

# **APPENDIX B2**

State of California  
AIR RESOURCES BOARD

## **TP-934**

# **Test Procedure for Determining Evaporative Emissions from Model Year 2028 and Subsequent On-Road Motorcycles**

Adopted: XXXX XX, 2024

### **Emissions Compliance and Certification Division**

Note: This is a newly adopted test procedure shown without underline as permitted by California Code of Regulations, title 1, § 8.

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## TP-934

# Test Procedure for Determining Evaporative Emissions from Model Year 2028 and Subsequent On-Road Motorcycles

The applicable date of adoption or date of amendment for the Title 40, Code of Federal Regulations (CFR) sections that are incorporated in this test procedure, and are hereby incorporated by reference, are shown in section 9 of this test procedure.

## 1 APPLICABILITY

This test procedure TP-934 is used by the California Air Resources Board (CARB) to determine evaporative emissions from model year 2028 and subsequent on-road motorcycles (ONMC). This test procedure is proposed pursuant to section 43101 of the California Health and Safety Code (H&SC).

### 1.1 Terms and Definitions

In addition to the following definitions, the definitions set forth in the incorporated "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," incorporated by reference in title 13, California Code of Regulations (CCR), section 1976; California Health and Safety Code Section 39041; California Vehicle Code, Section 400; and title 13, California CCR, section 1976, 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 CARB Executive Officer or his or her authorized representative or designate.
- 1.1.2 For the purpose of this procedure, the terms "ARB" or "CARB" refer 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 or the value of any positive increase in emissions from before or after durability testing.
- 1.1.4 For the purpose of this procedure, the term "Executive Officer" refers to the CARB 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.
- 1.1.6 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.

## **1.2 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 calendar 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 gasoline meeting the fuel properties and specifications for "California Certification Gasoline" in Part II, section A.3.1 of the "California 2026 and Subsequent Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in title 13, CCR, section 1961.4.

## **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.

## **1.6 40 CFR Part 1066**

If a manufacturer opts to use Title 40, CFR, Part 1066, in lieu of 40 CFR Part 86, the 40 CFR Part 86, modifications contained herein shall still apply.

## **2 PRINCIPLE AND SUMMARY OF TEST PROCEDURES**

This test procedure measures evaporative emissions from a complete vehicle with complete evaporative emission control systems or evaporative family by subjecting them to durability tests, preconditioning, a hot soak evaporative test, and a diurnal evaporative test as described in Section 6 of this procedure. The evaporative family is defined as engine or equipment models in the same engine class that are grouped together based on similar fuel system characteristics as they relate to evaporative emissions. The engine family and the evaporative family may be considered equivalent at the manufacturer's discretion. 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.

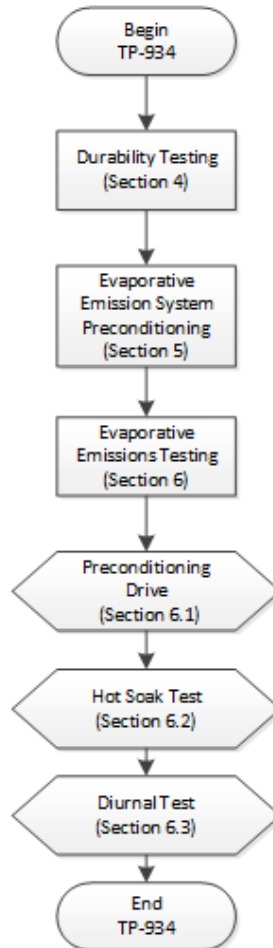
Prior to evaporative emissions testing, the vehicle's evaporative emissions control system must undergo durability testing to ensure that the emissions control devices continue to function as designed for the useful life of the vehicle. Real world end of useful life emissions are simulated during vehicle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

Evaporative emissions are quantified by direct measurement. 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 hot soak and diurnal emissions by undergoing a one-hour hot soak and a 72-hour diurnal evaporative emissions test with variable temperature as defined in Section 6.3.1.

A flowchart summarizing the procedure is shown in Figure 1.

**Figure 1: TP-934 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 the sections in Title 40, CFR, Parts 86 and 1066 or Commission Delegated Regulation No 134/2014 of 16 December 2013 supplementing Regulation (EU) No 168/2013 of the European Parliament and of the Council with regard to environmental and propulsion unit performance requirements and amending Annex V thereof, 02014R0134 - EN - 20.03.2018 (EU 134/2014), Annex II, which are incorporated by reference in Section 9 of this test procedure.



