plane which contains the line defined by the points where the vehicle’s front and rear tires are in contact with the testing surface when positioned in normal upright riding position on the level testing surface and which is parallel to the axis of the wheel axles.

1.1.5.2 For vehicles with three or more wheels, the plane defined by the points where the vehicle’s tires contact the testing surface while the vehicle is positioned in normal upright riding position on the level testing surface with the tires inflated to normal manufacturer recommendations.

1.1.6 For the purpose of this procedure, when the term "methanol" is used in any federal regulations referenced within this document, it shall mean methanol and/or ethanol, except as otherwise indicated in this test procedure.

1.1.7 For the purpose of this procedure, the term "travel axis" shall mean the axis defined by the direction the vehicle travels while in normal use and located in the horizontal plane that the vehicle sits.

1.1.8 For the purpose of this procedure, the term "upright axis" shall mean a line passing through the travel axis which is perpendicular to the horizontal plane. Under normal use conditions, this is the same as the vertical axis.

1.1.9 For the purpose of this procedure, the term “useful life” shall mean the time required for half the number of vehicles sold in a model year to no longer be in use.

Why was this definition of useful life added to the test procedure?
What does it mean with regard to the Reg or Test Procedure?
Why is the EVAP system "useful life" definition different than that used in ARB's OHRV exhaust gas regulation (Subsection 2112(12), 5 yrs, 10,000km, 1000 hrs)?

1.2 Test Data Availability

The manufacturer shall provide the specific information that supports its assurance of the system's performance with the requirements within this procedure within 30 days of a written request by the Executive Officer.

1.3 Safety

This test procedure involves the use of flammable materials and should only be used by, or under the supervision of, those familiar and experienced in the use of such operations and materials. Appropriate safety precautions should be observed at all times while performing this test procedure.

1.4 Test Fuel Specification

The test fuel used for all parts of this procedure, unless otherwise specified, shall be California certification gasoline as specified in "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" Section II.A.100.3.1.2 as adopted March 22, 2012, as incorporated by reference herein.

1.5 Alternative Test Procedures

With prior approval alternative test procedures can be used. It must be demonstrated that the alternative method is equivalent to or more stringent than the method set forth in this test procedure.

2 PRINCIPLE AND SUMMARY OF TEST PROCEDURES

This test procedure measures evaporative emissions from a complete vehicle or piece of equipment with complete evaporative emission control systems as defined in 13 CCR 2752 (a)(8) by subjecting them to durability tests, preconditioning, and a diurnal evaporative test as described in Section 6 of this procedure. The engine with a complete evaporative emission control system must be tested as a complete vehicle except where a test rig is explicitly allowed. Where not otherwise specified, the vehicle shall be in an approximately level position during all phases of the test sequence.

Prior to evaporative emissions testing, the vehicle's evaporative emissions control system must undergo durability testing to ensure that the emissions control devices continue to function as designed for the useful life of the vehicle. Real world end of useful life emissions are simulated during vehicle preconditioning.

Evaporative emissions are quantified by direct measurement or by a combination of direct measurement and calculation. Evaporative emissions are directly measured with a hydrocarbon analyzer in a sealed testing enclosure following a defined temperature profile and maintaining atmospheric pressure. The volume of the enclosure must be accurately determined whenever hydrocarbons are being measured. The total mass of hydrocarbons emitted from a test vehicle over the test period is calculated based on measured concentration, known molecular weight, and volume of the testing enclosure.

The vehicle shall demonstrate adequate control of diurnal emissions through one of the following test sequences:

Vehicle may undergo a 72-hour diurnal evaporative emissions test with variable temperature as defined in Section 6.4.1.

Alternatively, a steady state diurnal test may be used to show compliance. The vehicle's evaporative emissions control system is demonstrated to be adequately designed and constructed by performing a 24-hour diurnal test in conjunction with the vented emissions requirements as described in Section 6.4.2. The steady state diurnal test must be conducted with the testing enclosure maintained at a constant temperature of 86°±3°F, with a vent connecting the evaporative vent of the vehicle to the atmosphere outside the testing enclosure. The purpose of the steady state diurnal test is to evaluate fuel permeation and verify the construction of the evaporative emissions control system. Compliance is shown with the vented emissions requirement using the Calculation Method as described in Appendix A or by using a pressure relief valve that opens at 2 pounds per square inch (psi) or greater, or which does not release vapor from the tank during the second of two consecutive 24-hour diurnal temperature cycles from 72° to 96°F. A flowchart summarizing the procedure is shown in Figure 1.

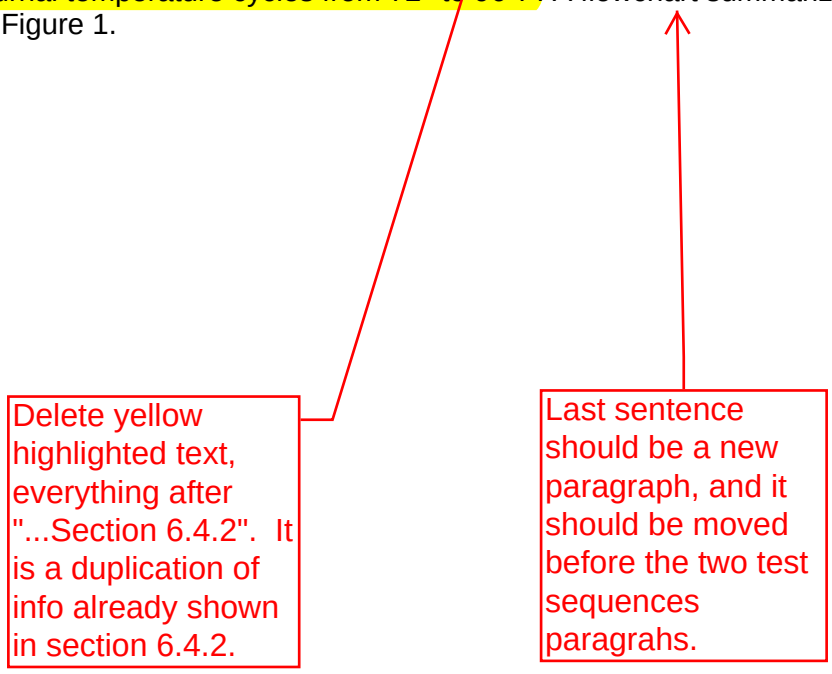
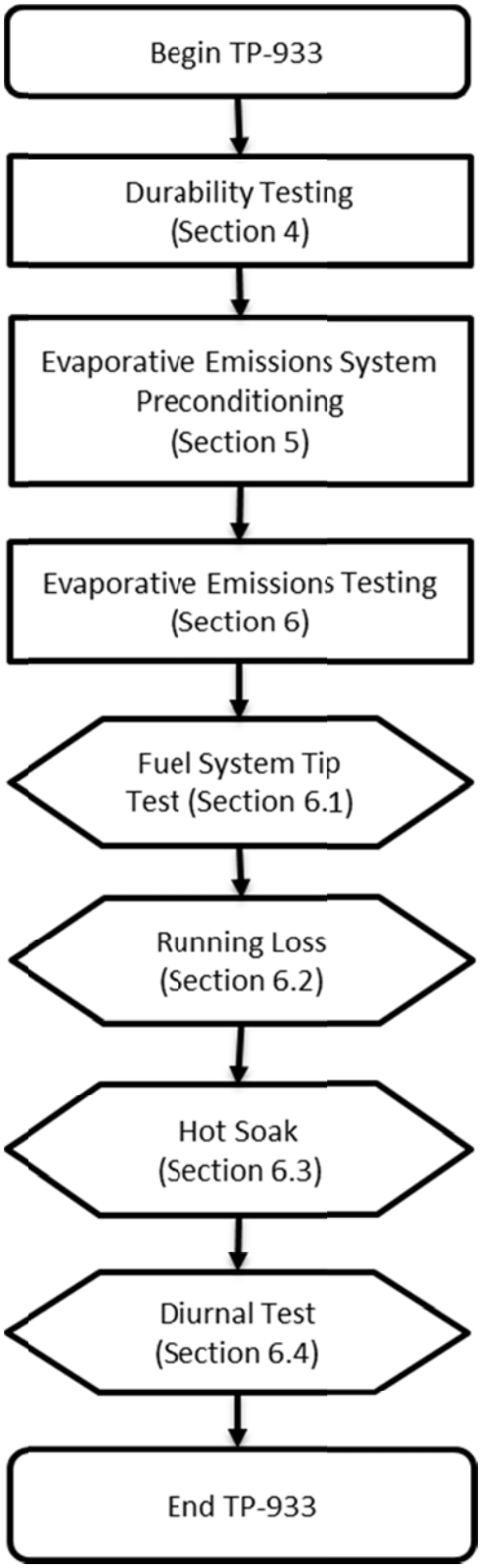


Figure 1: TP-933 Summary Flowchart



3 INSTRUMENTATION

Equipment used during this testing shall, at a minimum, meet the requirements set forth in this section. This document incorporates by reference Title 40, Code of Federal Regulations (CFR), Part 86 – CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES, Subpart 107-96, 108-79, 108-00, and 508-78.

