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State of California AIR RESOURCES BOARD

TP-934

Test Procedure for Determining Evaporative Emissions from On-Road Motorcycles

Adopted: XXXX XX, 2022

California Air Resources Board

Emissions Compliance and Certification Division

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

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Test Procedure for Determining Evaporative Emissions from On-Road Motorcycles (ONMC)

1 APPLICABILITY

This test procedure 934 is used by the California Air Resources Board (CARB) to determine ONMC evaporative emissions. This test procedure is proposed pursuant to section 43101 of the California Health and Safety Code (CH&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 and Subsequent Model Motor Vehicles" as last amended September 2, 2015, California Health and Safety Code Section 39041, California Vehicle Code, Section 400 and title 13, California Code of Regulations (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 term "ARB" or “CARB” 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 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.
- 1.1.5.2 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.

1.2 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, adopted March 22, 2012, as last amended December 19, 2018, which is 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.

1.6 40 CFR Part 1066

If a manufacturer opts to use Title 40, Code of Federal Regulations (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.

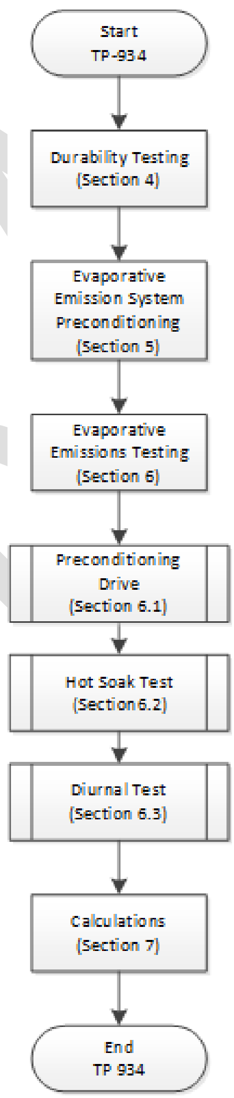
Prior to evaporative emissions testing, the vehicle's evaporative emissions control system must undergo durability testing to ensure that the emissions control devices continue to function as designed for the useful life of the vehicle. Real world end of useful life emissions are simulated during vehicle 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 Title 40, Code of Federal Regulations (CFR), Parts 86 and 1066 – Control of Emissions from New and In-Use Highway Vehicles and Engines, subpart 107-96, 108-79, 108-00, and 508-78 (2012).

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 last amended September 2, 2015, 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 section 86.508-78, 40 CFR section 86.108-00, or 40 CFR section 86.108-79 (2012), 40 CFR 1066.210, or ECE/TRANS/180/Add.2 (2005) 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°F 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, 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

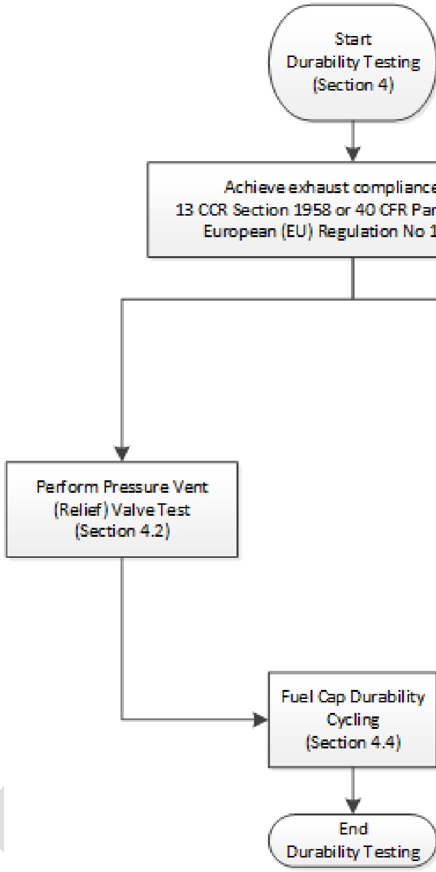
The carbon canister test bench or associated combination of testing equipment shall meet the requirements specified in section 5.2 of this procedure.

4 DURABILITY TESTING

Certification of an 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 emission control system must satisfy 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 September 18, 2017, and incorporated by reference herein. This must be done before proceeding to the durability testing section of this procedure, unless each evaporative emissions-related part has undergone equivalent durability testing for exhaust.

In addition, ONMC manufacturers must comply with the durability requirements in sections 4.1 through 4.3 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. 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 (60°C± 2°C) 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 (0°C± 2°C) for 30 minutes. (Up to 20 minutes is allowed for the temperature to reach 32ºF (0°C) 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.

