

California Environmental Protection Agency



**Vapor Recovery Test Procedure**

**PROPOSED TP - 201.6-C**

**Determination of Liquid Removal Rate**

**Adopted:** \_\_\_\_\_

All text is proposed for adoption.



**California Environmental Protection Agency  
Air Resources Board**

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**TP-201.6-C**

**Determination of Liquid Removal Rate**

A set of definitions common to all certification and test procedures is in:

**D-200 Definitions for Vapor Recovery Procedures**

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

**1. APPLICABILITY**

- 1.1** This procedure is used to quantify the removal rate of liquid from the vapor passage of a Phase II balance system hose equipped with a liquid removal device. This procedure determines compliance with the performance standards defined in the Certification Procedure, CP-201, for the purposes of certification and for determining gasoline dispensing facilities compliance.

**2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE**

- 2.1** Liquid in the vapor path of a coaxial hose is drained and measured. If the amount drained exceeds 25 ml, a liquid removal test is conducted. For those hoses with less than 25 ml drained, testing may be required at the discretion of the district. A liquid removal test is conducted by introducing gasoline into the vapor path of a coaxial hose through the nozzle bellows. After a quantity of gasoline is dispensed, the amount of gasoline remaining in the hose is measured and the liquid removal rate is determined.

**3. BIASES AND INTERFERENCES**

- 3.1.** Slits or tears in the hose or nozzle vapor path may bias the results towards compliance.
- 3.2.** Spillage of liquid when draining hoses or introducing gasoline may invalidate the test.
- 3.3.** A breach of the inner product hose may introduce additional gasoline into the outer vapor path resulting in a larger volume drained than introduced.
- 3.4.** Improper nozzle and or hose orientation while dispensing may bias results toward non-compliance.

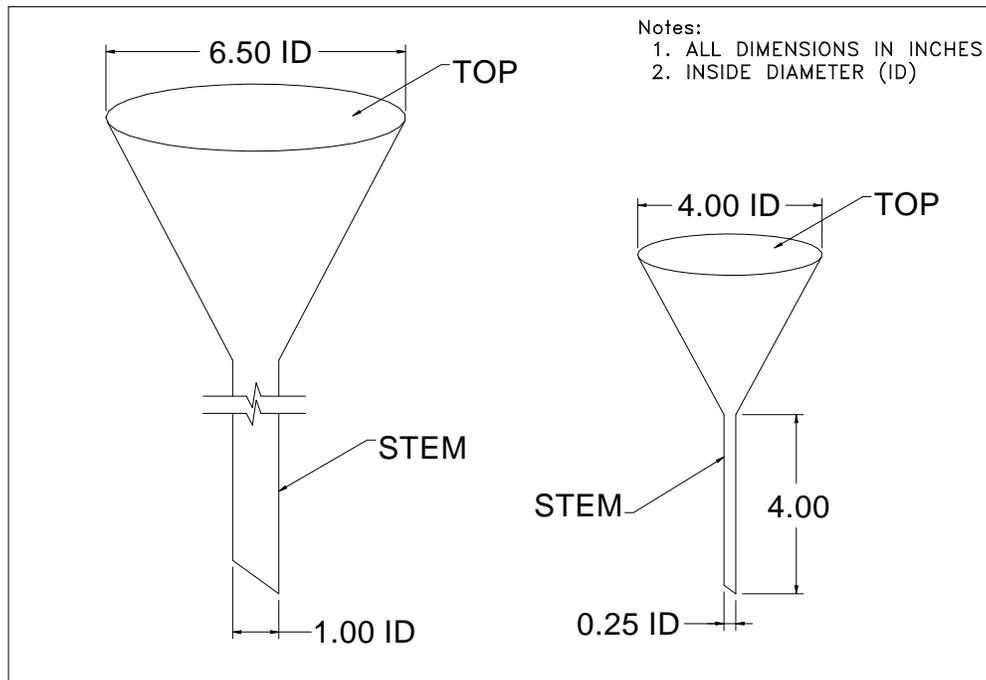
#### 4. SENSITIVITY, RANGE, AND PRECISION

- 4.1 The range of measurement of the liquid removal rate is dependent upon the range of the graduated cylinder used for testing.
- 4.2 To ensure precision, graduated cylinder readings shall be measured at the liquid level meniscus.

