

California Environmental Protection Agency



Vapor Recovery Test Procedure

PROPOSED: TP-201.2E

Gasoline Liquid Retention in
Nozzles and Hoses

Adopted: _____

All text is proposed for adoption.

**California Environmental Protection Agency
Air Resources Board**

Vapor Recovery Test Procedure

DRAFT TP-201.2E

**Gasoline Liquid Retention in
Nozzles and Hoses**

Definitions common to all certification and test procedures are in:

D-200 Definitions for Vapor Recovery Procedures

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

1. PURPOSE AND APPLICABILITY

- 1.1** The purpose of this procedure is to quantify the volume of liquid gasoline retained within the nozzle spout and vapor passage of the hose between refueling events. Gasoline retained on the atmospheric side of the vapor check valve, and/or in the nozzle's liquid path, is subject to potential evaporation and/or spillage and is referred to as "Liquid Retention". The potential decrease in Phase II efficiency and the resulting Precursor Organic Compound (POC) emissions due to liquid retention can be calculated based on the liquid quantities measured and volume of gasoline dispensed.
- 1.2** The procedure also measures the amount of gasoline dispensed if the nozzle trigger is accidentally depressed prior to activation of the dispenser. For the purpose of this procedure, this phenomenon shall be referred to as "Spitting".

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

- 2.1** A gasoline-resistant graduated cylinder is used to measure the liquid gasoline retained in the nozzle/hose assembly during each test run. A Baseline evaluation of each nozzle's initial retained quantity of gasoline, subject to liquid retention, is conducted. The Baseline Run is conducted without regard to prior dispenser throughput. After completing the Baseline Run on all nozzles at the GDF the Test Run is conducted. The Test Run evaluates retained gasoline subject to liquid retention at the conclusion of an observed refueling event. The quantity of dispensed fuel is recorded and included in the Test Run evaluation.
- 2.2** During the Baseline Run, a gasoline resistant graduated cylinder is used to measure "spitting" at each nozzle. Spitting is defined as the amount of fuel that is "dispensed" by depressing the nozzle trigger **prior to** activating the dispenser.

3. BIASES AND INTERFERENCES

- 3.1 Do not compress the bellows of a balance-type nozzle with a vapor check valve. This will open the valve and may allow gasoline which is not normally subject to spillage or evaporation to be drained from the nozzle and hose.
- 3.2 Do not actuate the dispenser. This will pressurize the hose and may result in the inclusion of gasoline not normally subject to spillage, evaporation or spitting.

4. EQUIPMENT

- 4.1 Funnel. Gasoline resistant, non-breakable funnel of appropriate size(s) for use with the graduated cylinders.
- 4.2 Graduated Cylinders. Gasoline resistant, non-breakable graduated cylinders with maximum capacities of 10, 25 and 100 ml. The 10 ml graduated cylinder may be necessary to quantify liquid retain less than two (2.0) ml.
- 4.3 Gasoline Can. Use an approved gasoline can of at least one (1.0) gallon capacity and equipped with a vapor tight cap.
- 4.4 Other Equipment. Gasoline resistant gloves and safety glasses.

5. PROCEDURE

- 5.1 To ensure consistency between runs, take all graduated cylinder readings at the liquid level meniscus, holding the graduated cylinder vertical and at eye level.
- 5.2 After each measurement, empty the graduated cylinder(s) into the gasoline can. As needed, carefully empty the gasoline from the gasoline can into the LOWEST OCTANE Phase I product riser.

5.3 Baseline Run

- 5.3.1 Record the following on the BASELINE RUN FIELD DATA SHEET
 - a) Gasoline Dispensing Facility Name and Address
 - b) System Manufacturer
 - c) Dispenser and/or Nozzle Number
 - d) Gas Grade

Note: The steps below must be followed, in the specified sequence, for each nozzle tested.

- 5.3.2 Verify that the 25 ml graduated cylinder is completely empty. Position the funnel in the top of the graduated cylinder. If a bellows-equipped nozzle is being tested, the funnel used must be wide enough to capture any liquid retained in the bellows.
- 5.3.3 Remove nozzle from the dispenser holster and hold nozzle in normal upright position (nozzle pointed up) at approximately waist height.