4.1.3 Carbon Performance - A maximum loss of 12 percent or less of butane working capacity is required following 150 load/purge cycles as well as preconditioning and purge with warm 77°F± 9°F (25°C± 5°C) room air with ambient relative humidity. 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 vapor/air loaded at 40 grams/hr, and purged each time with a minimum of 300 bed volumes of room air per flow rates specified in Section 5.2.1). Finally, the canister butane working capacity must be recalculated according to Section 5.2.1. 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 4.1.3.

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 may be performed at ambient temperature. All testing temperatures must be within ± 5°F (± 3°C) of the required temperature if specified. In addition, no leakage must occur until 13.8 kPa or -3.5kPa for all tests and there must not be any visible deformation or cracks during any part of the durability testing.

4.2.1 Vibration

The vibration test is performed in a suitable fixture while maintaining its specified orientation with a vibration frequency of 60 Hz at an acceleration of 4.5 x 9.8 m/s^2. The valve must be subjected to continuous sinusoidal vibration for 10^7 times.

4.2.2 Dust

The dust test is performed in a test room filled by dust indicated by JIS (Japanese Industrial Standards) Z8901 type 15 with a concentration of 100 µg/m3. The valve is pressured to open and then close when the tank is evacuated to a maximum of -2.94 kPa +/- 0.1kPa. Three hundred (300) pressure/vacuum cycles are required.

4.2.3 Ozone

The ozone test is a static test performed in a closed environment that can produce ozone to the specified level and temperature for a period of time. The pressure vent valve must be subjected to a continuous exposure of 150 ppb +/- 5 ppb (parts per billion) of ozone at 86°F +/- 3°F (20°C± 2°C) for 120 hours.

4.2.4 Ultraviolet (UV)

The UV test is a static test performed in an environment that can expose the pressure vent valve to a specified irradiance for a period of time. The pressure vent valve shall be exposed to at least 24 W/m^2 (0.4 $W\text{-}h/m^2/min$) 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 light when installed on an engine.

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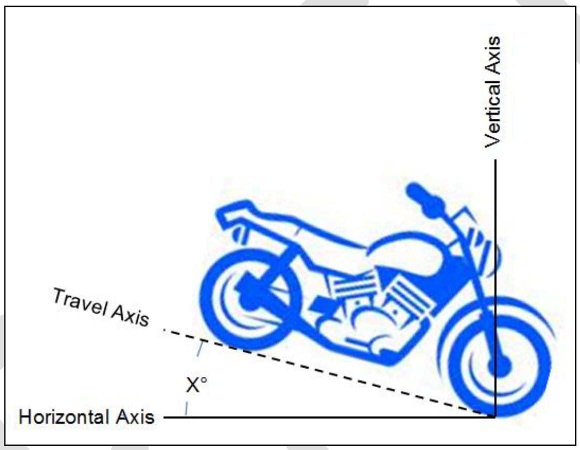
4.3 Carbon Canister Protection - Tip Test

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 test fuel.

4.3.1 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 as defined as follows:

a) 30° ± 2° for two-wheel ONMCs
b) 15° ± 2° for all other ONMCs.

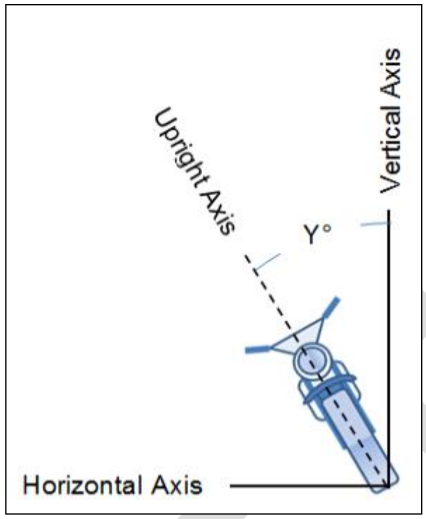
Figure 3: Horizontal Tilt



4.3.2 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. Three-wheeled vehicles shall be tilted on two-wheels for the vertical tilt position. 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 as defined as follows:

a) Unsupported position on either side (i.e., vehicle lying on its side) for two-wheel ONMCs.
b) 15° ± 2° for all other ONMCs.

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.

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 and seek approval in lieu of conducting the tip test. Manufacturers must seek approval prior to conducting evaporative emissions testing.