#### 5. EQUIPMENT

- 5.1. Stopwatch. Use a stopwatch accurate to within 0.2 seconds.
- 5.2 Funnels. Large and small gasoline compatible, non-breakable, funnels with dimensions similar to those as shown in Figure 1, or equivalent.
- 5.3 Tape Measure. Use a standard tape measure with a minimum length of 5 feet.
- 5.4 Graduated Cylinders. Gasoline compatible, non-breakable 0-25ml, 0-100ml, 0-250 ml, and 0-500 ml graduated cylinders with stable base plates. The 25ml cylinder may be necessary to quantify volumes of liquid less than 20 ml.

**FIGURE 1: NOZZLE SPECIFICATIONS**



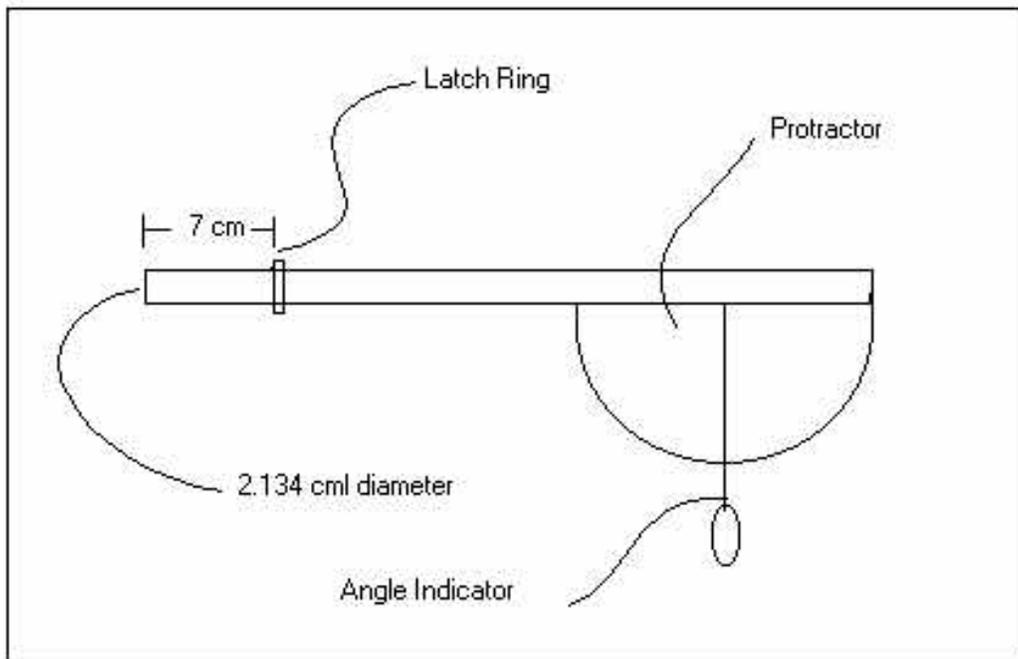
- 5.6 Gasoline Test Tank. (Optional) A portable tank, meeting fire safety requirements for use with gasoline, may be used to receive the gasoline dispensed during testing. The tank shall have sufficient volume so that at least 10 gallons may be dispensed prior to activating the primary shutoff mechanism of the nozzle. The tank shall be constructed

with a fill pipe opening meeting the specifications listed in Section 7.5 and 7.6 of this procedure. To minimize testing-related emissions, vehicle refueling events should be used for this procedure whenever feasible.

- 5.7 Traffic Cones. Use traffic cones to encircle the area where testing is conducted.
- 5.8 Spout Angle Device. Use an angle measurement device to ensure the nozzle spout is resting in the vehicle or test tank fill pipe at an angle of  $30^\circ (\pm 5^\circ)$  degrees from horizontal during dispensing. A typical way to do this is to use a spout angle measurement device, as shown in Figure 2.

