California Environmental Protection Agency

Air Resources Board

Vapor Recovery Test Procedure

TP-201.1C

Leak Rate of Drop Tube/Drain Valve Assembly

Adopted: July 3, 2002
Amended: October 8, 2003

California Environmental Protection Agency
Air Resources Board

Vapor Recovery Test Procedure

TP-201.1C

Leak Rate of Drop Tube/Drain Valve Assembly

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 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

The purpose of this procedure is to quantify the leak rate of drop tube/drain valve assembly when the spill container drain valve is configured to pass liquid into the drop tube as shown in Figure 1. It is used to certify and to determine the compliance of components with the performance specification for the maximum allowable leak rate as defined in CP-201 Vapor Recovery Certification Procedure for Gasoline Dispensing Facilities.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

A compatible dust cap for a Phase I product adaptor is modified to allow the introduction of nitrogen into the Phase I drop tube. A pressure gauge is connected to the modified cap and nitrogen is flowed into the drop tube. If the resulting nitrogen flow rate necessary to maintain a steady-state pressure is less than or equal to the specifications described in CP-201, the drop tube/drain valve assembly is verified to be in compliance. An inflatable bladder is installed in the Phase I drop tube below the spill container drain valve path to eliminate potential biases resulting from the level of fuel in the storage tank.

3. BIASES AND INTERFERENCES

3.1 Missing or defective gaskets on the Phase I product adaptor or a loose adaptor may bias the results towards noncompliance. Prior to a final determination of noncompliance of the component(s), use leak detection solution on all visible components to verify the absence of leaks.

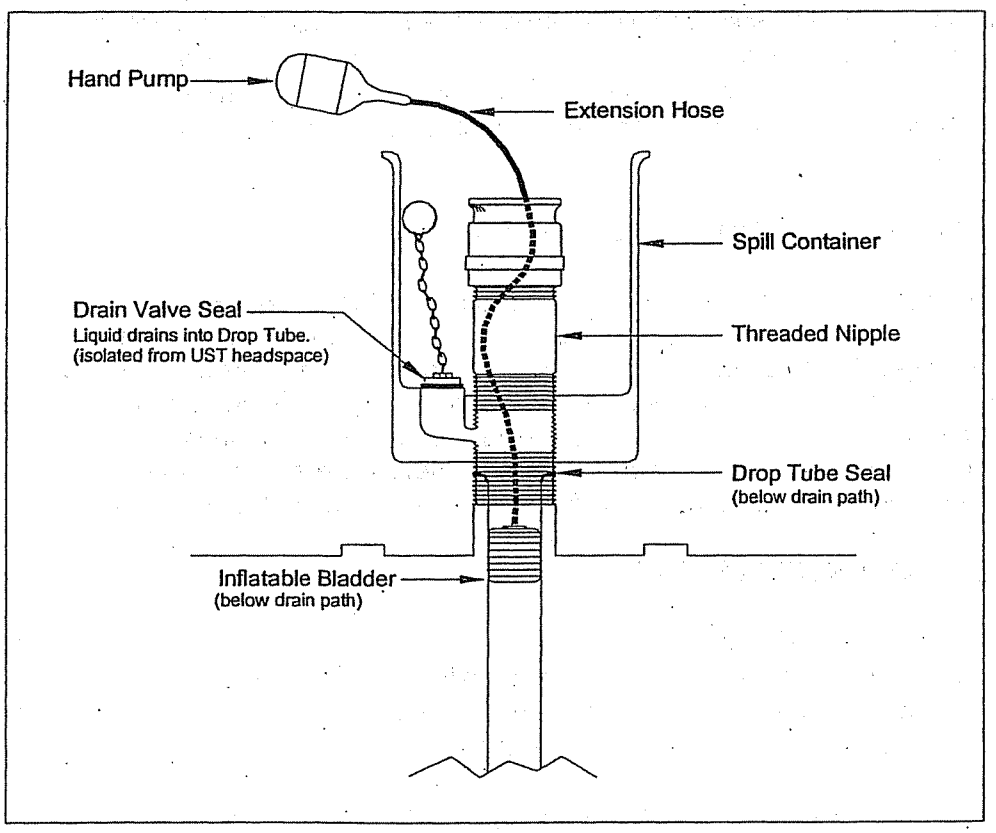
3.2 Leaks in the test equipment will bias the results toward noncompliance. Prior to conducting the test, this bias is eliminated by conducting a leak check of the test equipment. Leak detection solution may also be used during the test to verify the absence of leaks in the test equipment.

4. SENSITIVITY, RANGE, AND PRECISION

4.1 Flow Meter. The measurable leak rate is dependent upon the sensitivity, range and precision of the flow meter used for testing. The flow meter minimum sensitivity shall be 12.5 ml/min (.026 CFH) with minimum accuracy of ± 5 percent full-scale. The device scale shall be 150mm (5.91 inches) tall to provide a sufficient number of graduations for readability. For electronic flow metering devices, the minimum sensitivity shall be 1.0 ml/min (0.0021 CFH) with a minimum full-scale accuracy of ±1.0 percent.