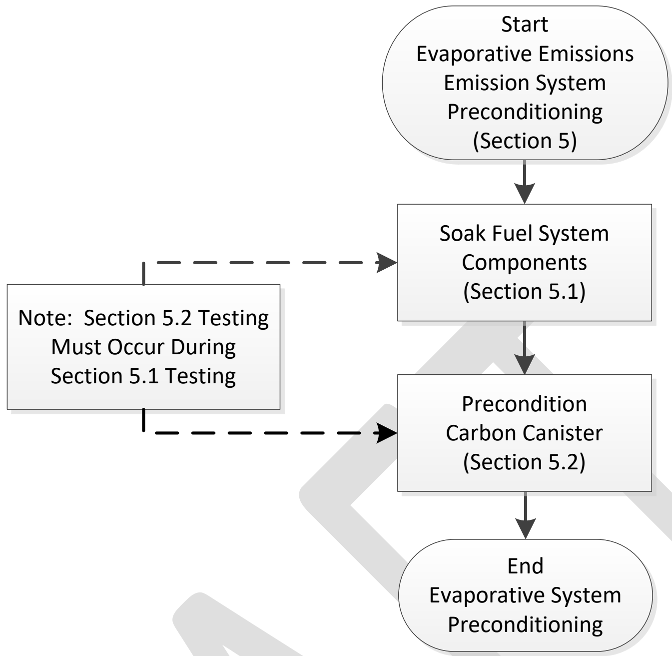
4.4 Fuel Cap Durability Cycling

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.

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 evaporative test fuel E10 (commercial pump fuel containing 10 percent ethanol) for a total of 140 days or less if using one of the accelerated alternative options in Section 5.1. E10 pump fuel 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 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. 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 must be filled with test fuel at the beginning of the test.

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 between 68ºF (20°C) and 86ºF (30°C) or;

2. Soak for 1,680 hours while maintaining an ambient temperature between 104℉ (40°C) and 113℉ (45°C) 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 68ºF (20°C) to 86ºF (30°C) equals 1/3360th of a test, 1 hour at 104℉ (40°C) to 113℉ (45°C) equals 1/1680th of a 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 section1060.520 (2012) 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 a temperature between 68ºF (20°C) and 86ºF (30°C), 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.

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.

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 must be soaked for at least 7 days at a temperature no higher than 95°F (35°C) 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 a temperature between 68 and 86° 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 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 must 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 must 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.

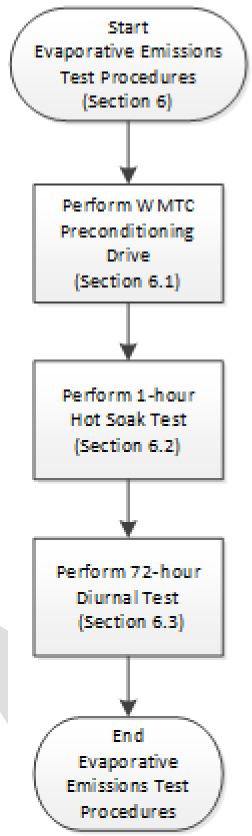
5.2.3 The canister purge shall be performed with ambient air of humidity controlled to 50 ± 25 grains per pound of nitrogen. This may be accomplished by purging the canister in a room that is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal 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 percent butane and 50 percent nitrogen by volume at a rate of 15 ± 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) dynamometer schedules in United Nations Economic Commission for Europe (UNECE) Global Technical Regulations No.2, which is hereby incorporated by reference. For the purpose of this preconditioning, all soak and test temperatures must be between 68ºF (20°C) and 86ºF (30°C).

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 percent 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 subsection 6.1.1.4.

6.1.1.3 Drain and refill the fuel tank of the vehicle to 50 +/- 5 percent with test fuel.

6.1.1.4 Soak the vehicle with the key off for 12 to 36 hours.

6.1.1.5 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.

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

6.1.1.7 Following the soak, perform the applicable WMTC preconditioning drive.

Following the completion of the preconditioning drive, a hot soak test must be conducted as specified in subsection 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 68ºF (20°C) and 86ºF (30°C). (NOTE: Per section III.A.3.2 in "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (2015), if artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F (21°C).)

6.2.1 Purge hot soak enclosure several minutes before completing the WMTC preconditioning drive.

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±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 and Subsequent Model Motor Vehicles" as last amended September 2, 2015.

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 ± 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 68ºF (20°C) and 86ºF (30°C).

6.2.9 At the end of the 60±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 and Subsequent Model Motor Vehicles" as last amended September 2, 2015.

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 - The diurnal enclosure shall be purged for several minutes prior to the diurnal test. Reduce the temperature of the enclosure to 65° ± 3°F (18° ± 2°C). When enclosure temperature stabilizes to 65 ± 3°F (18° ± 2°C), the diurnal soak period begins and is not less than 6 hours nor more than 36 hours at 65° ± 3°F (18° ± 2°C). Perform the diurnal test procedure described in 40 CFR section 1066.955 or 86.133-96 (2012) but apply the ambient temperature profile in section III.D.10.3.7 in "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (2015), which is hereby incorporated by reference with the following exceptions.