3.1 Vehicle Test Enclosure

This test procedure incorporates by reference "CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES" as amended March 22, 2012, Parts III.A and III.B, for evaporative emission measurement enclosure requirements and calibrations with the following exceptions:

3.1.1 The fuel tank temperature is not controlled in this procedure for the diurnal evaporative tests and the tip tests. Fuel tank temperature is only controlled for the pressure relief option in Section 6.4.2. Therefore, disregard all sections pertaining to fuel tank temperature monitoring and fuel tank temperature management systems except as required.

3.1.1.1 If showing compliance with a pressurized fuel tank, revise subparagraph 40 CFR §86.107-96(e), (Temperature Recording System) to read: In addition to the specifications in this section, the vapor temperature in the fuel tank must 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 (e.g. saddle tank), 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 Executive Officer may approve alternate sensor locations where the specifications above cannot be met or where tank symmetry provides redundant measurements.

3.2 Dynamometer

3.2.1 The chassis dynamometer shall meet the requirements of 40 CFR §86.508-78, 40 CFR §86.108-00, or 40 CFR §86.108-79 as long as it is capable of accurately simulating the test weight of the vehicle.

3.2.2 The chassis dynamometer shall be calibrated according to the requirements used in 3.2.1 above. The calibration shall be conducted at a temperature of 86°F ±3°F.

3.3 Fuel Vapor and Alcohol Hydrocarbon Analyzer

The fuel vapor and alcohol hydrocarbon analyzer shall meet the requirements specified in 40 CFR §86.107-96(b). As described in Section 7, ethanol measurements may be omitted if the calculated mass of hydrocarbon emissions is multiplied by an adjustment factor that accounts for alcohol vapor.

3.4 Test Data Recording System

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

a) Cell/enclosure ambient temperature
b) If applicable, temperatures of vehicle fuel tank liquid (T_{liq}) and vapor space (T_{vap})
c) If applicable, vehicle fuel tank headspace pressure
d) If applicable, dynamometer roll speed
e) Flame Ionization Detector (FID) output voltage recording the following parameters for each sample analysis:
    1) zero gas and span gas adjustments
    2) zero gas reading
    3) If applicable, dilute sample bag reading
    4) If applicable, dilution air sample bag reading
    5) zero gas and span gas readings
f) Ethanol sampling data including the:
    1) volumes of deionized water introduced into each impinger
    2) rate and time of sample collection
    3) volumes of each sample introduced into the gas chromatograph
    4) flow rate of carrier gas through the column
    5) column temperature
    6) chromatogram of the analyzed sample

3.5 Carbon Canister Bench Aging Equipment

Carbon canister bench aging equipment shall meet the requirements specified in Section 4.1 of this procedure.

3.6 Carbon Canister Test Bench

The carbon canister test bench or associated combination of testing equipment shall meet the requirements specified in Section 5.2 of this procedure.

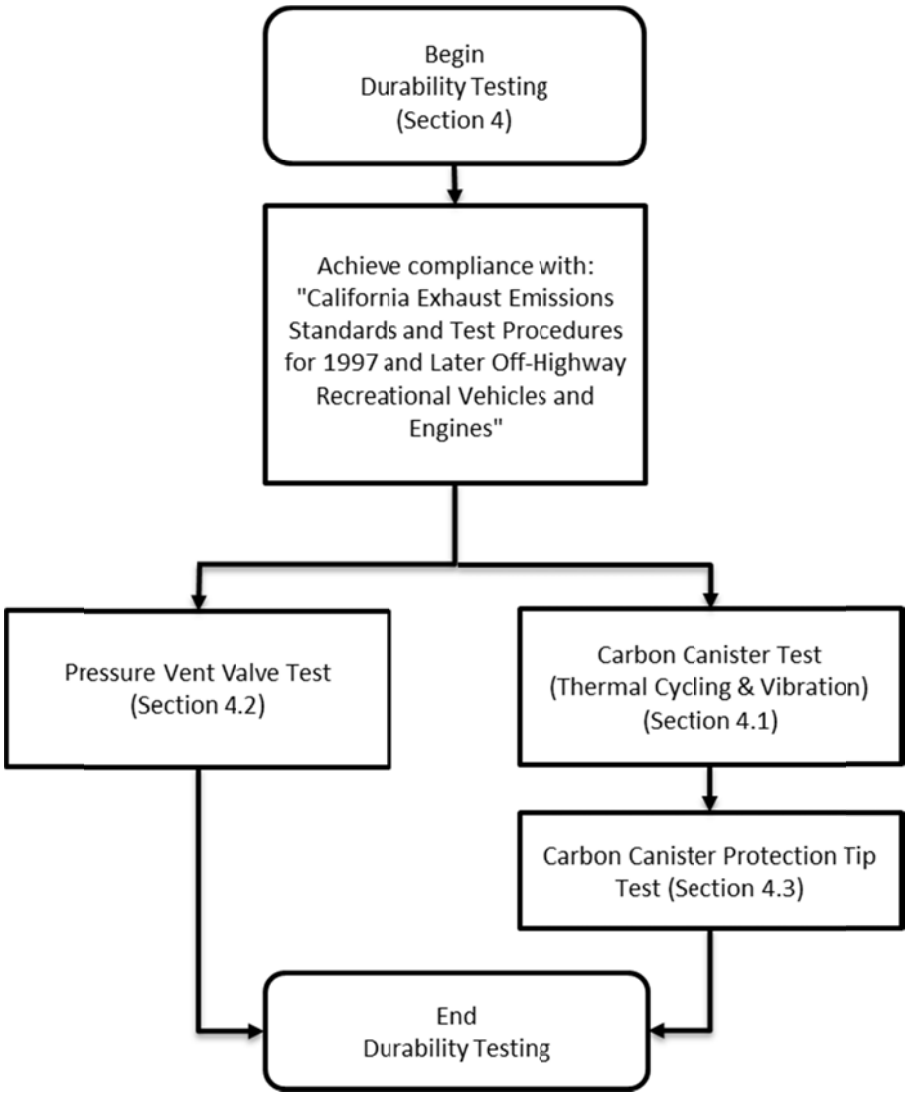
4 DURABILITY TESTING

Certification of an OHRV evaporative emission control system requires a manufacturer to first demonstrate the durability of each evaporative emission control system family. This is required prior to performing the evaporative emissions test described in Section 6 to ensure the vehicle will meet evaporative emissions standards over the useful life of the vehicle. The evaporative emission control system must satisfy durability requirements as prescribed in “901 ” as amended, July 16, 2007, and incorporated here by reference. This must be done before proceeding to the durability testing section of this procedure, unless each evaporative emissions-related part has undergone durability testing for exhaust in another model of the same vehicle as specified in *California Exhaust Emissions Standards And Test Procedures For 1997 And Later Off-Highway Recreational Vehicles And Engines*, California Environmental Protection Agency, Air Resources Board, El Monte, CA, August 15, 2007 and incorporated here by reference.

In addition, OHRV manufacturers must comply with the durability requirements in Sections 4.1 through 4.3 of this test procedure or get approval for ARB for an alternative durability procedure. Carry-over and carry-across of deterioration factors may be allowed for systems

using components that have successfully completed durability testing. Applicants shall be allowed to proceed to Section 5 of this test procedure if they remain free of defects after the durability tests prescribed below. An applicant may propose modifications to the durability tests in this section if they can clearly demonstrate that the alternative durability test procedures are representative of end of useful life. Durability testing shall include the steps outlined in Figure 2.

Figure 2: Durability Flow Chart



4.1 Carbon Canister Test

For systems that utilize a carbon canister, the durability test procedures shall include thermal cycling and vibration exposure of the canister.

4.1.1 For thermal cycling, the test must subject the canister to 100 cycles of the following temperature profile:

4.1.1.1 Heat and hold at 140ºF ±4ºF for 30 minutes. (Up to 10 minutes is allowed for the temperature to rise and stabilize)

4.1.1.2 Cool and hold at 32ºF ±4ºF for 30 minutes. (Up to 20 minutes is allowed for the temperature to reach 32ºF during the cooling period)

4.1.2 For the vibration test, the canister must be subject to a peak horizontal acceleration of 4.5 x gravitational acceleration (g – 9.8 meters per second squared) at 60 Hertz (Hz) with a total of 10,000,000 cycles. The orientation of the canister, while being subject to vibration, must be the same as when mounted on the vehicle during normal use. If the canister is mounted on the vehicle using a vibration isolation system, the canister may be mounted in a test rig using the same vibration isolation system for conducting the test.

4.2 Pressure Vent Valve

If the fuel system employs a fuel vapor pressure vent valve, prior to the time of submission of a certification application, the applicant is required to submit and obtain approval of an evaporative emission durability test procedure for the pressure vent valve. The procedure shall have provisions to demonstrate durability after exposure to ultraviolet (UV) light, ozone, vibration and dust. Once approved, the pressure vent valve durability procedure may be used by any applicant using a similar pressure vent valve.

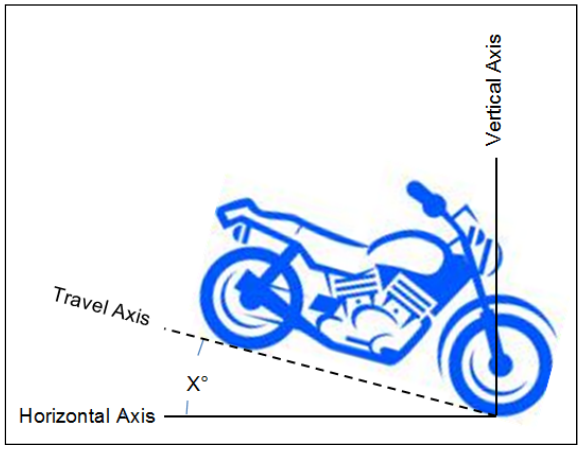
4.3 Carbon Canister Protection - Tip Test

The carbon canister protection tip test can be conducted with a vehicle or with a test rig that represents the actual position and orientation of the fuel system components. The fuel tank must be filled to 100 percent of nominal capacity with certification fuel.

