

California Environmental Protection Agency



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Portable Outboard Marine Tank Test Procedure

TP-512

**Permeation Rate from Portable Outboard Marine Tank
Fuel Hoses and Portable Outboard Marine Tank Primer Bulbs**

Adoption Date: To be Determined

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**California Environmental Protection Agency
Air Resources Board**

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**Permeation Rate from Portable Outboard Marine Tank
Fuel Hoses and Primer Bulbs**

The definitions in Section 2468.2, Article 6, Chapter 9 of Title 13, California Code of Regulations (CCR) apply to this test procedure.

For the purpose of this procedure, the term "ARB" refers to the California Air Resources Board, and the term "Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

1. APPLICABILITY

This test procedure is used by the ARB to determine the permeation rate from a portable outboard marine tank fuel hose and portable outboard marine tank primer bulb as required in Certification Procedure CP-510. This test procedure is applicable in all cases where portable outboard marine tank fuel hoses and portable outboard marine tank primer bulbs are subject to the maximum allowable permeation rates for portable outboard marine tank fuel hoses and portable outboard marine tank primer bulbs that are manufactured for sale, advertised for sale, sold, or offered for sale in California or that are introduced, delivered or imported into California for introduction into commerce.

1.1 Requirement to Comply with Other Applicable Codes and Regulations

Certification or approval by the Executive Officer does not exempt a portable outboard marine tank fuel hose or primer bulb from compliance with other applicable codes and regulations such as local, State or federal safety codes and regulations.

1.2 Safety

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

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

Permeation emissions may result if fuel penetrates the molecular structure of a material and migrates to ambient air. The resulting emissions can be observed by measuring daily weight loss. This procedure specifies test fuel and requires an eight (8) week preconditioning period followed by a fifteen (15) day test period. Measurements are

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obtained using a top loading balance.

3. BIASES AND INTERFERENCES

- 3.1** Moisture, temperature and pressure can bias mass measurements. All data shall be recorded on the data sheet.
- 3.2** Samples stored near high concentrations of hydrocarbon vapor may gain weight. Care shall be taken to purge the temperature enclosure at regular intervals to limit hydrocarbon vapor buildup.
- 3.3** Incorrectly installed components may bias the reported results.
- 3.4** Some electronic balances are sensitive to the effects of small static charges. If small amounts of static electricity influence the balance, the portable outboard marine tank fuel hose assembly shall be statically discharged or the balance shall be shielded from the effects of static electricity.

4. SENSITIVITY AND RANGE

The range of measurements is approximately 200 to 3,000 grams depending on the installed components. All measurements shall be conducted using an electronic top loading balance. This balance shall be capable of a measurement of at least 125% of the expected maximum test weight. The balance shall have a minimum readability of 0.1 grams and minimum reproducibility of ± 0.2 grams.

5. EQUIPMENT

- 5.1** An electronic top loading balance that meets the requirements of Section 4.
- 5.2** NIST or NVLAP traceable calibration weights. A sufficient number of weights to verify measurements at 20%, 80%, and 100% of the balance range
- 5.3** A ventilated temperature enclosure capable of maintaining 73°F +/- 9°F.
- 5.4** A barometric pressure instrument capable of measuring atmospheric pressure at the location of the balance to within +/-0.02 inches of mercury.
- 5.5** A relative humidity measuring instrument capable of measuring relative humidity percentage (%RH) at the location of the balance with a sensitivity of +/-2%RH.
- 5.6** Test Fuel: E-10 (90% fuel complying with California Phase 3 Reformulated Gasoline requirements with 10% by volume Ethanol).

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6. CALIBRATION PROCEDURE

- 6.1** All instruments and equipment used to conduct this procedure shall be calibrated per the manufacturer's specifications before testing.
- 6.2** The electronic balance shall be calibrated by a certified calibration company or agency within 12 months of testing.
- 6.3** During testing, the accuracy of the balance shall be verified with calibration weights at 20%, 80% and 100% of the balance range. All verification readings shall be within +/-2% of the calibration weight mass. During test weigh-ins, no more than 25 measurements or 2 hours shall pass (whichever is earliest) without verifying the accuracy of the balance. Tare the balance and repeat the previous measurement if the zero reading drifts more than +/-0.1 grams.

7. TEST PROCEDURES

This procedure shall be used to calculate the permeation rate in order to demonstrate compliance with the maximum allowable permeation rate as specified in CP-510.