### **3.1 Vehicle Test Enclosure**

This test procedure incorporates by reference "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," which is incorporated by reference in title 13, CCR, section 1976, Parts III.A and III.B, for evaporative emission measurement enclosure requirements and calibrations.

### **3.2 Dynamometer**

- 3.2.1 The chassis dynamometer shall meet the requirements of 40 CFR sections 86.508-78, 86.108-00, 1066.210, or EU 134/2014, Annex II 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 between 68° and 86°F.

### **3.3 Fuel Vapor and Alcohol Hydrocarbon Analyzer**

The fuel vapor and alcohol hydrocarbon analyzer shall meet the requirements specified in 40 CFR section 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, dynamometer roll speed;
- c) 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; and
  - 5) zero gas and span gas readings;
- d) 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; and
- 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 ONMC 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 emissions control system must satisfy the durability requirements as prescribed in "TP-901 - Test Procedure for Determining Permeation Emissions from Small Off-Road Engines and Equipment Fuel Tanks," as last amended May 6, 2019, and incorporated by reference herein. This must be done before proceeding to Section 5 of this procedure, unless each evaporative emissions-related part has undergone equivalent durability testing for exhaust. Slosh testing may be omitted for metal fuel tanks and plastic fuel tanks that do not use surface barrier treatments for evaporative emissions control.

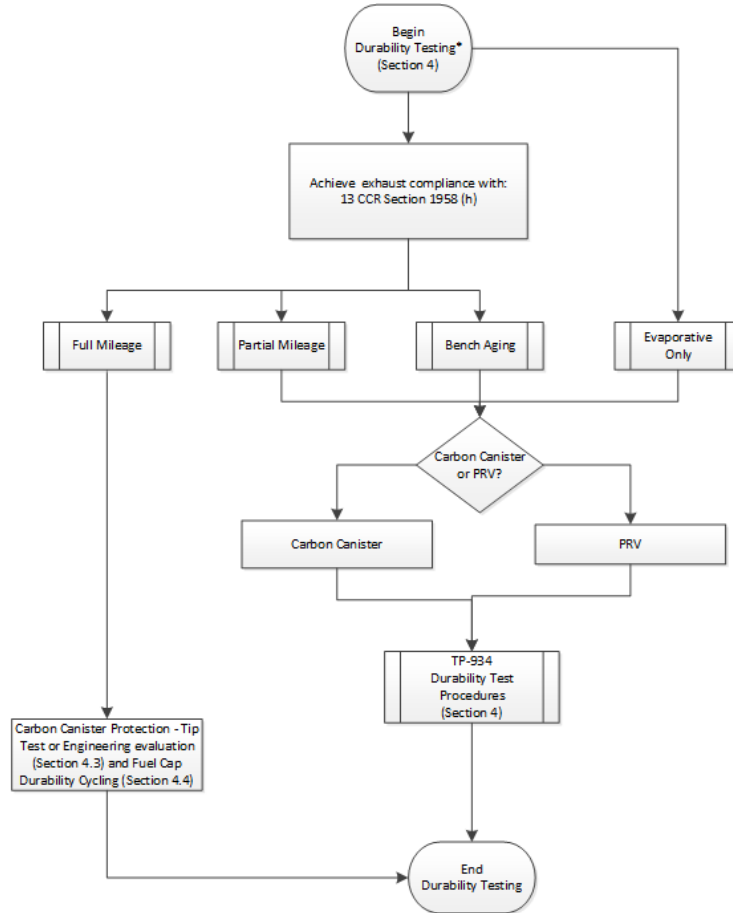
Evaporative emissions control systems that utilize carbon canisters shall meet the requirements of Appendix B before durability testing of Section 4 or service accumulation.

In addition, ONMC manufacturers shall comply with the durability requirements in Sections 4.1 through 4.4 of this test procedure or get approval from CARB 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 their products 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. A vehicle that has completed the full useful life service accumulation with the evaporative components installed throughout the duration of service accumulation may be exempt from the vibration durability requirements (Section 4.1.1), whichever are applicable. Durability testing shall include the steps outlined in Figure 2. Vehicles that have undergone partial mileage service accumulation with carbon canisters may use a hybrid approach to complete the vibration durability portion (Section 4.1.1) of this test procedure. If evaporative components have gone through a fraction of the useful life through service accumulation, then the remainder fraction of the useful life mileage may be applied to the number of cycles to complete durability testing for each section.