4.3.1 Orient the vehicle such that the travel axis is tilted X degrees above and below the horizontal plane. See Figure 3 for a schematic. Hold the vehicle for at least 1 minute in both the positive and negative position. X shall be as defined as follows:

a) 30° ±2° for off-road motorcycles.
b) 30° ±2° for all other OHRVs.

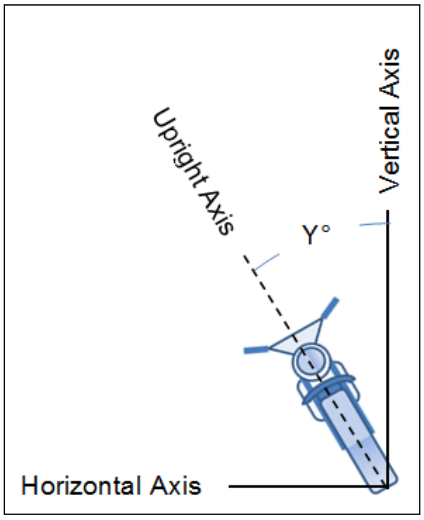
Figure 3: Horizontal Tilt



4.3.2 Orient the vehicle such that the upright axis is tilted Y degrees from the vertical axis with rotation being about the travel axis. See Figure 4 for a schematic. Hold this position in both the positive and negative position for at least 1 minute each. Y shall be as defined as follows:

a) Unsupported position on either side for off-road motorcycles (i.e., vehicle lying on its side).
b) 15° ±2° for all other OHRVs.

Figure 4: Vertical Tilt



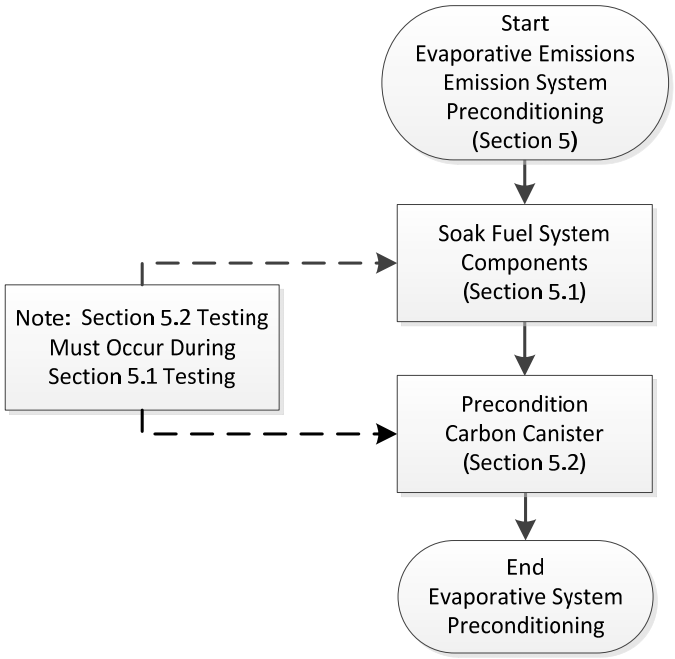
The weight of the vehicle's carbon canister must be measured before and after the tests specified in this section to determine weight gain. If the weight gain is 10 percent of the butane working capacity or more, the vehicle fails the test.

Alternative carbon canister protection tip tests may be submitted for approval. All proposed alternatives to the carbon canister protection tip test must show that the carbon canister functions as it should at the end of useful life, while subjecting it to the potential for liquid gasoline contamination consistent with vehicle usage. As a guideline, all alternative carbon canister tip tests should include real world liquid fuel exposure (e.g. volumes, rates, and total events), real world purges (e.g., rates and bed volumes), and use of a damaged canister during testing as described in this procedure.

5 EVAPORATIVE EMSSIONS SYSTEM PRECONDITIONING

The purpose of the preconditioning period is to introduce test fuel into the fuel system and condition all fuel system components to in-use conditions. Evaporative system preconditioning can be done in conjunction with mileage accumulation for exhaust testing as long as the fuel system has continuously held evaporative test fuel E10 (Commercial Pump Fuel containing 10 percent ethanol) for a total 140 days. E10 pump fuel may only be used for the portion of the soaking period; however, fuel must be switched to E10 certification fuel for a minimum of 30 days prior to testing. The preconditioning procedure shall include the steps outlined in Figure 5.

Figure 5: Preconditioning Flowchart



5.1 Soak Fuel System Components

Precondition the tank and other fuel delivery system components by filling the tank to its nominal capacity with fresh test fuel. Cap the tank within one minute of filling. After filling the tank, start the vehicle engine and allow it to idle for approximately fifteen minutes. Soak the tank and other components continuously for a total of 3,360 hours while maintaining an ambient temperature between 68ºF and 86ºF. Alternatively, components may be preconditioned using a fuel system test rig. The test rig must include all the components of the fuel and evaporative emissions control system connected and oriented as they would be installed in the vehicle. The tank and fuel lines must be filled with certification fuel at the beginning of the test. A fuel system may be soaked for less than 3,360 hours if data is provided using one of the following two documents incorporated by reference: “TP-901 - Test Procedure for Determining Permeation Emissions from Small Off-Road Engines and Equipment Fuel Tanks” adopted July 26, 2004 or 40 CFR §1060.520 which was adopted on October 8, 2008 that shows steady state permeation has been reached. If slosh testing is required, the slosh time may be considered part of the preconditioning period, provided all fuel system components tested remain filled with fuel, and are never empty for more than one hour over the entire preconditioning period.

If the fuel system is allowed to sit more than 6 weeks at 68°F to 86°F, a 1-week presoak must be conducted with fresh fuel before testing begins. The fresh fuel presoak can be counted as part of the 3,360-hour soak, so long as the fuel system is empty less than one hour.

Prior to beginning any test sequence to measure running loss, hot soak, or diurnal emissions, a vehicle may, at the manufacturer’s option, be preconditioned to minimize non-fuel emissions by being soaked at an elevated temperature prior to testing. To ensure steady state permeation rates, the vehicle must be soaked for at least 7 days at a temperature no higher than 95°F immediately prior to emissions testing.

5.2 Precondition Carbon Canister

For systems that utilize carbon canisters, Subsections 5.2.2 through 5.2.4 of the preconditioning sequence must be completed no sooner than 96 hours preceding the beginning of the evaporative emission test procedure described in Section 6 at 86° ±3°F.

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 must be preconditioned separately. If production evaporative canisters are equipped with a functional service port designed for vapor load or purge steps, the service port shall be used to precondition the canister.

The following steps shall be performed in preconditioning the carbon canister:

5.2.1 Determine the canister's nominal working capacity based on the average capacity of no less than five canisters. These five canisters shall be the same as the canister on the vehicle undergoing testing. A manufacturer may use the butane working capacity provided by the canister vendor, if the vendor certifies that the working capacity has been determined using the following procedures:

a) Each canister must be loaded no less than 10 times and no more than 100 times, to 2 gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ±2 grams butane per hour per liter of canister volume. Each canister loading step must be preceded by canister purging with 300 canister bed volume exchanges at 0.8 cubic feet per minute (cfm) per liter of canister volume.

b) Each canister must first be purged with 300 canister bed volume exchanges at 0.8 cfm per liter of canister volume. The working capacity of each canister shall be established by determining the mass of butane required to load the canister from the purged state so that it emits 2 grams of hydrocarbon vapor; the canister must be loaded with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ±2 grams butane per hour per liter of canister volume.

5.2.2 Prepare the vehicle’s evaporative emission canister 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 to avoid damage to the components and the integrity of the fuel system. A replacement canister may be temporarily installed during the soak period while the canister from the test vehicle is preconditioned.

5.2.3 The canister purge shall be performed with ambient air of humidity controlled to 50 ±25 grains per pound of dry air. This may be accomplished by purging the canister in a room that is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal flow rate of 0.8 cfm per liter of canister volume and the duration shall be determined to provide a total purge volume flow through the canister equivalent to 300 canister bed volume exchanges. The bed volume is based on the volume of adsorbing material in the canister.