4.2 Pressure Gauge. The measurable pressure is dependent upon the sensitivity, range and precision of the pressure gauge used for testing. For mechanical pressure gauges, the maximum pressure range shall be 0-4 inches H_2O. The minimum full-scale accuracy shall be ± 3.0 percent and the gauge shall be readable to the nearest 0.10 inches H_2O. For electronic pressure gauges, the maximum pressure range of the device shall be –10 to 10 inches H_2O. The minimum full accuracy shall be ± 1.5 percent of full-scale range and the pressure gauge shall be readable to the nearest 0.01 inches H_2O.

Figure 1
Typical Inflatable Bladder Installation



5. EQUIPMENT

5.1 Pressure Gauge. Use a pressure gauge with minimum specifications listed in Section 4 to monitor the pressure in the drop tube.

5.2 Flow Meter. Use a flow meter with minimum specifications listed in Section 4 to set the required nitrogen flow rate(s).

5.3 Nitrogen. Use commercial grade gaseous nitrogen in a high-pressure cylinder, equipped with a pressure regulator and a one psig pressure relief valve.

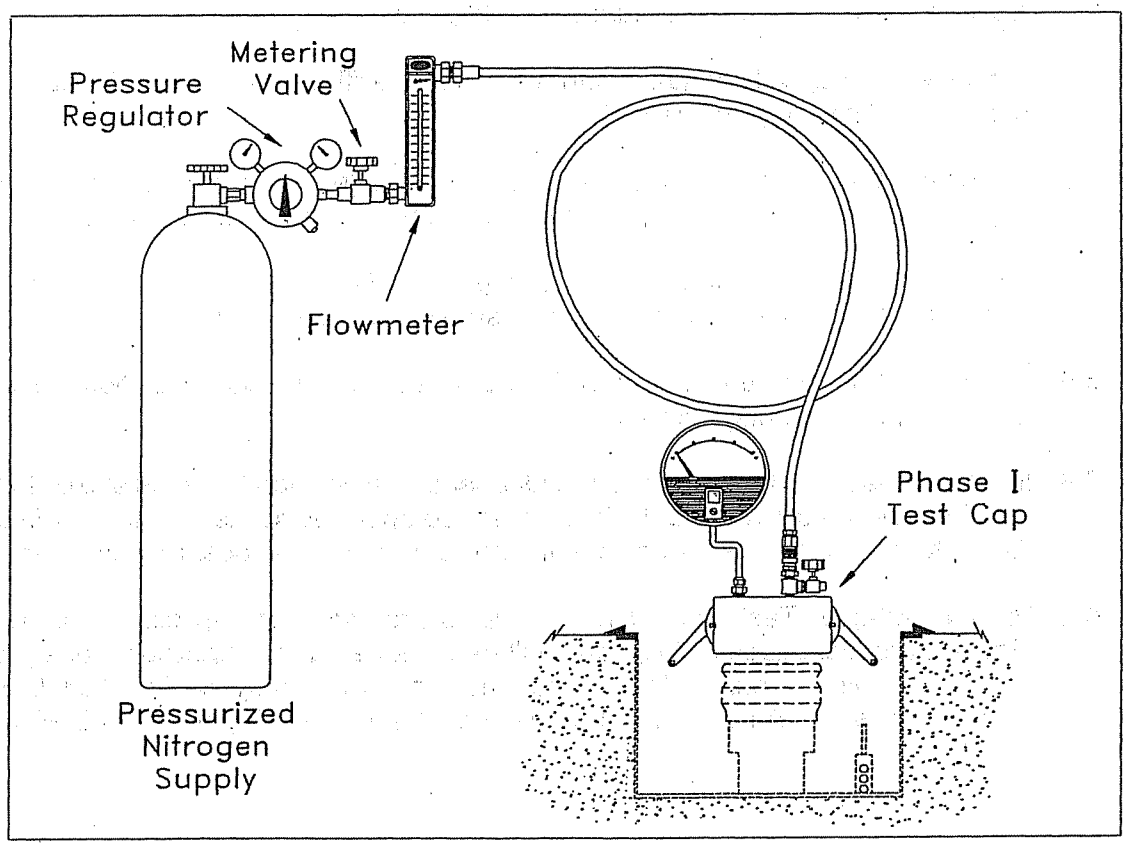
5.4 Stopwatch. Use a stopwatch accurate to within 0.10 seconds to time the pressurization of the drop tube and pressure stabilization period.