- Example: Vehicle completed 20,000km of service accumulation and useful life is 50,000km.
- $20,000 / 50,000 = 0.4 * 100\% = 40\%$  completed.
- $100\% - 40\% = 60\%$  remaining.
- For carbon canister vibration cycling, the remaining cycles would be  $= 60\% * 10,000,000 = 6,000,000$  to complete vibration durability testing.

**Figure 2: Durability Flow Chart**



\* - Note: Activated Carbon must meet the requirements of Appendix B before any carbon canister durability testing

### 4.1 Carbon Canister Test

Manufacturers shall perform the Carbon Canister Test on systems that utilize a carbon canister. For systems that utilize a carbon canister, the durability test procedures shall include thermal cycling and vibration exposure of the canister. Activated carbon used in the carbon canister shall meet the carbon performance requirements specified in Appendix B of this test procedure prior to conducting the carbon canister durability tests.

- 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  $140^{\circ}\text{F} \pm 4^{\circ}\text{F}$  for 30 minutes. (Up to 10 minutes is allowed for the temperature to rise and stabilize).
  - 4.1.1.2 Cool and hold at  $32^{\circ}\text{F} \pm 4^{\circ}\text{F}$  for 30 minutes. (Up to 20 minutes is allowed for the temperature to reach  $32^{\circ}\text{F}$  during the cooling period).
- 4.1.2 For the vibration test, the canister shall 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 (Relief) Valve**

If the fuel system employs a fuel vapor pressure vent (relief) valve that controls vented emissions from the fuel tank, it shall be subject to the durability demonstration prescribed in Section 4.2. Unless otherwise specified, all testing shall be performed at ambient temperature. All testing temperatures shall be within  $\pm 5^{\circ}\text{F}$  ( $\pm 3^{\circ}\text{C}$ ) of the required temperature, if specified. In addition, no leakage shall occur until 13.8 kPa or -3.5kPa for all tests and there shall not be any visible deformation or cracks during any part of the durability testing.

### 4.2.1 Vibration

Manufacturers shall perform the vibration test, which is performed in a suitable fixture while maintaining its specified orientation with a vibration frequency of 60 Hz at an acceleration of  $4.5 \times 9.8 \text{ m/s}^2$ . The valve must be subjected to continuous sinusoidal vibration for  $10^7$  times.

### 4.2.2 Dust

Manufacturers shall perform the dust test, which shall be performed in a test room filled by dust indicated by JIS (Japanese Industrial Standards) Z8901: 1995, which is incorporated by reference herein, type 15 with a concentration of  $100 \mu\text{g}/\text{m}^3$ . The valve shall be pressured to open and then close when the tank is evacuated to a maximum of  $-2.94 \text{ kPa} \pm 0.1 \text{ kPa}$ . Three hundred (300) pressure/vacuum cycles are required.

#### 4.2.3 Ozone

Manufacturers shall perform the ozone test, which is a static test performed in a closed environment that can produce ozone to the specified level and temperature over a specified time. The pressure vent valve shall be subjected to a continuous exposure of 150 ppb +/- 5 ppb (parts per billion) of ozone at 86°F +/- 3°F for 120 hours.

#### 4.2.4 Ultraviolet (UV)

Manufacturers shall perform the UV test if any part of the pressure valve will be exposed to sunlight when installed on an engine. The UV test is a static test performed in an environment that can expose the pressure vent valve to a specified irradiance over a specified time. The pressure vent valve shall be exposed to at least 24 W/m<sup>2</sup> (0.4 W-h/m<sup>2</sup>/min) of ultraviolet light for at least a total time of 450 hours. The ultraviolet radiation exposure test may be omitted if no part of the pressure vent valve will be exposed to sunlight when installed on an engine.

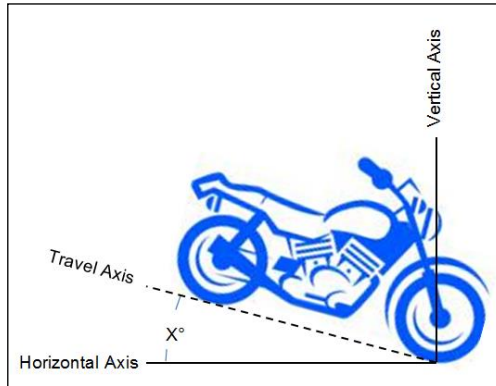
### 4.3 Carbon Canister Protection - Tip Test

The manufacturer shall design a fuel system, such that the canister is protected from exposure to liquid fuel when the motorcycle is tipped. The manufacturer shall demonstrate compliance with this requirement using one of the following options.