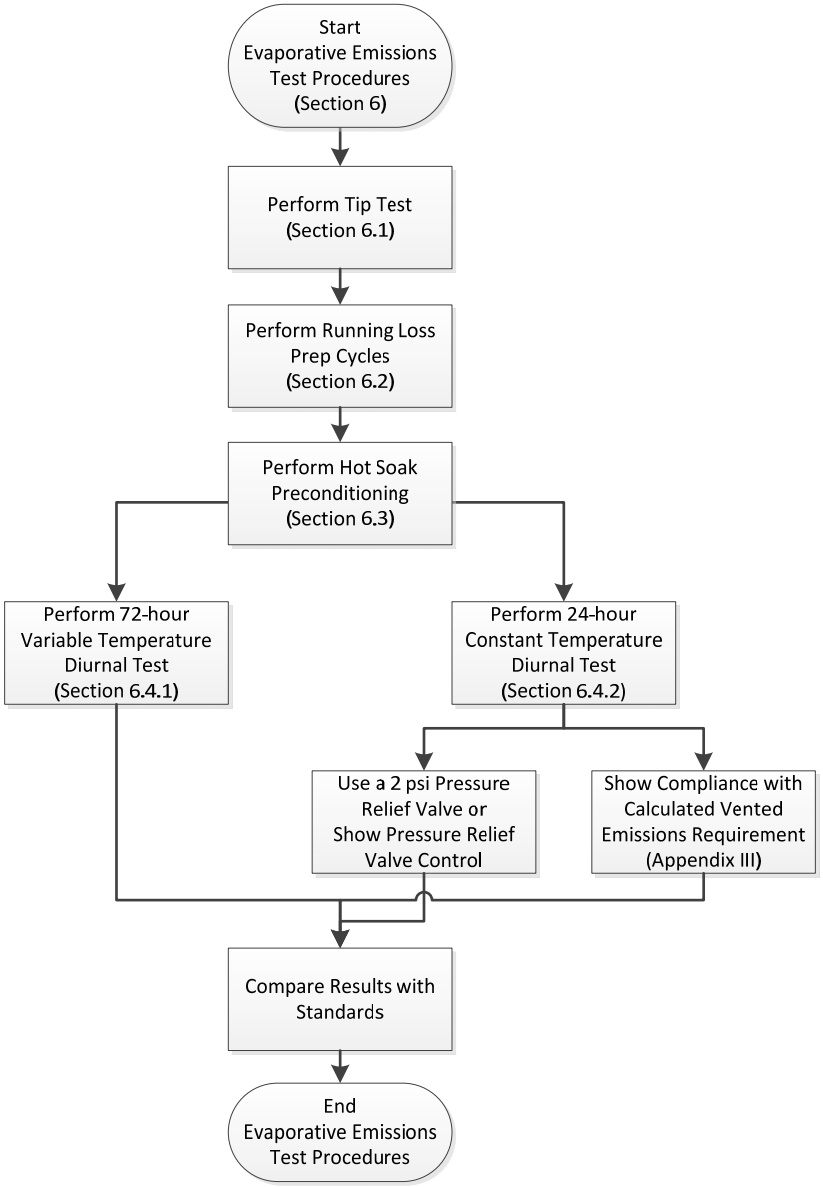
5.2.4 The evaporative emission canister shall then be loaded by sending to the canister an amount of commercial grade butane vapors equivalent to 1.5 times its nominal working capacity. The canister shall be loaded with a mixture composed of 50 percent butane and 50 percent nitrogen by volume at a rate of 15 ±2 grams butane per hour per liter of

canister volume. If the canister loading at that 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. The new rate may be used for all subsequent canister loading within this preconditioning. The time of initiation and completion of the canister loading shall be recorded.

6 EVAPORATIVE EMISSIONS TEST PROCEDURES

The Evaporative Emissions Test Procedures shall include the steps outlined in Figure 6.

Figure 6: Evaporative Emissions Testing Flowchart

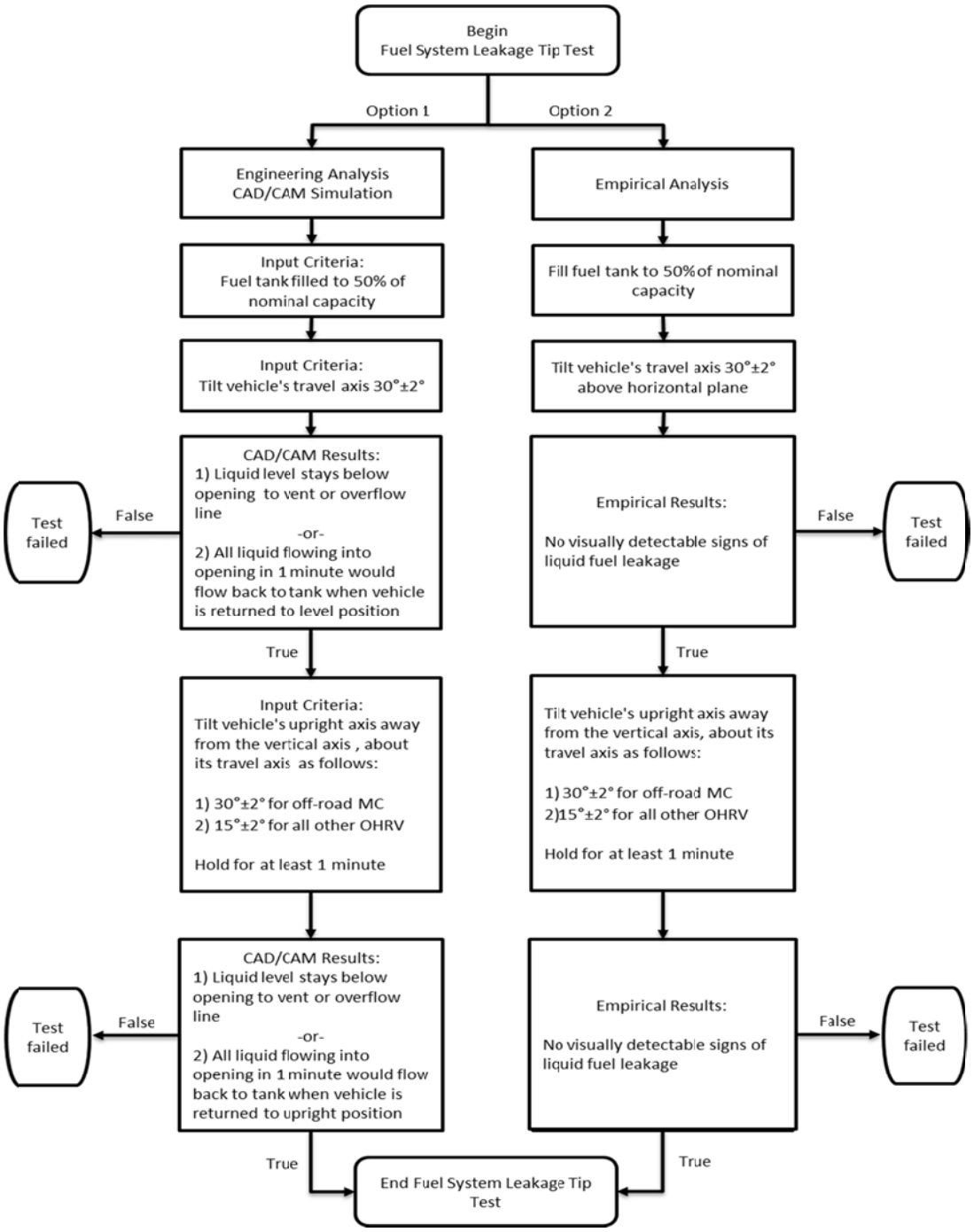


6.1 Fuel System Leakage Tip Test

The fuel system leakage tip test shall be performed during the soak specified in Subsection 6.2.1.5. The fuel tank must be filled to 50 percent with certification fuel. During

the test the vehicle is tipped to inspect for visible signs of liquid leakage. If any test fuel leakage is observed, then the vehicle fails the test. See Figure 7 for a summary of the steps in the fuel system leakage tip test.

Figure 7: Fuel System Leakage Tip Test Flow Chart



An engineering analysis may be performed as an alternative to the tests described in this section. The analysis must demonstrate that zero liquid leakage will occur within one minute when the vehicle, with the gasoline tank filled to 50 percent of rated capacity, is tipped as specified in Subsection 6.1.

To perform the analysis, a Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) design program may be used to determine the level of fuel in the system that would occur when the tank is filled to 50 percent of its nominal capacity. To demonstrate compliance, the height of the fuel surface when the vehicle is tilted must be below the height of any opening to a vent or overflow line or it must be demonstrated that the total volume of fuel flowing into the opening in one minute would flow back into the fuel tank when the vehicle is returned to a level surface.

All tip measurements shall be made to an accuracy of ±1° of arc.

The tip test shall be conducted with the vehicle on a level surface as described below:

6.1.1 Orient the vehicle such that the travel axis is tilted X degrees above and below the horizontal plane. See Figure 3 for a schematic. Hold the vehicle for at least 1 minute in both the positive and negative position. Note any visible signs of fuel leakage. X shall be as defined as follows:

a) 30° ±2° for off-road motorcycles.
b) 30° ±2° for all other OHRVs.

6.2 Running Loss Conditioning

The running loss test is designed to simulate vehicle operation and canister purging during operation. Follow the dynamometer schedules in 40 CFR §86.515-78, incorporated here by reference. For the purpose of this running loss conditioning, all soak and test temperatures are 86° ±3°F.

6.2.1 The following steps shall be performed before beginning the running loss test:

6.2.1.1 The fuel tank of the vehicle to be tested shall be drained and refilled to 50 percent with test fuel.

6.2.1.2 Soak for at least 6 hours after being refueled. Following this soak period, conduct a refueling cycle by running the test vehicle through one Urban Dynamometer Driving Schedule (UDDS) driving cycle. The drain and fill and 6-hour soak may be omitted on subsequent tests of the vehicle if the vehicle remains under laboratory temperatures between tests. The later test preconditioning will begin with Subsection 6.2.1.5.

