California Environmental Protection Agency

Air Resources Board

**Vapor Recovery Test Procedure**

PROPOSED TP - 201.6

# DETERMINATION OF LIQUID REMOVAL OF PHASE II VAPOR RECOVERY SYSTEMS OF DISPENSING FACILITIES

Adopted: April 12, 1996
Amended: April 28, 2000

Note: this document consists of the text of the proposed amendment to TP-201.6. Proposed deletions are noted by ~~strikeout~~ and proposed additions are noted by underline.

**California Environmental Protection Agency**
**Air Resources Board**

**Vapor Recovery Test Procedure**

**TP-201.6**

**Determination of Liquid Removal of**
**Phase II Vapor Recovery Systems of**
**Dispensing Facilities**

## 1 APPLICABILITY

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

**D-200 Definitions for**
**Certification Procedures and**
**Test Procedures for**
**Vapor Recovery Systems**

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

This procedure is used to quantify the removal of liquid gasoline from the vapor passage of coaxial hoses equipped with a liquid removal device. It is applicable in all cases where a liquid removal system is required in conjunction with a Phase II balance system ~~and in most cases where a vacuum-assist Phase II system is utilized~~. This test procedure is explicitly not applicable to vapor assist type systems.

## 2 PRINCIPLE AND SUMMARY OF TEST PROCEDURE

~~A dynamic pressure baseline is established pursuant to TP-201.4. Sufficient~~ All gasoline is drained from the dispenser hose's vapor passage and a measured amount of liquid gasoline, usually 150 ml, is then introduced into the vapor passage. ~~of the coaxial hose to produce a dynamic pressure between 2.0 and 6.0 inches water column at a nitrogen flowrate of 60 CFH.~~ After ten gallons of gasoline are dispensed the ~~dynamic pressure is measured and compared to the baseline value. The total liquid volume removed is also considered.~~ liquid remaining in the hose is measured and the amount removed determined by subtraction with consideration of liquid which may adhere to the hose wall or be lost by evaporation.

~~This procedure may be used to determine only the removal rate of the liquid removal device if that is all that is required by some regulation.~~

## 3 BIASES AND INTERFERENCES

~~Any leaks in the nozzle vapor path or hose vapor path will result in erroneously low dynamic pressure results.~~

~~Alteration of the hose and loop configuration between the prefueling test and the post refueling test may result in erroneous dynamic pressure results.~~

~~If the hose connection, at the dispenser, is sufficiently low to allow the 100 CFH nitrogen flow to displace liquid gasoline into the underground Phase II piping, this test procedure shall not be used.~~

~~If the Phase II system type precludes conducting a dynamic pressure test, this test procedure shall be used only to determine the volume of liquid gasoline removed per gallon of gasoline dispensed.~~

Pouring 150 ml of fuel into the vapor passage may cause some nozzles to shut off prematurely. This can be usually overcome by using a smaller volume.

Allowing insufficient time for liquid to drain from the hose can cause errors in measurement of the volume drained.

## 4 SENSITIVITY, RANGE, AND PRECISION

~~For all procedures, available gauge ranges, which shall be used as appropriate for operating conditions, are from 0.0 inches WC to full scale readings (inches WC) of: 0.5, 1.0, 2.0, 5.0, and 10.0.~~ Range of measurement of liquid removal is approximately from 0 to 15 ml removed per gallon dispensed; upper range depends on volume of gasoline lost due to evaporation and surface adhesion to the hose wall and on the ability of the nozzle to function without premature shutoff with 150 ml of gasoline in the vapor passage.

## 5 EQUIPMENT

~~See TP-201.4 for a list of dynamic pressure test equipment.~~

### 5.1 Stopwatch

Use a stopwatch accurate to within 0.2 seconds.

### 5.2 Graduated Cylinder

Use a shatterproof ~~0-300 (minimum)~~250 milliliter cylinder which is compatible for use with gasoline.

~~5.3 Pressure Gauge~~

~~Use a 0-30 (minimum) psig pressure gauge to measure the gasoline delivery pressure.~~

## 6 CALIBRATION PROCEDURE

This section is reserved for future specification.