4.3.1 *Option 1:* Manufacturers shall perform a 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 shall be filled to 100 percent of nominal capacity with test fuel.

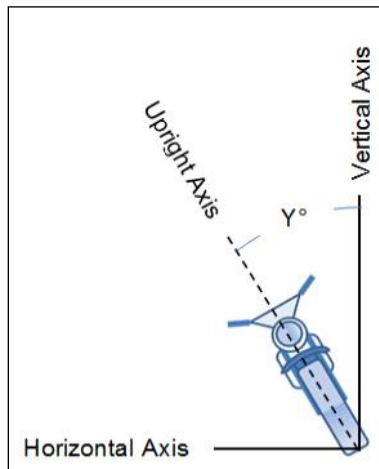
4.3.1.1 In less than 5 seconds, orient the vehicle such that the travel axis is tilted X degrees above and below the horizontal plane. See Figure 3 for a schematic. Hold the vehicle for 60 or more seconds, or such longer period of time as a manufacturer may choose, in both the positive and the negative position. X shall be defined as 30° ± 2° for two-wheel ONMCs as identified in Figure 3 below.

**Figure 3: Horizontal Tilt**



4.3.1.2 In less than 5 seconds, 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 the negative position for 60 or more seconds, or such longer period of time as a manufacturer may choose. Y shall be defined as an unsupported position on either side (i.e., vehicle lying on its side) for two-wheel ONMCs as identified in Figure 4.

**Figure 4: Vertical Tilt**



4.3.1.3 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% of the butane working capacity (BWC) or more, the vehicle fails the test.

4.3.1.4 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.

4.3.2 *Option 2:* As an alternative to the carbon canister protection tip test, CARB will allow manufacturers to provide an engineering evaluation of their strategy to control liquid fuel from contaminating the canister ( i.e., rollover valve in line with the canister) and seek approval in lieu of conducting the tip test. Manufacturers must seek approval prior to conducting evaporative emissions testing.

#### **4.4 Fuel Cap Durability Cycling**

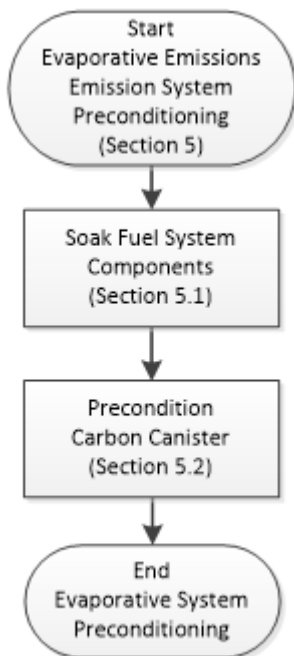
Installations cycles shall be performed with the fuel cap intended for use with the fuel tank by putting the fuel cap on and taking off 300 times. Tighten the fuel cap each time in a way that represents the typical in-use experience. If the vehicle has already undergone fuel cap cycling of TP-901, then Section 4.4 may be omitted.

### **5 EVAPORATIVE EMISSIONS 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 either the test fuel specified in Section 1.4 of this test procedure, reference fuel "Petrol (E5)" as specified in Appendix 2 to Annex II of EU 134/2014, or commercially available unleaded gasoline containing 10% ethanol (E10 pump fuel) for a total of 140 days or less if using one of the accelerated alternative options in Section 5.1. E10 pump fuel or Petrol (E5) may only be used for the portion of the soaking period; however, fuel must be switched to E10 test fuel for a minimum of 30 calendar days prior to testing. The preconditioning procedure shall include the steps outlined in Figure 5.



**Figure 5: Preconditioning Flowchart**



Note that Section 5.2 testing may occur after Section 5.1 if the Section 5.1 testing includes the preconditioned carbon canister (from Section 5.2) for the entire fuel soak period. If the soaked vehicle or test rig is transported after Section 5.1 testing then the test vehicle or test rig must be exposed to fuel during the transportation. If the soaked fuel system is transported to second laboratory after conducting the Section 5.1 soak, it must be subjected to a 1-week presoak with fresh fuel at a temperature no higher than 95°F, prior to beginning any test sequence to measure hot soak or diurnal emissions.