6.2.1.3 Install fuel temperature sensors as needed.

6.2.1.4 Drain and refill the fuel tank of the vehicle to 50 percent with test fuel.

6.2.1.5 Soak the vehicle with the key off for 12 to 36 hours between the end of the refueling and the start of the cold start preconditioning cycle.

6.2.1.6 During the soak period, perform the tip test specified in Subsection 6.1 and purge and load the evaporative control system canister using the procedures defined in Sections 5.2.2, 5.2.3, and 5.2.4. The evaporative control system canister is not required to be installed while performing the tip test specified in Subsection 6.1.

6.2.1.7 The location and speed of a fan used to cool the vehicle must comply with the requirements described in Appendix B.

6.2.1.8 The speed profile is the United Stated Environmental Protection Agency (U. S. EPA) UDDS as specified in 40 CFR §86.515-78. The same cycle (Class I or Class II) must be used as is required for exhaust emissions

certification. The steady state engine test for All-Terrain Vehicles (ATV) is not allowed for this test procedure.

6.2.1.9 Perform a cold start UDDS preconditioning cycle on the dynamometer.

6.2.1.10 Perform a hot start UDDS preconditioning cycle on the dynamometer.

Following the completion of the running loss preconditioning, a hot soak preconditioning must be conducted as specified in Subsection 6.3.

6.3 Hot Soak Preconditioning

The hot soak evaporative emission preconditioning is designed to soak the OHRV after operation. The test temperature for the hot soak is 86° ±3°F.

6.3.1 The hot soak must be performed within 7 minutes of the completion of the UDDS hot start cycle, performed in Subsection 6.2.

6.3.2 Turn off all engine cooling fans when the engine is turned off.

6.3.3 During the time between the end of the UDDS hot start cycle and the beginning of the hot soak preconditioning, the engine is allowed to be shut off for no more than 4 minutes immediately preceding the start of the hot soak preconditioning.

6.3.4 Soak the OHRV at 86° ±3°F for 90 ±0.5 minutes.

6.3.5 If the Calculation Method is to be used for the diurnal test, the carbon canister must be removed immediately following the hot soak test and the butane working capacity must be determined by loading the canister to 2 gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ±2 grams butane per hour per liter of canister volume.

6.3.6 Upon completion of the hot soak test, proceed to the diurnal test in Subsection 6.4.

6.4 Diurnal Test

Upon completion of the hot soak, the diurnal test shall begin. The diurnal test can be conducted by direct measurement of three consecutive 24-hour diurnal tests (72-hour diurnal test) or by measuring emissions for a single 24-hour diurnal test and showing vented emissions compliance (steady state diurnal test) as described in Sections 6.4.1 and 6.4.2, respectively.

6.4.1 72-Hour Diurnal Test - Begin the 3-day diurnal test by lowering the temperature of the enclosure in which the diurnal test will be performed to 72° ±3°F within 60 minutes of completing the hot soak test. Diurnal soak period is 6 to 36 hours at 72° ±3°F. Perform the diurnal test procedure described in 40 CFR §86.133-96, incorporated her by reference with the following exceptions.

6.4.1.1 When the word "methanol" or the term C_{CH3OH} (methanol concentration) is used, it shall be replaced by ethanol or the term C_{C2H5OH} (ethanol concentration).

6.4.1.2 All references to the hot soak test performed in 40 CFR §86.138-96 shall mean the hot soak conditioning previously described in Section 6.3 of this procedure.

6.4.1.3 All references to the calculations performed in 40 CFR §86.143 shall be replaced with the calculations performed in Section 7 of this procedure.

6.4.1.4 Omit the following language from Section (a)(1), “The diurnal emission test may be conducted as part of either the three-diurnal test sequence or the

supplemental two-diurnal test sequence, as described in 40 CFR §86.130-96."

6.4.1.5 Omit Section (a)(3), and all of Sections (j), (o) and (p).

6.4.1.6 Omit the following language from Section (e), "…and the test vehicle windows and luggage compartment(s) opened…".

6.4.1.7 Revise Section (i)(5) as follows, "Within 10 minutes of closing and sealing the test enclosure doors, analyze enclosure atmosphere for hydrocarbons and record. This is the initial (time=0 minutes) hydrocarbon concentration, CHC_i, required in Section 7 of this procedure. The final hydrocarbon measurement shall be conducted no more than 60 seconds from the end of the test."

6.4.1.8 Omit the following language from Section (n), "…the test vehicle windows and luggage compartments may be closed …".

6.4.2 Steady State Diurnal Test

The purpose of the steady state diurnal test is to demonstrate control of permeation emissions and to verify proper evaporative emissions system construction.

6.4.2.1 Perform the diurnal test as defined in Subsection 6.4.1 except:

6.4.2.2 Attach vent line(s) to air-port(s) of carbon canister(s) that will direct any air/vapor exiting the canister to the exterior of the test enclosure. This air/vapor need not be measured.

6.4.2.3 The test shall be conducted at a constant temperature of 86° ±3°F.

6.4.2.4 A single steady state 24-hour diurnal is required.

6.4.2.5 Compliance is shown if the emissions measured in this section are lower than the standard and either of the following can be shown:

a) Calculate maximum gasoline vapor loading and show that the carbon canister is operating in the range where it is at least 99.5 percent effective (0.5 percent bleed emissions) based on best modeling practices. The best modeling practices method must be accepted by ARB staff prior to certification or follow the requirements in Appendix A of this test procedure.

b) The OHRV uses a pressure relief valve which does not release vapor from the tank up to 2 pounds per square inch gauge (psig).

c) The OHRV uses a pressure relief valve which does not release vapor from the tank during the second of two consecutive 24-hour diurnal temperature cycles from 72°F to 96°F. The fuel temperature must be below the boiling point for test fuel and the pressure relief valve must not open during both the running loss and hot soak conditioning or it has to vent to the intake.

Change "either" to "any" because there are now three options, a), b), and c).

7 CALCULATIONS: EVAPORATIVE EMISSIONS

Total mass emissions from Subsection 6.4.1 must be calculated using the measurements of initial and final concentrations to determine the mass of hydrocarbons and ethanol emitted pursuant to "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as amended, March 22, 2012, Parts III.D.11. Alternatively, ethanol measurements may be omitted if the calculated mass of hydrocarbon emissions is multiplied by a percentage adjustment factor equal to:

E10 adjustment factor = (100% - 0.5 x % fuel alcohol content) x (1 + (%ethanol x 3))

(e.g., for E10 adjustment factor = (100% - 0.5 x 10%) x 1.3= 124%)

For OHRVs, the vehicle volume is assumed to be 5 cubic feet (1.42 cubic meters) unless the

manufacturer provides a measured OHRV volume.

8 LIST OF TERMS

ARB	California Air Resources Board
ATV	All-Terrain Vehicle
CAD/CAM	Computer-Aided Design/Computer-Aided Manufacturing
C_{C2H5OH}	Ethanol concentration
C_{CH3OH}	Methanol concentration
CCR	California Code of Regulations
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CH&SC	California Health and Safety Code
^oC	Degrees Celsius
^oF	Degrees Fahrenheit
E10	Commercial Pump Fuel containing 10 percent ethanol
HC	Hydrocarbon
HZ	Hertz
KM/H	Kilometers per Hour
MC	Motorcycle
MPH	Miles Per Hour
OHRV	Off-Highway Recreational Vehicle
PSIG	Pounds per Square Inch – Gauge
T_{liq}	Fuel tank liquid temperature
T_{vap}	Fuel tank vapor space temperature
TP	Test Procedure
TP-933	Test Procedure for determining evaporative emissions from off-highway recreational vehicles
UV	Ultraviolet
UDDS	U.S. EPA Urban Dynamometer Driving Schedule

9 DOCUMENTS INCORPORATED BY REFERENCE

California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, California Environmental Protection Agency, Air Resources Board, El Monte, CA, March 22, 2012.

California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles, California Environmental Protection Agency, Air Resources Board, El Monte, CA, March 22, 2012.

California Exhaust Emissions Standards And Test Procedures For 1997 And Later Off-Highway Recreational Vehicles And Engines, California Environmental Protection Agency, Air Resources Board, El Monte, CA, August 15, 2007.

Control of Emissions from New and In-Use Highway Vehicles and Engines. Title 40, Code of Federal Regulations, Part 86. United States Environmental Protection Agency, Subpart 107-96, 108-79, 108-00, and 508-78.

Reddy, S. Raghuma. Prediction of Fuel Vapor Generation From a Vehicle Fuel Tank as a Function of Fuel RVP and Temperature. SAE Technical Paper 892089, September 25-28,1989. Copyrighted.

Test Procedure for Determining Permeation Emissions from Small Off-Road Engine and Equipment Fuel Tanks, TP-901, California Environmental Protection Agency, Air Resources Board, Sacramento, CA, July 26, 2004.

10 APPENDICES

10.1 Appendix A - Calculation Method for Demonstrating the Adequacies of the Vented Evaporative Emissions System

The calculations in this section are based on the ideal gas law, and equations generated in *SAE 892089- Prediction of Fuel Vapor Generation From a Vehicle Fuel Tank as a Function of Fuel RVP and Temperature* adopted September 25-28, 1989 and incorporated here by reference. All final results should be calculated to two significant figures.