## 7 PRE-TEST PROTOCOL

~~7.1 Location of Test Site~~

~~Prototype systems will be located within 100 miles of Sacramento for testing. Other locations may be accepted at the discretion of the ARB Executive Officer.~~

7.~~2~~1 ~~Specification of~~ Test, Challenge, and Failure Modes for Certification Testing

The specification of test, challenge, and failure modes such as the number of liquid transfer episodes, volume and volumetric rate of liquid transfer, storage tank volumes, etc. shall be done according to the principles of CP-201 § 5 for the testing and evaluation of vapor recovery equipment. The facility and system shall be prepared to operate according to any specified test, challenge, and failure modes.

7.~~3~~2 System and Facility Preparation

System equipment and components shall be completely operational and, at newly constructed facilities, any storage tanks involved in the test shall ~~be~~ have been initially filled to the appropriate volume a minimum of 24 hours prior to the scheduled test.

~~In addition, the system and facility shall be prepared to operate according to any specified test, challenge, and failure modes.~~

7.~~4~~3 Specific Pre-Test Protocol Items

(1) Use a stopwatch to accurately measure the gasoline dispensing rates at high, medium, and low nozzle hold-open clip settings with no other refueling activity occurring at the facility. At least one gallon shall be dispensed before timing the dispensing rate. For those nozzles without hold-open latches, use wedges to simulate the three latch positions. Record this data. Alternatively, dispensing rate may be determined simultaneously with liquid removal as provided for in Section 8 below.

~~(2) Quantify the gasoline delivery pressure using the 0-30 psig pressure gauge. This~~

~~pressure shall be measured with no other refueling activity occurring at the facility. Record this pressure.~~

~~(3) Position the TP-201.4 pressure test assembly 48 inches (±2 inches) from the face of the dispenser in order to represent a typical refueling configuration.~~

~~(4) Completely drain all liquid from the vapor passage of the coaxial hose. Sufficient time shall be allocated for this pre-test procedure, especially if the hose has internal convolutions.~~

(5~~2~~) Use the graduated cylinder to pour 150 milliliters of gasoline into the vapor passage of the hose.

(6~~3~~) Completely drain the gasoline from the vapor passage back into the graduated cylinder. ~~Subtract this quantity from the original 150 milliliters. This value represents the volume of gasoline lost due to surface adhesion to the hose wall.~~

NOTE: The intent of these last two steps is to ensure that the vapor passage surfaces are pre-wetted with liquid gasoline to limit errors due to liquid lost by adhesion to these surfaces in subsequent measurements.

~~(7) With no dispensing activity occurring at the gasoline dispensing facility, conduct the dynamic pressure tests at nitrogen flowrates of 20, 60, and 100 CFH, in accordance with TP-201.4. Record the results on the Field Data Sheet (Figure 4 of TP-201.4). This establishes the dry baseline values for dynamic pressures.~~

## 8 TEST PROCEDURE

~~The facility and system shall be prepared to operate according to any specified test, challenge, and failure modes.~~

(1) Use the graduated cylinder to pour 150 milliliters of gasoline into the vapor passage of the hose.

~~(2) With no dispensing activity occurring at the gasoline dispensing facility, conduct the dynamic pressure test, in accordance with TP-201.4, at nitrogen flowrates of 20, 60, and 100 CFH. Record this data. This establishes the wet baseline values for dynamic pressures. Ensure that the dynamic pressure, at 60 CFH, does not exceed six (6) inches $H_2O$. This is to preclude the possibility of premature nozzle shutoff while dispensing fuel. If the wet baseline value is less than two (2) inches $H_2O$, use the graduated cylinder to add sufficient gasoline to raise the dynamic pressure to a minimum of two (2) inches $H_2O$.~~

~~(3) Move the Delta P Test Unit and position a vehicle such that the fillpipe inlet is in approximately (±six inches) the same location previously occupied by the TP-201.4~~

~~pressure test assembly.~~

(~~4~~2) Using the ~~low~~ high hold-open clip setting, dispense 10.0 ±0.10 gallons into the vehicle gas tank with no other refueling activity occurring at the facility, measuring the dispensing time with the stopwatch if the dispensing rate was not previously established. Record the exact volume (and dispensing time if measured). If premature nozzle shutoff occurs after pouring 150 ml of gasoline into the vapor passage, then reduce the amount of gasoline poured into the vapor passage progressively in 25 ml increments to identify the largest volume which does not have this effect. Repeat all steps above and this step, adding the amount of gasoline thus established instead of 150 ml, and dispensing a proportionally lesser amount of fuel (i.e. (10.0 x liquidVolume/150ml)±0.10 gallons).