### **5.1 Soak Fuel System Components**

Manufacturers shall 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 15 +/- 1 minutes. Components may be preconditioned using a whole vehicle or 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 shall be filled with test fuel at the beginning of the test.

- a) Precondition the whole vehicle or fuel system rig continuously following one of the following 3 options defined below:
1. Soak continuously for a total of 3,360 hours while maintaining an ambient temperature no less than 68°F;
  2. Soak for 1,680 hours while maintaining an ambient temperature between 104°F and 113°F; or
  3. Soak for an equivalent combination of two soaks in either of the temperature ranges listed in 1 and 2 above. Soak time will be calculated by adding the weighted time at each test temperature until the vehicle is 100% soaked using the following values: 1 hour at 68°F to 86°F equals 1/3,360th of a test, 1 hour at 104°F to 113°F equals 1/1,680th of a test.
- b) A fuel system may be soaked for less than 3,360 hours if steady state permeation has been reached and preconditioning data is provided using one of the following documents, which are incorporated by reference: (i) "TP-901 - Test Procedure for Determining Permeation Emissions from Small Off-Road Engines and Equipment Fuel Tanks," as last amended May 6, 2019; (ii) 40 CFR section 1060.520; or (iii) 40 CFR section 1051.515. 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.
- c) Service accumulation for exhaust testing may be counted towards the preconditioning soak if the vehicle is within the test temperatures specified in Section 5.1 (a), fuel remains in the fuel system, and is not empty longer than one hour. If the preconditioning is complete during the service accumulation period, then it must be subjected to a 1-week presoak with fresh fuel at a temperature no higher than 95°F, prior to beginning any test sequence to measure hot soak or diurnal emissions.
- d) Alternatively, the fuel tank, fuel line system, and/or vapor vent line system can be preconditioned as separate components from the whole vehicle as long as the reason for the separate component preconditioning is accepted by CARB prior to vehicle certification and the components are subjected to the equivalent preconditioning required for a whole vehicle. Acceptance will be based on verification of good engineering judgement used to ensure components are subjected to conditions similar to what

would be found on the vehicle during preconditioning. These conditions include, but are not limited to, physical deformations, fuel fill volume for tanks, and fuel reservoir for fuel hoses and related components. Vapor vent lines must be exposed to liquid fuel for component preconditioning. This requirement only applies to separate component preconditioning and not to the fuel system preconditioning that is connected to filled fuel tanks. All components that are installed on the vehicle must be attached as it would be on a factory production vehicle.

If the fuel system is allowed to sit more than 6 weeks during any soak period, a 1-week Presoak (at the applicable conditions) must be conducted with fresh fuel before testing begins. The fresh fuel presoak can be counted as part of the applicable soak period, so long as the fuel system is empty less than one hour.

Prior to beginning any test sequence to measure 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 shall 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, Sections 5.2.2 through 5.2.4 of the preconditioning sequence shall be completed within 96 hours preceding the beginning of the evaporative emission test procedure described in Section 6 at a temperature between 68° and 86° F. This means that the canister loading must be completed within the 96-hour window before the start of Section 6, to ensure that the canister does not spend too much time in a loaded state.

For vehicles with multiple canisters in a series configuration, the set of canisters shall 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 butane 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 butane working capacity has been determined using the following procedures:

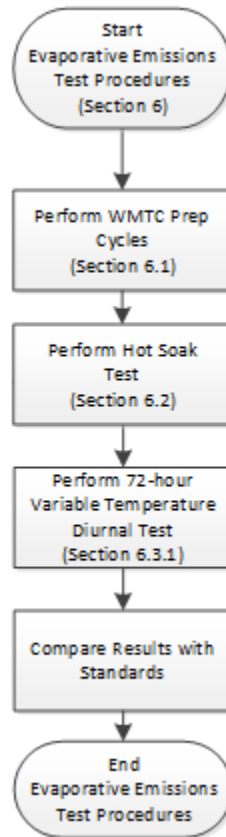
- a) Each test canister shall be loaded no less than 10 and no more than 100 times with 50:50 vol% butane-nitrogen at a rate of 15 g/h butane until 2g of breakthrough is detected. Each canister loading step must be preceded by canister purging with a minimum of 300 canister bed volumes at 10 L/min.
- b) Each canister shall first be purged with a minimum of 300 canister bed volumes at a rate of 10 L/min. The butane working capacity is calculated as the average mass increase of the last three load and average mass loss of the last three purge cycles and does not include the 2g of breakthrough during the loading cycle.