Figure A-1: Calculations Flow Chart

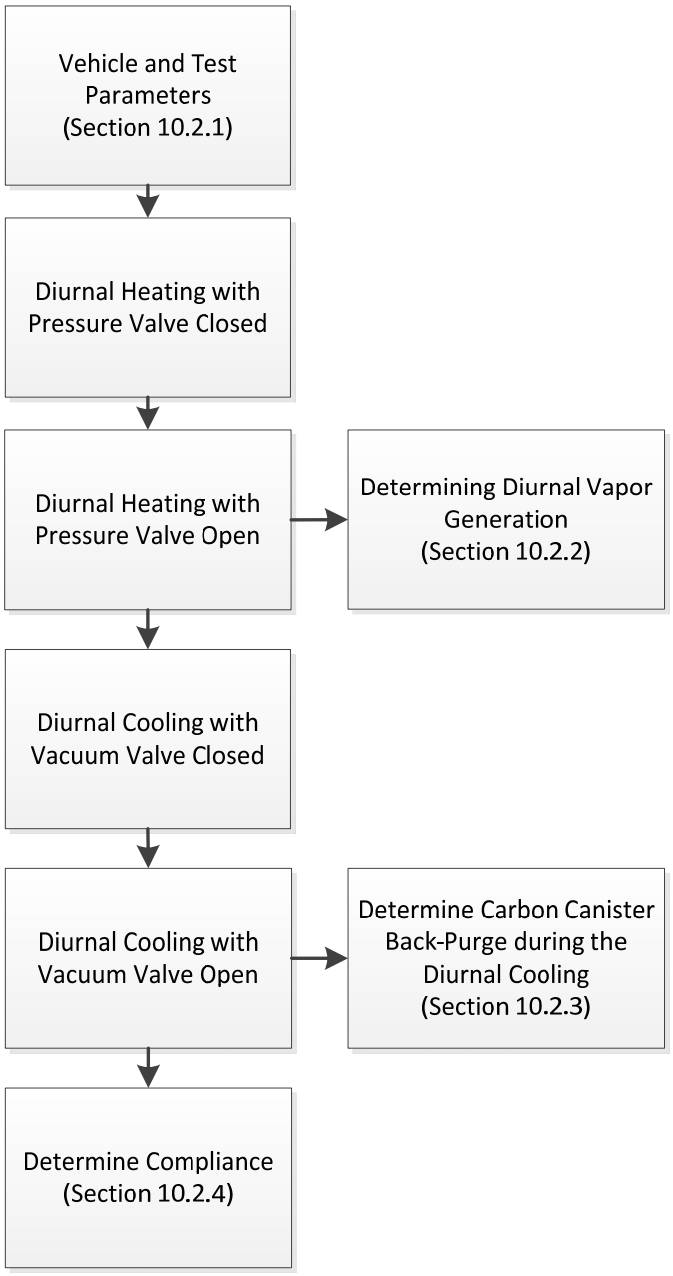
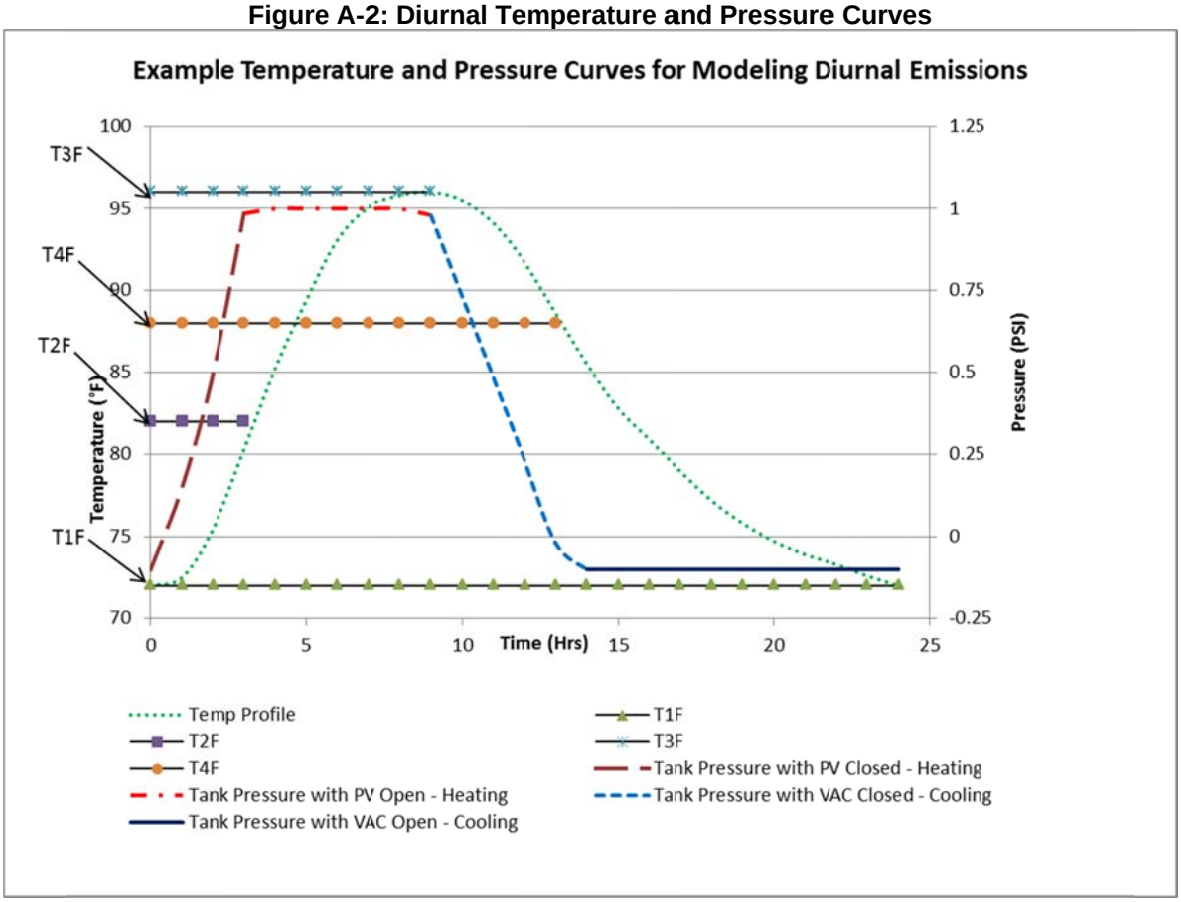


Figure A-2: Diurnal Temperature and Pressure Curves



10.1.1 Vehicle and Test Parameters

a. Fuel Volume Information

_____	(gal)	V_t	Total Volume of Fuel Tank
_____	(gal)	V_u	Usable Volume of Fuel Tank
_____	(gal)	V_i	Initial Fill Volume of Fuel Tank
_____	(gal)	V_{FP}	Fuel Used During Prep
_____	(gal)	V_{FR}	Fuel Used During Run Loss

EXAMPLE:

2.1	*(gal)*	V_t	*Total Volume of Fuel Tank*
2	*(gal)*	V_u	*Usable Volume of Fuel Tank*
1	*(gal)*	V_i	*Initial Fill Volume of Fuel Tank*
0.1	*(gal)*	V_{FP}	*Fuel Used During Prep*
0.1	*(gal)*	V_{FR}	*Fuel Used During Run Loss*

b. List of Temperatures

T1K = Initial/Final Diurnal Temperature (°K)
T2K = Temperature where Pressure Relief Valve Opens (°K)

T3K = Highest Diurnal Temperature (°K)
T4K = Temperature at which vacuum valve opens (°K)

c. Pressure Control Settings

_____	(psig)	P_{VO}	Opening Pressure
_____	(psig)	VAC_{VO}	Vacuum Opening Pressure

EXAMPLE:

1	*(psig)*	*P_{VO}*	*Opening Pressure*
0.1	*(psig)*	*VAC_{VO}*	*Vacuum Opening Pressure*

d. Fuel Reid Vapor Pressure (RVP)

_____	(psi)	RVP

EXAMPLE:

7	*(psi)*	*RVP*

e. Preconditioned Carbon Canister Specifications
The carbon canister must be preconditioned as specified in subsection 5.2. Butane working capacity of a carbon canister must be established at 2-grams break through using “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as amended March 22, 2012, with the flow rates and temperatures specified in subsection 5.2.

_____	(cc)	BV	Carbon Bed Volume
_____	(g/canister)	TBWC	Total Equilibrated Butane Working Capacity
_____	(g/100cc)	BWC	Butane Working Capacity of Carbon
_____	(g/100cc)	GWC	Gasoline Capacity per Volume of Carbon

EXAMPLE:

122	*(cc)*	*BV*	*Carbon Bed Volume*
9.5	*(g/canister)*	*TBWC*	*Total Equilibrated Butane Working Capacity*
7.8	*(g/100cc)*	*BWC*	*Butane Working Capacity of Carbon*
8.2	*(g/100cc)*	*GWC*	*Gasoline Capacity per Volume of Carbon*

f. Determine the Total Gasoline Working Capacity (TGWC) of Canister

The TGWC is the total mass of gasoline vapor that a purged canister can expect to hold. TGWC is determined by direct measurement similar to TBWC but using an aged canister vapor from gasoline at 96°F instead of butane, or by calculating TGWC using canister bed volume, BWC and GWC.