- 5.3.4 Carefully tilt the nozzle tip down into the funnel/graduated cylinder assembly. Lower the nozzle as close to the ground as possible and “walk out” the hose while keeping the nozzle tip in the funnel/graduated cylinder. Keep the nozzle lowered and hose “walked out” while any gasoline in the nozzle/hose assembly drains into the funnel/graduated cylinder. Maintain the nozzle in this position and hose “walked out” for at least fifteen (15) seconds, allowing any retained liquid to drain from the nozzle. After the required fifteen (15) seconds, keep the hose and nozzle in this position until there is no flow (drips) of gasoline for ten (10) seconds. If the flow does not stop, continue to measure drips for an additional two minutes. Remove the nozzle from the funnel/graduated cylinder and return it to the dispenser holster.
- 5.3.5 Record the following information on the BASELINE RUN FIELD DATA SHEET.
 - a) Nozzle Type
 - b) Nozzle Serial Number
 - c) Nozzle Date Code (if applicable)
 - d) Spout Type, Aluminum (AL) or Stainless Steel (SS)
 - e) Total amount of liquid gasoline (ml) in the graduated cylinder.

5.3 Spitting

- 5.4.1 Remove the nozzle from dispenser holster and hold the nozzle a normal upright position (spout pointed up) at approximately waist height.
- 5.4.2 Keeping the nozzle at approximately waist height, and at arms' length from your body, carefully insert the nozzle tip down at least two inches into the 0-100 ml graduated cylinder and tilt both nozzle and cylinder down until the spout and graduated cylinder are vertical. Lower the nozzle as close to the ground as possible, keeping it in the cylinder and pointed down. With the dispenser in the **OFF** position, pull the nozzle trigger and hold in the fully open position. Keep the nozzle in the graduated cylinder with the trigger pulled until there is no flow (drips) of gasoline for ten (10) seconds. Remove the nozzle from the graduated cylinder and return it to the dispenser holster.
- 5.4.3 On the Spitting section of the BASELINE RUN FIELD DATA SHEET record the number of additional milliliters (ml) of gasoline that “spit” into the graduated cylinder when the trigger was pulled.
- 5.4.4 Repeat the steps in sections 5.4.1 through 5.4.3 until there is no longer tension on the trigger. Use additional lines on the form as needed.

5.5 Test Run

Note: The steps below must be followed, in the specified sequence, for each nozzle tested. It is not necessary to select nozzles for the Test Run in the same order as for the Baseline Run, as long as the Baseline Run precedes the Test Run for each nozzle.

- 5.5.1 Wait until a customer drives up to the pump and uses the nozzle of interest.

Observe the dispensing event. Note whether topping off occurred. Approximately 60 seconds after the nozzle has been returned to the dispenser holster at the end of the refueling event, perform the following procedures.

- 5.5.2 Test the nozzle/hose assembly pursuant to Section 5.3.1 through 5.3.4.
- 5.5.3 Record the total amount of liquid gasoline in the graduated cylinder on the TEST RUN FIELD DATA SHEET under "Test Run Total, ml".

5.6 Regeneration of Liquid Retention

Certain defects may cause the nozzle to act as self-refilling open container. If regeneration of liquid is suspected, the following procedure can be used to measure the resulting quantity of liquid.

- 5.6.1 Allow 5 to 10 minutes following a test run, with no other fueling activity involving the nozzle. Test the nozzle/hose assembly pursuant to Section 5.3.1 through 5.3.4. (Note: this test **should not** directly follow a spitting test.)
- 5.6.2 Record the total amount of liquid gasoline in the graduated cylinder on the REGENERATION FIELD DATA SHEET under "Retained Liquid, ml".
- 5.6.3 Repeat, allowing 5 to 10 minutes between repetitions, with no other fueling activity involving the nozzle, until no liquid is found or until regeneration has been sufficiently documented.