**FIGURE 2: SPOUT ANGLE MEASUREMENT DEVICE**

**NOTE: THIS IS A DRAFT ILLUSTRATION AND IS SUBJECT TO REVISION**



- 5.9 Field Data Sheet. Use a data sheet to record information similar to that as shown in Form 1. Form 1 serves as an example; districts may require a modified version.
- 5.10 Gasoline Container. Use a portable fuel container equipped with a tight fitting cap, of at least 1.0 gallon capacity.

## 6. PRE-TEST PROCEDURE

- 6.1 Verify that the 500 ml graduated cylinder is empty. Position the large funnel into the graduated cylinder.
- 6.2 Remove the nozzle from the dispenser and carefully tilt the spout into the funnel/graduated cylinder assembly.

- 6.3** Lower the nozzle and funnel/graduated cylinder assembly as close to the ground as possible. "Walk out" the hose while keeping the nozzle lowered and hose fully extended. The hose shall slope downward from the dispenser toward the nozzle.
- 6.4** Open the nozzle's vapor check valve by compressing the bellows. Allow two minutes for all liquid to drain. Use caution to avoid spillage.
- 6.5** Return the nozzle to the dispenser and measure the amount of liquid drained. If the amount drained is less than 200 ml, transfer the liquid into an appropriately sized graduated cylinder. For example, if 40 ml of liquid was drained, use the 100 ml graduated cylinder to take the measurement.
- 6.6** Record the amount of liquid drained on Form 1.
- 6.7** If the amount drained is greater than or equal to 25 ml, proceed to Section 7 of the procedure. Hoses with greater than 25 ml drained are considered to be pre-wetted. If the amount drained is less than 25 ml, proceed to the next nozzle/hose to be evaluated and repeat Section 6.1-6.6 **or** at the discretion of the district proceed to section 6.8.
- 6.8** PREWET the hose as follows:
  - 6.8.1. Carefully pour between 150 to 175 ml of gasoline into the 250 ml graduated cylinder.
  - 6.8.2. Remove the nozzle from the dispenser and position the nozzle upright so that the spout is in a vertical position.
  - 6.8.3. Open the nozzle's vapor check valve by compressing the bellows and insert the small funnel between the bellows and nozzle spout.
  - 6.8.4. Carefully introduce the gasoline into the vapor path of the hose. Use caution not to spill the gasoline. Remove the small funnel after the gasoline has been introduced.
  - 6.8.5. Carefully drain the gasoline from the vapor path as described in Section 6.1 through 6.5. Proceed to Section 7.

## **7. TEST PROCEDURE**

- 7.1** Pour 150 ml to 175 ml of gasoline into the 250 ml graduated cylinder. Measure and record this volume on Form 1.
- 7.2** Remove the nozzle from the dispenser and position the nozzle upright so that the spout is in a vertical position.
- 7.3** Open the nozzle's vapor check valve by compressing the bellows and carefully insert the stem of the small funnel between the bellows and nozzle spout.

- 7.4 Carefully introduce the measured volume into the vapor path of the hose. Use caution not to spill the gasoline. Remove the small funnel after the gasoline has been introduced.
- 7.5 Position a vehicle or test tank fill pipe opening 48 (±6) inches from the dispenser measured perpendicular to the nozzle hanger and 30 (±6) inches above grade. Use the tape measure to verify these distances. See Figure 3.
- 7.6 Insert the nozzle into the fill pipe. Use the angle measuring device to ensure the spout shall rest in the vehicle or test tank fill pipe at an angle of +30° (±5°) measured from horizontal. See Figure 3.
- 7.7 Dispense 7.5 (±0.5) gallons at the highest possible flow rate by holding the nozzle lever in the fully open position. Use a stopwatch to measure the time elapsed while dispensing. Record the volume of fuel dispensed and the elapsed time on a form similar to that as shown in Form 1.
- 7.8 Calculate the dispensing rate using the equation below. If the dispensing rate is less than 5.0 gallons per minute (GPM), or a minimum rate approved by the Executive Officer as being consistent with normal operation, the test results are invalid. If the dispensing rate is greater than 10.0 GPM the test results are invalid.