~~(5) Move the vehicle and return the TP-201.4 pressure test assembly to its original position, using the traced outline of the base to verify it's position.~~

~~(6) Conduct the dynamic pressure test, in accordance with TP-201.4, at nitrogen flowrates of 20, 60, and 100 CFH. Record this data. These values represent the post-refueling dynamic pressures.~~

(~~7~~3) Carefully drain any gasoline present in the vapor passage of the hose into the graduated cylinder. Record this quantity. If compliance is demonstrated at a high flow rate, testing at lower flow rates is not required unless specified by the ARB Executive Order applicable to the specific type of vapor recovery system or an applicable regulation.

(~~8~~4) If necessary, r~~R~~epeat appropriate steps with the hold-open clip in both the medium and ~~high~~ low positions. Record this data. If performance meets specified requirements of the ARB Executive Order applicable to the specific type of vapor recovery system or an applicable regulation at any of the three flow rates (high, medium or low hold-open clip settings), then compliance of the system shall be considered to be demonstrated. In the absence of other quantitative requirements the requirements of CP-201, section 4.2.6.1 shall apply if a system is determined by the Executive Officer of the ARB to be subject to performance specifications for liquid removal devices.

(5) Use the graduated cylinder to pour the same amount of gasoline into the vapor passage of the hose. Dispense no gasoline.

(6) Completely drain the gasoline from the vapor passage back into the graduated cylinder. Subtract this quantity from the volume added. This value represents the volume of gasoline lost due to evaporation in transfer to and from the graduated cylinder and adhesion of liquid to vapor passage surfaces in previous measurements.

## 9 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

## 10 RECORDING DATA

~~This section is reserved for future specification.~~ Record data on a form similar to the one shown in Figure 1.

## 11 CALCULATING RESULTS

The volume of liquid gasoline removed from the hose vapor passage per gallon of gasoline dispensed is calculated as follows:

$$VR = \frac{(VI - VW) - VF}{G}$$

where:

| | | |
|---|---|---|
| VR | = | Gasoline removed per gallon dispensed, milliliters/gallon |
| VI | = | Total initial volume poured into hose vapor passage, milliliters |
| VW | = | The liquid lost due to wall adhesion and evaporation, milliliters |
| VF | = | The volume of gasoline remaining in the hose vapor passage after dispensing, milliliters |
| G | = | The total gallons dispensed, gallons |

~~The percent increase in dynamic pressure, from dry baseline to post refueling conditions, is calculated as follows:~~

~~$$PI = \frac{PPR - PDB}{PDB} \times 100\%$$~~ ~~Delete equation~~

~~where:~~

| | | |
|---|---|---|
| ~~PI~~ | ~~=~~ | ~~The percent increase in dynamic pressure from dry baseline to post refueling conditions, percent~~ |
| ~~PPR~~ | ~~=~~ | ~~The post refueling dynamic pressure, inches $H_2O$~~ |
| ~~PDB~~ | ~~=~~ | ~~The dry baseline dynamic pressure, inches $H_2O$~~ |
| ~~100~~ | ~~=~~ | ~~Conversion factor from decimal fraction to percent~~ |

## 12 REPORTING RESULTS

This section is reserved for future specification.

## 13 ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB 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. Because of the evolving nature of technology and procedures for vapor recovery systems, such approval shall not be granted in subsequent cases without a new request for approval and a new demonstration of equivalency.

(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained in the ARB Executive Officer's files and shall be made available upon request.

## 14 REFERENCES

This section is reserved for future specification.

## 15 FIGURES

~~This section is reserved for future specification.~~

**Figure 1. Field Data Form**

<figure to be added>
**Figure 1. Field Data Form**

Facility Name & Address_____
Inspector_____ Date_____
Vapor Recovery System Type_____
Applicable Air Resources Board Executive Order # _____

| Pump Number | Gasoline Grade | (VI) Liquid Gasoline Added, ml | (G) Gallons Dispensed | (T) Time to Dispense, Seconds | 60(G)/(T) Dispensing Rate, GPM | (VF) Liquid Gasoline Remaining, ml | (VW) Liquid Gasoline Lost With No Dispensing | (VI+VW-VF)/G Removal Rate, ml/gallon |
|---|---|---|---|---|---|---|---|---|
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