6.3.1.1 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).

6.3.1.2 All references to the hot soak test performed in 40 CFR section 1066.965 or 86.138-96 (2012) 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 (2012) 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 (18° ± 2°C). 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 and Subsequent Model Motor Vehicles" (2015).

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 subsection 6.2.5 and 6.3.1 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 last amended September 2, 2015, 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 % nominal fuel alcohol content) x (1 + (%ethanol x 3))

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

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
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
L/MIN	Liters per Minute
MC	Motorcycle
MPH	Miles Per Hour
ONMC	On-Road Motorcycle
PSIG	Pounds per Square Inch – Gauge
T_{liq}	Fuel tank liquid temperature
T_{vap}	Fuel tank vapor space temperature
TP	Test Procedure
TP-934	Test Procedure for determining evaporative emissions from on-road motorcycles
UV	Ultraviolet
WMTC	World harmonized Motorcycle Test Cycle

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, adopted March 22, 2012, as last amended December 19, 2018.

California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles, California Environmental Protection Agency, Air Resources Board, El Monte, CA, adopted August 5, 1999, as last amended September 2, 2015.

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, adopted November 22, 1994, as last amended October 25, 2012.
Control of Emissions from New and In-Use Highway Vehicles and Engines, Title 40, Code of Federal Regulations, Parts 86 and 1066. United States Environmental Protection Agency, 40 CFR section 86.107-96 (2012), 40 CFR section 86.108-79 (2012), 40 CFR section 86.108-00 (2012), 40 CFR section 86.130-96 (2012), 40 CFR section 86.133-96 (2012), 40 CFR section 86.138-96 (2012), 40 CFR section 86.143-96 (2012), 40 CFR section 86.508-78 (2012), 515-78 (2012), 1066.210 (2014), 1066.925 (2014), 1066.955 (2014), 1066.965 (2014).

Control of Evaporative Emissions from New and In-Use Nonroad and Stationary Equipment, Title 40, Code of Federal Regulations, Part 1060. United States Environmental Protection Agency, 40 CFR section 1060.520 (2012).

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

UN Global Technical Regulations No.2, MEASUREMENT PROCEDURE FOR TWO-WHEELED MOTORCYCLES EQUIPPED WITH A POSITIVE OR COMPRESSION IGNITION ENGINE WITH REGARD TO THE EMISSION OF GASEOUS POLLUTANTS, CO2 EMISSIONS AND FUEL CONSUMPTION, ECE/TRANS/180/Add.2/Amend.4, February 3, 2020.

9.1 Appendix A – Variable Speed Cooling Blower

Unless specified below, the cooling fan specifications shall meet the requirements of ECE/TRANS/180/Add.2, section 6.5.2.5.

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 ± 0.05 meters (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):

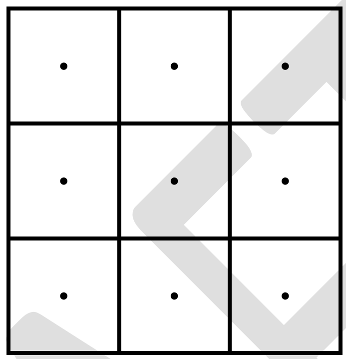
Actual dynamometer roll speed	Allowable cooling air speed
0 km/h	0 km/h
Above 0 km/h to <10 km/h	0 km/h
At 10 km/h to 50 km/h	Roll speed ± 5 km/h

Above 50 km/h	Roll speed ± 10 percent

f) The cooling air speed above must be determined as an averaged value of 9 measuring points.

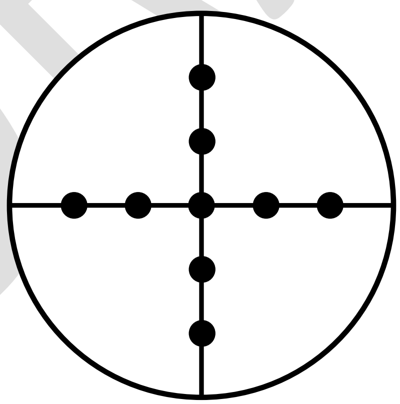
1) For blowers with rectangular outlets, both horizontal and vertical sides of the blower outlet must be divided into 3 equal parts yielding 9 equal rectangular areas (see the diagram below). The measurement points are located at the center of each rectangular area.

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 ± 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.