- 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  $50 \pm 25$  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 10 L/min and the duration shall be determined to provide a total purge volume flow through the canister equivalent to a minimum of 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 butane working capacity. The canister shall be loaded with a mixture composed of 50% butane and 50% nitrogen by volume at a rate of  $15 \pm 2$  grams butane per hour. 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 Preconditioning Drive

The preconditioning drive is designed to simulate vehicle operation and canister purging during operation. Follow the World Harmonized Motorcycle Test Cycle (WMTC) chassis-dynamometer test cycle in European Union (EU) Commission Delegated Regulation EU 134/2014, Annex II, Appendix 6, section (3), which is incorporated by reference. For the purpose of this preconditioning, all soak and test temperatures shall be between 68° and 86°F.

6.1.1 The following steps shall be performed before beginning the preconditioning drive:

- 6.1.1.1 The fuel tank of the vehicle to be tested shall be drained and refilled to 50 +/- 5% with test fuel.
- 6.1.1.2 Soak for at least 6 hours after being refueled. Following this soak period, conduct a refueling cycle by running the test vehicle through one applicable WMTC 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 and has been less than 14 days between tests. The later test preconditioning will begin with Section 6.1.1.4.
- 6.1.1.3 Drain and refill the fuel tank of the vehicle to 50 +/- 5% with test fuel.
- 6.1.1.4 The vehicle shall be refueled within 1 hour after completion of the preconditioning drive. The fuel cap(s) shall be installed within 1 minute after refueling. The vehicle shall be parked within five minutes after refueling.
- 6.1.1.5 Soak the vehicle with the key off for 12 to 36 hours.
- 6.1.1.6 During the soak period, purge and load the evaporative control system canister using the procedures defined in Sections 5.2.2, 5.2.3, and 5.2.4.
- 6.1.1.7 The location and speed of a fan used to cool the vehicle shall comply with the requirements described in Appendix A of this Test Procedure (Section 10).
- 6.1.1.8 Following the soak, perform one (1) applicable WMTC preconditioning drive.
- 6.1.1.9 Soak the vehicle under laboratory temperatures with the key off for 1 hour +/- 5 minutes.
- 6.1.1.10 Following the soak, perform an additional applicable WMTC preconditioning drive.
- 6.1.1.11 Following the completion of the preconditioning drive(s), a hot soak test must be conducted as specified in Section 6.2.

## **6.2 Hot Soak Test**

The hot soak evaporative emission test is designed to measure the emissions from the ONMC after operation. The test temperature for the hot soak is between 68° and 86°F. (NOTE: Per section III.A.3.2 in "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001

through 2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976, if artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F.)

The following steps shall be performed to conduct the hot soak evaporative emission test:

- 6.2.1 Purge hot soak enclosure several minutes before completing the WMTC preconditioning drive(s).
- 6.2.2 Zero and span FID hydrocarbon analyzer immediately before the hot soak test.
- 6.2.3 If applicable, place fresh impingers in the alcohol sample collection system immediately before the start of the test.
- 6.2.4 Turn on enclosure mixing fans and continue operating throughout the hot soak test. The fans should circulate air at  $0.8 \pm 0.2$  cfm per cubic foot of the nominal enclosure volume.
- 6.2.5 Analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the initial (time=0 minutes) hydrocarbon concentration, CHCe1 and the initial (time=0 minutes) alcohol concentration, CC2H5OHe1, required in section III.D.11 of the "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976, incorporated by reference herein.
- 6.2.6 Push the vehicle (do not drive) to the enclosure. The engine must be turned off before any part of the vehicle enters the enclosure.
- 6.2.7 Push the vehicle into the enclosure. The hot soak enclosure doors shall be closed and sealed within two minutes of engine shut off and within seven minutes of completing the WMTC preconditioning drive.
- 6.2.8 The  $60 \pm 0.5$  minutes hot soak test begins when the enclosure door(s) are sealed. The hot soak test shall be performed at an ambient temperature between 68° and 86°F.
- 6.2.9 At the end of the  $60 \pm 0.5$  minute test period, analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the final (time=60 minutes) hydrocarbon concentration, CHCe1 and the final (time=60 minutes) alcohol concentration, CC2H5OHe1, required in section III.D.11 of the "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through

2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976.

### 6.3 Diurnal Test

Upon completion of the hot soak test, the vehicle shall remain in the enclosure to perform, the diurnal test. The diurnal test is conducted by direct measurement of three consecutive 24-hour diurnal tests (72-hour diurnal test).