TGWC of Canister

TGWC= TBWC * GWC / BWC = _____*_____/_____

Where,
GWC, TBWC, BWC = (From Section 10.1.1.e)

EXAMPLE:
*TGWC= 9.5*8.2/7.8 = 10g/canister*

g. Determine Vapor Space Volume of Fuel Tank at end of all Prep Cycles (V_p)

$V_p = V_t - V_i + V_{FP} + V_{FR}$

V_p = _____ – _____ + _____ + _____

Where,
V_t, V_i, V_{FP}, V_{FR} = (From Section 10.1.1.a)

EXAMPLE:

V_p=2.1-1+0.1+0.1=1.3

h. Determine Carbon Canister Gasoline Vapor Capacity at Beginning of Diurnal Test ($TGWC_{di}$)

The carbon canister gasoline vapor capacity at the beginning of the diurnal test is the total mass of gasoline vapor that the canister can expect to hold at the beginning of the diurnal test. $TGWC_{di}$ is determined by direct measurement similar to BWC (Section 6.3.5) but using vapor from gasoline at 96°F instead of butane, or calculate using canister bed volume and measured butane capacity at the beginning of the diurnal test ($TBWC_{di}$).

$TGWC_{di}$ = measured gasoline vapor capacity at beginning of diurnal test
$TGWC_{di} = (GWC/BWC)*TBWC_{di}$ = _____/_____*_____

$TGWC_{di}$ = _____

EXAMPLE:
$TGWC_{di}$ *Measured to be = 7g*

10.1.2 Determining Diurnal Vapor Generation

Vapor generation occurs as a result of temperature increase of the fuel in the fuel tank. Vapor emissions occur when the generated vapor is able to exit the fuel tank. If the system does not use a pressure relief system, vapor emissions will occur during the entire diurnal heating stage from 72°F to 96°F. If the system uses a pressure relief system, the emissions occur only at temperatures where fuel tank pressures exceed the relief pressure. If such a tank system is employed, the temperature at which the relief valve opens must be determined.

a. Calculate gasoline vapor pressure at lowest temperature of diurnal cycle (72°F or 22.2°C)

Vapor pressure

$$P_{tgasoline}(T1K) = A * T1K * RVP * e^{\frac{-B}{T1K}}$$

Where,
T1K = 22.2° C + 273.2 K = 295.4 K
$A = 25.61$
$B = 2789.78$
RVP = (From Section 10.1.1.d)

EXAMPLE:

$P_{tgasoline}(72°F) = 25.61 * 295.4 * 7 * e^{\frac{-2789.79}{295.4}} = 4.19\ psi$

b. Determine partial pressure of air in the fuel tank at lowest temperature of diurnal cycle.

$P_{air}(72°F) = P_{atm} – VAC_{VO} – P_{tgasoline}(72°F)$

$P_{air}(72°F) =$ _____ – _____ – _____

Where,
P_{atm} = 14.7 psi
VAC_{vo} = (From Section 10.1.1.c)
$P_{tgasoline}$ (72ºF) = (From Section 10.1.2.a)

EXAMPLE:
$P_{air}(T1) = 14.7 - 0.1 - 4.19 = 10.4$ psi

Find the temperature (T2) at which the relief valve opens. This will be where the internal tank pressure equals atmospheric pressure plus the pressure relief valve. If no pressure control system is used T2 equals 72°F.

Solve using numerical analysis to find a value for T2K where:

P_{tank}(pres. Open) = $P_{atm} + P_{vo} = P_{tgasoline}(T2K) + P_{air}(T2K)$

Where,

$$P_{tgasoline}(T2K) = A * T2K * RVP * e^{-\frac{B}{T2K}}$$

$$P_{air}(T2K) = \frac{T2K * P_{air}(T1K)}{T1K}$$

RVP = (From Section 10.1.1.d)
P_{vo}= (From Section 10.1.1.c)

EXAMPLE:
Assume T2F is 82°F (301°K)
$P_{tgasoline}(301K) = 25.61*301*7*e^{(2789.78/301)}=5.1$ psi
$P_{air}(301K) = (301*10.4)/295.4 = 10.6$

$P_{tgasoline}$(301K) + P_{air}(301K) = 10.6 + 5.1 = 15.7psi = 14.7+1
Therefore, T2F=82°F

c. Using the Reddy Vapor Generation equation, determine the vapor generation in grams per gallon for a diurnal cycle from T2, for systems with pressure relief, to T3.

$$\mathrm{VAPOR_{diurnal}} = \mathrm{C} * \mathrm{e}^{\mathrm{D}*\mathrm{RVP}} * (\mathrm{e}^{\mathrm{E}*\mathrm{T3}} - \mathrm{e}^{\mathrm{E}*\mathrm{T2}})$$

Where,
$\mathrm{C} = 0.00817$
$\mathrm{D} = 0.2357$
$\mathrm{E} = 0.0409$
T2 (F) = (From Section 10.1.2.c, converted to °F)
T3 (F) = max diurnal (96°F)
V_p = (From Section 10.1.1.g)
RVP = (From Section 10.1.1.d)

Vapor generation for a non-pressurized system using a 72°F to 96°F temperature profile at sea level with 7 RVP fuel simplifies to:

$VAPOR_{diurnal}$= 1.35 g/gal

<u>EXAMPLE:</u>
*$VAPOR_{diurnal}$ = 0.00817*e^(0.2357*7)*(e^(0.0409*96)-e(0.0409*82)) = 0.94g/gal*

10.1.3 Determine Carbon Canister Back-Purge During the Diurnal Cooling

The weight of hydrocarbon vapor back purged (passively purged) from the canister during diurnal cooling steps is a function of the volume of air drawn into the fuel tank as it cools. The amount of air purging the canister will be the difference between the air volume in the fuel tank at the end of cooling less the amount in the tank when the air first begins to enter the tank. In a system that does not employ a pressure relief/vacuum valve system, the flow of air begins as soon as the cooling starts. In a system that employs pressure control, the air flow begins when the in tank pressure equals atmospheric pressure less the opening pressure of the vacuum relief valve. The following calculations provide a calculation method appropriate for either type of system.

a. Calculate gasoline vapor pressure at the highest temperature of the diurnal cycle (96°F or 36.6°C)

Vapor pressure

$$\mathrm{P_{tgasoline}}(96°\mathrm{F}) = \mathrm{A} * \mathrm{T3K} * \mathrm{RVP} * \mathrm{e}^{\frac{-\mathrm{B}}{\mathrm{T3K}}}$$

Where,
$\mathrm{T3K} = 35.6°\mathrm{C} + 273\mathrm{K} = 308.75\mathrm{K}$
$\mathrm{A} = 25.61$
$\mathrm{B} = 2789.78$

RVP = (From Section 10.1.1.d)

EXAMPLE:

$P_{tgasoline}(96°F) = 25.61 * 308.75 * 7 * e^{\frac{-2789.79}{308.75}} = 6.59\ psi$

b. Determine partial pressure of air in the fuel tank at the highest temperature of the diurnal cycle.

$$\mathrm{Pair}(96°\mathrm{F}) = \mathrm{P_{atm}} + \mathrm{P_{vo}} - \mathrm{P_{tgasoline}}\ (96\ \mathrm{F})$$

Where,
$\mathrm{Patm} = 14.7$ psi
P_{vo} = (From Section 10.1.1.c)

P_{air} (96°F) = 14.7+_____-6.59 =

EXAMPLE:
P_{air} (96°F) = 14.7 + 1 - 6.59 = 9.11 psi

Find the temperature (T4) at which the vacuum relief valve opens. This will be where the internal tank pressure equals atmospheric pressure less the vacuum valve setting. This temperature may be found using numerical analysis to determine the temperature where the tank pressure plus the relief valve pressure is equal to atmospheric pressure. If no pressure control system is used this temperature will be 96°F.

$$\mathrm{P_{tank}}(\text{vac open}) = \mathrm{P_{atm}} - \mathrm{VAC_{vo}} = \mathrm{P_{tgasoline}}(\mathrm{T4K}) - \mathrm{P_{air}}(\mathrm{T4K})$$

Where,

$$\mathrm{P_{tgasoline}}(\mathrm{T4K}) = \mathrm{A} * \mathrm{T4K} * \mathrm{RVP} * e^{-\frac{\mathrm{B}}{\mathrm{T4K}}}$$

$$\mathrm{P_{air}}(\mathrm{T4K}) = \frac{\mathrm{T4} * \mathrm{P_{air}}(\mathrm{T3K})}{\mathrm{T3K}}$$

Where,
RVP = (From Section 10.1.1.d)
P_{air}(T3) = (From Section 10.1.3.b)
VAC_{vo} = (From Section 10.1.1.c)

Solve for T4K
T4K = _____

EXAMPLE:
Assume T4F is 88°F (304.1°K)
*$P_{tgasoline}$(304.1K) = 25.61*304.1*7*e^(2789.78/304.1)=5.6 psi*
*P_{air}(304.1K) = (304.1*10)/308.56 = 9.0 psi*
$P_{tgasoline}$(304.1K)+P_{air}(304.1K) = 9.0 + 5.6 = 14.6psi = 14.7 - 0.1
Therefore T4F = 88°F

c. Determine the volume of air in the fuel tank in gallons at the temperature when the vacuum valve opens.

$$V_{air}(T4K) = \frac{V_p * P_{air}(T4K)}{(P_{atm} - VAC_{vo})}$$

Where,
$P_{tgasoline}(T4)$ = (From Section 10.1.3.c)
VAC_{vo} = (From Section 10.1.1.c)
V_p = (From Section 10.1.1.g)

EXAMPLE:

$$V_{air}(T4K) = \frac{1.3 \quad * 9.1}{(14.7\text{-}0.1)} = 0.8 \text{ gal}$$

d. Determine the volume of air in the fuel tank in gallons at the minimum temperature of the diurnal cycle (T1=72°F).

$$V_{air}(T1) = \frac{V_p * P_{air}(T1K)}{(P_{atm} - VAC_{vo})}$$

Where,
$P_{air}(T1) = P_{air}(72F)$ (From Section 10.1.2.b)
VAC_{vo} = (From Section 10.1.1.c)
V_p = (From Section 10.1.1.g)

EXAMPLE:

$$V_{air}(T1K) = \frac{1.3 \quad * \ 10.43}{(14.7 - 0.1)} = 0.92 \ gal$$

e. The volume of air purging the carbon canister in gallons is the difference between these volumes.