$$\text{GPM} = 60 \times (\text{G} / \text{T})$$

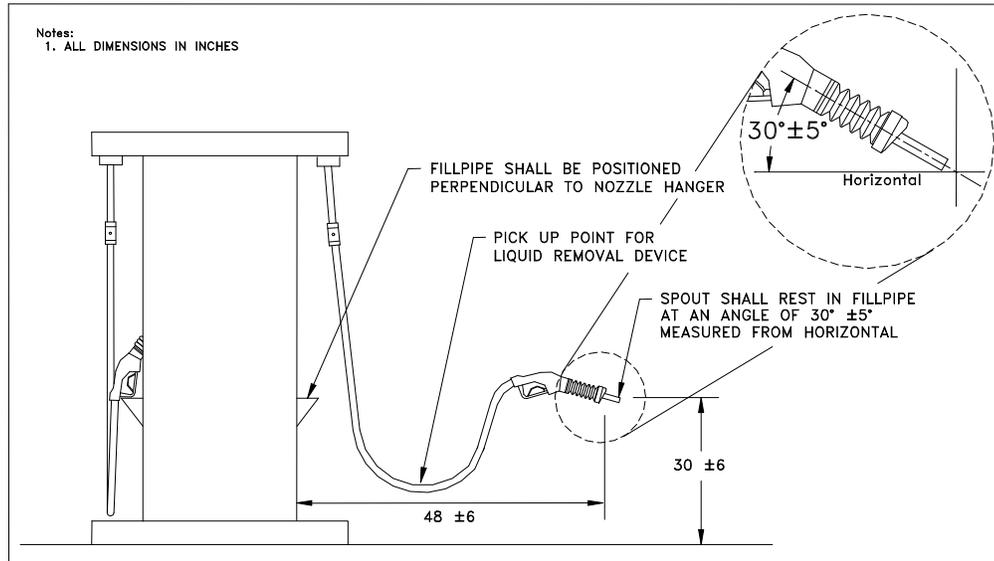
Where:

GPM	=	dispensing rate (in gallons per minute)
G	=	gallons of fuel dispensed
T	=	number of seconds required to dispense

- 7.9 Using the 250 ml graduated cylinder and large funnel, carefully drain the remaining liquid from the vapor path of the hose as described in Section 6.1 through 6.5. Record this quantity on Form 1.
- 7.10 If the liquid removal rate is less than the minimum rate specified in CP-201, but within 10.0 percent of the minimum rate specified, repeat the test two additional times and average the three results.

**FIGURE 3**

## NOZZLE AND HOSE POSITIONING FOR LIQUID REMOVAL TESTING



## 8. CALCULATING RESULTS

8.1 The liquid removal rate shall be calculated as follows:

$$VR = \frac{VI - VF}{G}$$

Where:

VR	=	Gasoline removed per gallon dispensed, milliliters/gallon
VI	=	Total initial volume poured into hose vapor passage, milliliters
VF	=	Volume of gasoline remaining in the hose vapor passage after dispensing, milliliters
G	=	Total dispensed, gallons

## 9. REPORTING RESULTS

9.1 Record all applicable liquid removal rate information on Form 1.

9.2 If the calculated liquid removal rate is greater than or equal to the minimum removal rate as specified in CP-201, the liquid removal device has demonstrated compliance.

9.3 If the calculated liquid removal rate is less than the minimum required, the liquid removal device is not in compliance.

## 10. ALTERNATIVE TEST PROCEDURES

**10.1** This procedure shall be conducted as specified. Modifications to this test procedure shall not be used to determine compliance unless prior written approval has been obtained from the Executive Officer, pursuant to Section 14 of Certification Procedure CP-201.