- 7.1** Identify the test component with a unique ID number and record on the data sheet (see Figure 1).
- 7.2** Determine the inside surface area of component to the nearest square centimeter and record on the data sheet.
- 7.3** Install the component on a test can similar to the type described in SAE J1527.
- 7.4** Fill the test assembly (test can with component) with test fuel. Primer bulbs shall be actuated once per week during preconditioning and once per day during testing to ensure the inner cavity remains in contact with test fuel.
- 7.5** Precondition for 8 weeks at 73°F +/- 9°F or 4 weeks at 110°F +/- 9°F.
- 7.6** Acclimate the test assembly to 73°F +/- 4°F for a period of 6 to 36 hours prior to testing. At no time during the test period shall the test assembly be removed from this test temperature for more than 15 minutes.
- 7.7** Check the balance with calibration weights at 20%, 80%, and 100% of the balance range (see Section 5.2).
- 7.8** Carefully weigh the test assembly and record the weight, date, time, temperature, relative humidity (%), and barometric pressure on the data sheet.
- 7.9** Confirm the balance has not deviated. Check the balance with calibration weights at 20%, 80% and 100% of the balance range. See Section 5.2.

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7.10 After 24 hours (+/-30 minutes), repeat Sections 7.7 through 7.9.

7.11 Repeat Sections 7.7 through 7.10 for a minimum of 15 days or until a constant weight loss has been achieved, whichever is later. Constant weight loss is defined as the results of ten consecutive readings with a correlation coefficient of 95% or greater. See Section 8.

8. CALCULATING RESULTS

Inside Surface Area

The inside surface area of the fuel hose and primer bulb shall be converted to square meters as follows:

$$A_m = A_{cm} / 10,000$$

Where:

- A_m = inside surface area (square meters)
- A_{cm} = measured inside surface area (square centimeters)
- 10,000 = number of square centimeters per square meter

Daily Weight Loss

The daily weight loss is calculated by subtracting the final weight from the initial weight:

$$W_{loss} = W_i - W_f$$

Where:

- W_{loss} = daily weight loss (grams/day)
- W_i = initial measured weight (grams) in a 24-hour period
- W_f = final measured weight (grams) for the same 24-hour period

Permeation Rate

$$P = W_{loss} / A_m$$

Where:

- P = permeation rate (grams/day/square meters)
- W_{loss} = daily weight loss (grams/day)
- A_m = inside surface area (square meters)

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Constant Weight Loss Correlation Coefficient

Plot the cumulative daily weight loss (grams) against the sampling time (days). Perform a linear regression of ten (10) consecutive data points (spreadsheet or hand calculation) using the equation shown below. A correlation coefficient of 95% or greater shall demonstrate constant weight loss.

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

Where:

- r = correlation coefficient
- n = number of samples (10)
- X = day number (i.e., 1-10)
- Y = cumulative daily weight loss (grams)

9. RECORDING DATA

Record all required data on a field data sheet. An example of a field data sheet is shown in Figure 1. Alternate test forms may be used provided they list the same minimum parameters as shown in Figure 1.

10. QUALITY ASSURANCE / QUALITY CONTROL

All certified fuel specifications and data accuracy verifications including, but not limited to, annual calibrations and daily calibration checks shall be submitted with the test data when requesting ARB certification. All data must be carefully recorded on the field data sheet during the test. Any unusual occurrences in the process operation, unusual test instrument readings, or items that could possibly affect the test results should be noted on the data sheet. It is recommended that a checklist, in addition to the data sheet be used to assure all data needed for calculation or process information are obtained.

11. ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the Executive Officer. In order to secure the Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating, to the Executive Officer's satisfaction, that the alternative test procedure is equivalent to this test procedure.

- (1) Such approval shall be granted on a case-by-case basis only and ARB approvals submitted with the affected test data.
- (2) Documentation of any such requests, equivalency demonstrations, and ARB approvals shall be maintained by the ARB and shall be made available upon request.

12. REFERENCES

Society of Automotive Engineers (SAE), "Surface Vehicle Standard J1527 Marine Fuel Hoses", March 1, 2004 revision

Air Resources Board (ARB) "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles", October 2007 revision

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Figure 1 – Sample Data Sheet

Test Company: _____ Test Personnel: _____

Sample ID #: _____ Assembly Manufacturer: _____

Fuel Hose Class: _____ Fuel Hose Internal Diameter: _____

Assembly Weight (dry): _____ Assembly Length: _____ Inside Surface Area: _____

Hose Connector Model(s): _____ Primer Bulb Model: _____

Balance Make/Model: _____ Capacity/Resolution: _____ Annual Calib. Date: _____

Test Start:

Test Fuel Type: _____ Test Fuel Weight: _____

Test Start, Date/Time: _____ Test End, Date/Time: _____

Fuel Hose Assembly Permeation Results: (attach additional sheets for 15 or more test days)

Highest Daily Weight Loss: _____ (grams/day) **Permeation Rate:** _____ (grams/day/sq. meter)

Day	Weight			Temp.	% R.H.	Baro.	Pre Run Calibration Check			Post Run Calibration Check		
	Initial	Final	Loss				20%	80%	100%	20%	800%	100%
0		----	----									
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15	----											

Documentation of Performance (attach additional sheets as necessary)

Date: _____ Comment: _____

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