6. CALCULATIONS

6.1 The mass of liquid retain in the nozzle/hose assembly shall be calculated as follows:

$$M_r = (6.2 \text{ pounds/gallon}) \left(\frac{1 \text{ gallon}}{3,785 \text{ mls}} \right) (V_r) \quad \text{Equation 6.1}$$

Where:

- M_r = Mass of liquid retain in nozzle/hose assembly, pounds
- V_r = Volume of liquid retain in nozzle/hose assembly, ml
- 6.2 = Weight of gasoline, pounds/gallon
- 3,785 = Conversion from gallons to ml, ml/gallon

6.2 The mass of vapors recovered during the refueling event, assuming 100 percent

Phase II recovery shall be calculated as follows:

$$M_{vap} = \left(\frac{8.4 \text{ pounds}}{1,000 \text{ gallons}} \right) (G_{dis}) \quad \text{Equation 6.2}$$

Where:

- M_{vap} = Mass of vapors recovered at 100% recovery during refueling, pounds
- G_{dis} = Gallons of gasoline dispensed, gallons
- 8.4 = Weight of 1,000 gallons of vapors, pounds

6.3 The potential loss in control efficiency per refueling event shall be calculated as follows:

$$E_{loss} = 100 - \left(\frac{M_{vap} - M_r}{M_{vap}} \right) (100) \quad \text{Equation 6.3}$$

Where:

- E_{loss} = The potential loss in control efficiency due to liquid retention, percent

7. REPORTING

- 7.1** Report the retained liquid gasoline volumes for the BASELINE and TEST RUN procedures along with the total gallons of gasoline dispensed on the respective field data sheet.
- 7.2** Report the “spitting” volume on the BASELINE FIELD DATA SHEET.
- 7.3** Calculate and record the retain weight M_r , on the TEST RUN FIELD DATA SHEET.
- 7.4** Calculate and record the mass of vapors recovered during the refueling event, assuming a 100 percent recovery, M_{vap} on the TEST RUN FIELD DATA SHEET.
- 7.5** Calculate and record the potential loss of control efficiency, E_{loss} , on the TEST RUN FIELD DATA SHEET.
- 7.6** If regeneration of liquid is documented, calculate and record as specified above.

8. POST-TEST PROCEDURES

- 8.1** Use Equation 6.1 to calculate the mass of liquid retain for each refueling event
- 8.2** Use Equation 6.2 to calculate the mass of vapors recovered during each refueling event, assuming 100 percent Phase II vapor recovery.
- 8.3** Use Equation 6.3 to calculate the potential loss in efficiency for each refueling event.

9. FORMS

9.1 Form 1 - Example of Baseline Run Field Data Sheet.

9.2 Form 2 - Example of Test Run Field Data and Results Sheet.

9.3 Form 3 - Example of Regeneration Field Data Sheet.

**FORM 1 NOZZLE LIQUID RETENTION
BASELINE RUN FIELD DATA SHEET**

STATION NAME _____ ADDRESS _____
 CITY _____ PHASE II SYSTEM TYPE _____
 TEST CONDUCTED BY: _____ TEST DATE _____ GDF# _____

Nozzle or Dispenser Number	Gas Grade	Nozzle Manufacturer/ Model	Nozzle Serial Number	Nozzle Date Code	Spout Type AI/SS	Baseline Total, ml	Spitting, ml	Spitting, ml	Spitting, ml	Spitting, Total, ml

**FORM 2 NOZZLE LIQUID RETENTION
TEST RUN FIELD DATA SHEET**

STATION NAME _____ ADDRESS _____
CITY _____ PHASE II SYSTEM TYPE _____
TEST CONDUCTED BY: _____ TEST DATE _____ GDF# _____

Nozzle or Dispenser Number	Gas Grade	Nozzle Manufacturer/ Model	Nozzle Serial Number	Nozzle Date Code	Spout Type, AI / SS	Gallons Pumped	Dollar Amount	Test Run Total, ml	M _r , Pounds	M _{vap} , Pounds	E _{loss} , Percent

**FORM 3 NOZZLE LIQUID RETENTION
REGENERATION FIELD DATA SHEET**

STATION NAME _____ ADDRESS _____
 CITY _____ PHASE II SYSTEM TYPE _____
 TEST CONDUCTED BY: _____ TEST DATE _____ GDF# _____

Nozzle or Dispenser Number	Gas Grade	Nozzle Manufacturer/ Model	Retention 1st Test ml	Minutes since Last Test	Totalizer Reading	Retention Next Test ml	Minutes since Last Test	Totalizer Reading	Retention Next Test ml	Minutes since Last Test	Totalizer Reading	Total Retain ml