$V_{airpurge} = V_{air}(T1) - V_{air}(T4)$

$$V_{airpurge} = \_\_\_\_\_ - \_\_\_\_\_$$

Where,
$V_{airpurge(cc)} = V_{airpurge} * 3785.4cc/gal$
$V_{air}(T4)$ = (From Section 10.1.3.e)
$V_{air}(T1)$ = (From Section 10.1.3.f)

EXAMPLE:

$V_{airpurge} = V_{air}(T1) - V_{air}(T4) = 0.92 - 0.8 = 0.12$ gal
$V_{airpurge}(cc) = 0.13ga * 3785.4cc/gal = 454.2cc$

f. Calculate the purge in carbon bed volume(s).

$$BV_{purge} = \frac{V_{airpurge}(cc)}{BV}$$

Where,
BV = Total Volume of Carbon in Canister (From Section 10.1.1.e)
$V_{airpurge(cc)}$ = (From Section 10.1.3.e)

EXAMPLE:
BV_{purge}= 454.2/120 = 3.8 bed volumes

The efficiency of the back purge is a function of canister loading or canister saturation. Empirical data must be generated for the conditions at the beginning of the diurnal test.

EXAMPLE:
A purge efficiency of 0.15% of the total canister TBWC per bed volume purged.

*$VAPOR_{backpurge}$ = 0.0015*TBWC*(GWC/BWC)* BV_{purge}*
*$VAPOR_{backpurge}$ = 0.0015*9.4*(8.2/7.8)*3.8 = 0.056g*

Where,
TBWC = (*From Section 10.1.1.e)*
BWC = (*From Section 10.1.1.e)*
GWC = (*From Section 10.1.1.e)*
BV_{purge}= (from Section 10.1.3.g)

10.1.4 Calculating Compliance

a. Total diurnal vapor loading:

$VL_{diurnaltot} = 3*(VAPOR_{diurnal} * V_p) – (2 * VAPOR_{backpurge})$
$VL_{diurnaltot}$ = 3*(_____ * _____) – (2 * _____)

Where,
$VAPOR_{diurnal}$ = (From Section 10.1.2.d)
$VAPOR_{backpurge}$ =(From Section 10.1.3.g)

EXAMPLE:
$VL_{diurnaltot}$= 3(0.94*1.3)-(2*0.056) = 3.6g*

b. Total Canister Loading is equal to Canister loading prior to diurnal test plus diurnal vapor load:

$VL_{total} = TGWC – TGWC_{di} + VL_{diurnaltot}$

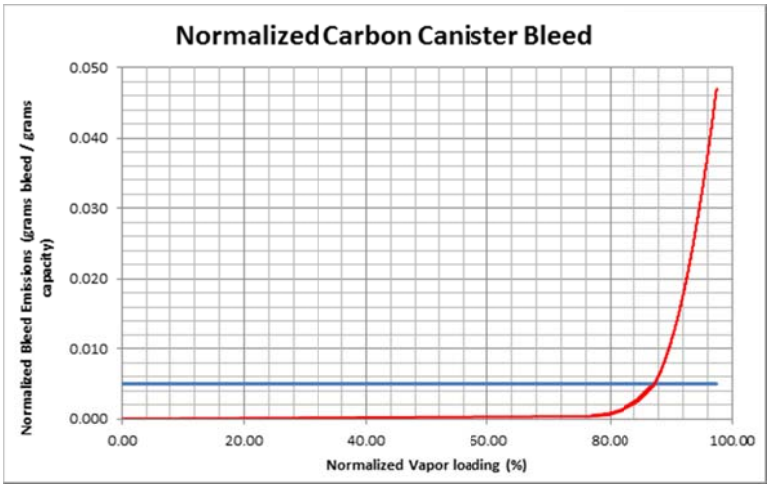
Where,
TGWC = (From Section 10.1.1.f)
$TGWC_{di}$ = (From Section 10.1.1.h)
$VL_{diurnaltot}$ = (From Section 10.1.4.a)

$\mathrm{VL_{total}}$ = _____ – _____ + _____ = _____

EXAMPLE:
VL_{total}= 10 – 7 + 3.6 = 6.6g

Criteria for approval of Certification- A graph similar to the one shown below, but appropriate for the carbon canister actually used, must be submitted. The x axis must show the loading of the canister as a percentage of its working capacity. The y axis must show the bleed emissions in grams of bleed per grams of working capacity when the canister is loaded at the rate defined in Section 5.2.1 (50/50 mixture by volume of butane and nitrogen at a rate of 15 ±2 grams butane per hour per liter of canister volume).

Figure A-3: EXAMPLE plot



Acceptable design (sizing) of the canister shall be demonstrated by a calculated total canister loading (VL_{total}) that is the lesser of 75 percent of the Normalized Loading or that Normalized Loading where the efficiency of the canister to control Bleed Emissions exceeds 0.005 grams of bleed emission / gram of total canister capacity (NVL%).

Normalized Load Limit Percentage:
NVL% = _____
Normalized Load:
NVL = NVL% * TGWC

Where,
TGWC = (From Section 10.1.1.f)

EXAMPLE:
NVL% = 75
*NVL=0.75*10 = 7.5g*

c. The design is acceptable if:

$NVL \geq VL_{total}$

_____ ≥ _____

EXAMPLE:
7.5g ≥ 6.6g……PASS!

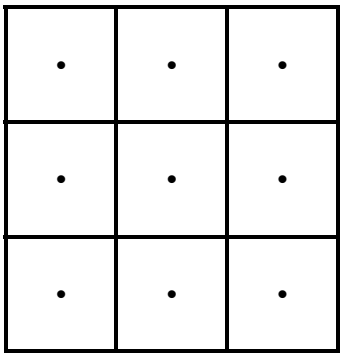
10.2 Appendix B – Variable Speed Cooling Blower

a) Variable speed cooling blower must direct air to the vehicle.
b) Blower outlet must be at least 0.4 square meters (4.31 square feet).
c) Blower outlet must be squarely positioned 0.3 ±0.05 meter (11.8 ±1.97 inch) in front of the vehicle.
d) Blower outlet lower edge height must be 0.1 meter (3.94 inch) to 0.2 meter (7.87 inch) above the ground.
e) Cooling air speed produced by the blower must be within the following limits (as a function of dynamometer roll speed):

Actual dynamometer roll speed	Allowable cooling air speed
0 km/h	0 km/h
Above 0 km/h to 5 km/h	0 km/h to roll speed + 2.5 km/h
Above 5 km/h to 25 km/h	Roll speed ± 2.5 km/h
25 km/h to 80 km/h	Roll speed ± 10 percent
Above 80 km/h	At least 72 km/h

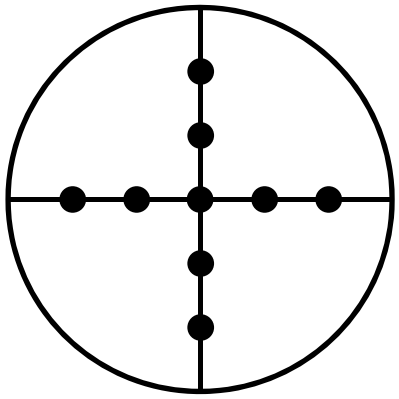
f) The cooling air speed above must be determined as an averaged value of 9 measuring points.
   1) For blowers with rectangular outlets, both horizontal and vertical sides of the blower outlet must be divided into 3 equal parts yielding 9 equal rectangular areas (see the diagram below). The measurement points are located at the center of each rectangular area.

Figure A-4



   2) For blowers with circular outlets, the blower outlet must be divided into 4 equal sectors defined by a vertical line and a horizontal line (see diagram below). The measurement points include the center of the blower outlet and locations on the radial lines (0°, 90°, 180°, and 270°) at radii of 1/3 and 2/3 of the total radius.

Figure A-5



g) In addition to the averaged cooling air speed requirements, each measuring point must be within ± 30 percent of actual roll speeds above 5 km/h.
h) Cooling air speed must be measured linearly at a distance of 0.3 ±0.05 meter (11.8 ±1.97 inch) from the blower outlet.
i) Cooling air speed measurements must be made with no vehicle or other obstruction in front of the blower outlet.
j) Instrument used to measure and verify cooling air speed must have an accuracy of 2 percent.