6.3.1 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  $65^{\circ} \pm 3^{\circ}\text{F}$  within 60 minutes of completing the hot soak test. The diurnal enclosure shall be purged for several minutes prior to the diurnal test. The diurnal soak period is 6 to 36 hours at  $65^{\circ} \pm 3^{\circ}\text{F}$ . Perform the diurnal test procedure described in 40 CFR section 1066.955 or 86.133-96 but apply the ambient temperature profile in section III.D.10.3.7 in "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976, with the following exceptions.

6.3.1.1 When the word "methanol" or the term  $C_{\text{CH}_3\text{OH}}$  (methanol concentration) is used, it shall be replaced by ethanol or the term  $C_{\text{C}_2\text{H}_5\text{OH}}$  (ethanol concentration).

6.3.1.2 All references to the hot soak test performed in 40 CFR section 1066.965 or 86.138-96 shall mean the hot soak test previously described in Section 6.2 of this procedure.

6.3.1.3 All references to the calculations performed in 40 CFR section 1066.925 or 86.143-96 shall be replaced with the calculations performed in Section 7 of this procedure.

6.3.1.4 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 section 86.130-96 (2012)."

6.3.1.5 Omit section (a)(3), and all of sections (j), (o) and (p).

6.3.1.6 Revise section (b) as follows: The test vehicle shall be soaked for not less than 6 hours nor more than 36 hours between the end of the hot soak test and the start of the diurnal emission test. For at least the last 6 hours of this period, the vehicle shall be soaked at



65°±3°F. The temperature tolerance may be waived for up to 10 minutes to allow purging of the enclosure at the beginning of the diurnal emission test.

6.3.1.7 Revise section (c) as follows: The test vehicle shall be exposed to ambient temperatures cycled according to the profile specified in section III.D.10.3.7 in "California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976.

6.3.1.8 Omit section (e).

6.3.1.9 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." Hydrocarbon emissions may be sampled continuously during the test period.

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

## **7 CALCULATIONS: EVAPORATIVE EMISSIONS**

Total mass emissions from Sections 6.2.5 and 6.3.1 shall 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 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles," incorporated by reference in title 13, CCR, section 1976, 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 = 108%.

For ONMCs, the vehicle volume is assumed to be 5 cubic feet (0.142 cubic meters) unless the manufacturer provides a measured ONMC volume.

## 8 LIST OF TERMS

ATV	All-Terrain Vehicle
CAD/CAM	Computer-Aided Design/Computer-Aided Manufacturing
CARB	California Air Resources Board
C <sub>C2H5OH</sub>	Ethanol concentration
C <sub>CH3OH</sub>	Methanol concentration
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CHC <sub>i</sub>	Initial Hydrocarbon Concentration
°C	Degrees Celsius
°F	Degrees Fahrenheit
E10	Commercial Pump Fuel containing 10 percent ethanol
HC	Hydrocarbon
H&SC	California Health and Safety Code
HZ	Hertz
KM/H	Kilometers per Hour
L/MIN	Liters per Minute
MC	Motorcycle
MPH	Miles Per Hour
ONMC	On-Road Motorcycle
PSIG	Pounds per Square Inch - Gauge
TP	Test Procedure
TP-934	Test Procedure for determining evaporative emissions from model year 2028 and subsequent on-road motorcycles
UV	Ultraviolet
WMTC	World harmonized Motorcycle Test Cycle

## 9 DOCUMENTS INCORPORATED BY REFERENCE

“California 2015 through 2025 Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Year Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” adopted March 22, 2012, amended August 25, 2022, California Environmental Protection Agency, Air Resources Board

“California 2026 and Subsequent Model Year Criteria Pollutant Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” adopted August 25, 2022, California Environmental Protection Agency, Air Resources Board

“California Evaporative Emission Standards and Test Procedures for 2001 through 2025 Model Year Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Heavy-Duty Vehicles and 2001 through 2027 Model Year Motorcycles,” adopted August 5, 1999, amended [INSERT DATE], State of California, Air Resources Board

“Commission Delegated Regulation No 134/2014 of 16 December 2013 supplementing Regulation (EU) No 168/2013 of the European Parliament and of the Council with regard to environmental and propulsion unit performance requirements and amending Annex V thereof, 02014R0134 - EN - 20.03.2018”

Title 40, CFR, Parts 86, sections: 86.107-96 (April 28, 2014), 86.108-00 (October 22, 1996), 86.130-96 (June 29, 2021), 86.133-96 (August 23, 1995), 86.138-96 (April 30, 2010), 86.143-96 (January 24, 2023), 86.508-78 (October 28, 1977), and 86.515-78 (April 28, 2014)

Title 40, CFR, Part 1066, sections: 1066.210 (June 29, 2021), 1066.925 (April 28, 2014), 1066.955 (April 28, 2014), and 1066.965 (April 28, 2014)

Title 40, CFR, Part 1060 section: 1060.520 (January 24, 2023).

Japanese Standards Association. Japanese Industrial Standard. JIS Z 8901:1995 - Test Powders and Test Particles, published June 2001

“Small Off-Road Engine Evaporative Emissions Test Procedure TP-901 Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks,” adopted July 26, 2004, amended May 6, 2019, California Environmental Protection Agency, Air Resources Board.

Title 40, CFR, Part 1051, section: 1051.515 (January 24, 2023).

## **10 Appendices**

### **10.1 Appendix A - Variable Speed Cooling Blower**

Unless specified below, the cooling fan specifications shall meet the requirements of EU 134/2014, Annex I, 4.5.2.5.

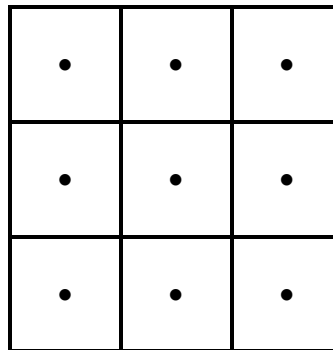
- a) Variable speed cooling blower must direct air to the vehicle.
- b) Blower outlet must be at least 0.4 square meters (4.31 square feet).
- c) Blower outlet must be squarely positioned  $0.3 \pm 0.05$  meters ( $11.8 \pm 1.97$  inch) in front of the vehicle.

- 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):

<b>Actual dynamometer roll speed</b>	<b>Allowable cooling air speed</b>
0 km/h	0 km/h
Above 0 km/h to <10 km/h	0 km/h
At 10 km/h to 50 km/h	Roll speed $\pm$ 5 km/h
Above 50 km/h	Roll speed $\pm$ 10 percent

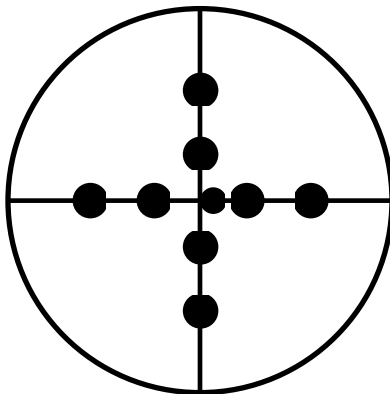
- f) The cooling air speed above must be determined as an averaged value of 9 measuring points.
- 1) For blowers with rectangular outlets, both horizontal and vertical sides of the blower outlet must be divided into 3 equal parts yielding 9 equal rectangular areas (see the diagram below). The measurement 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  $\pm 30$  percent of actual roll speeds above 5 km/h.
- h) Cooling air speed must be measured linearly at a distance of  $0.3 \pm 0.05$  meter ( $11.8 \pm 1.97$  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%.

## **10.2 Appendix B - Carbon Performance Requirements**

The carbon performance procedure of Section 10.2.1 must be conducted prior to the carbon canister durability procedures of Section 4.1. A manufacturer may use the carbon performance data provided by the canister vendor; if the vendor certifies that the carbon has met the carbon performance criteria according to Section 10.2.1.

10.2.1 A maximum loss of 12% or less of butane working capacity is required following 150 load/purge cycles as well as preconditioning and purge with warm  $77^{\circ}\text{F} \pm 4^{\circ}\text{F}$  ( $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) dry air. A common cycle is measuring the change in butane working capacity following the procedure in Section 5.2.1 performing the load/purge using 150 cycles of load with a mixture of 50 percent gasoline (or butane) vapor/air loaded at 40 grams/hr, and purged each time with a minimum of 300 bed volumes of dry air per flow rates specified in Section 5.2.1. The canister butane working capacity must be recalculated according to Section 5.2.1. The initial BWC should be established before fuel exposure of between 10 and 100 BWC cycles and the

final BWC should be established after 150 cycles of fuel exposure by performing not more than 10 BWC cycles.