5.5 Leak Detection Solution. Any non-flammable commercial liquid solution designed to detect vapor leaks may be used.

5.6 Inflatable bladder. Use an inflatable bladder and extension hose, as shown in Figure 1, to isolate the drain valve. Unless otherwise specified in the certification Executive Order for the system, a "3-4 model" inflatable plumber's bladder may be used.

5.7 Product Adaptor Test Cap. Use a modified product dust cap compatible with the Phase I product adaptor. The cap shall be equipped with connections for a pressure gauge and flow meter. An optional metering valve may be installed to relieve excess pressure. An example of a Product Adaptor Test Cap is shown in Figure 3.

Figure 2
Leak Rate Test Assembly



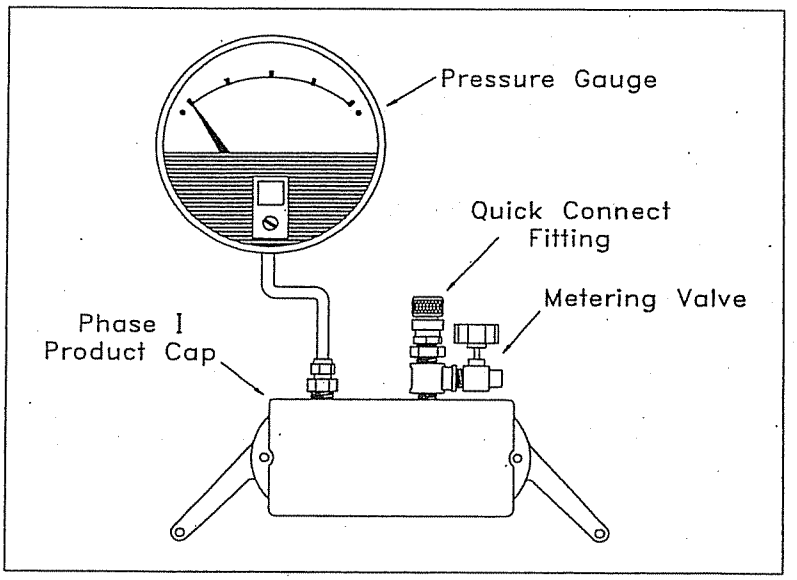
6. PRE-TEST PROCEDURES

6.1 The flow meter and pressure gauge shall be calibrated within six (6) months prior to conducting the testing. The flow meter(s) shall be calibrated for use with nitrogen. Calibrations shall be conducted in accordance with EPA or CARB protocols. CARB calibration methodology for flow meters and pressure gauges is contained in Appendix D of Air Monitoring Quality Assurance, Volume VI, Standard Operating Procedures for Stationary Source Emission Monitoring and Testing, January 1979.

6.2 Remove the lids from the spill containers and inspect the drain valve configuration. Verify that the drain valve passes liquid directly into the drop tube, as shown in Figure 1, rather than into the storage tank ullage space.

6.3 Inspect the Phase I product adaptor to ensure that the gasket is installed and that the adaptor is securely attached to the Phase I product riser.

Figure 3
Product Adaptor Test Cap



7. TEST PROCEDURE

7.1 Carefully install the inflatable bladder into the drop tube as shown in Figure 1 and inflate.

7.2 Connect the Product Adaptor Test Cap to the Phase I product adaptor and connect the flow meter and pressure gauge to the test cap as shown in Figure 2.

7.3 Open the nitrogen supply and adjust the nitrogen flow to a rate no greater than the maximum allowable leak rate specified for the drain valve in CP-201 and start the stopwatch for a maximum of 5 minutes.

7.4 Wait until the pressure gauge indicates a pressure equal to the performance specification pressure for the drain valve as defined in CP-201.

7.4.1 If the pressure gauge does not indicate the specified pressure within 5 minutes, the drain valve does not comply with the maximum allowable leak rate specification.

7.4.2 If the pressure gauge indicates the specified pressure within 5 minutes immediately reduce the nitrogen flow in order to stabilize at the specified pressure (±0.05 inches H_2O) for 30 seconds.

7.5 Record the flow rate required to stabilize at the pressure specified in CP-201.

7.5.1 If the final flow rate is below the detectable limit of the flow meter, record the lowest measurable flow rate and final pressure on the data sheet.

7.5.2 If the final flow rate is greater than the capacity of the flow meter, record the highest measurable flow rate and final pressure.

8. POST-TEST PROCEDURES

8.1 Carefully remove the Product Adaptor Test Assembly and the Inflatable Bladder from the Phase I drop tube.

8.2 Replace the caps on the appropriate Phase I adaptors, and the appropriate lids on the spill containers.

9. CALCULATING RESULTS

9.1 If the flow rate of nitrogen was at the upper limit of the flow meter and the measured pressure never reached the specified pressure, but was greater than 0.0 inches H_2O, the actual leak rate at a specified pressure shall be calculated as follows:

$$Q_{SP} = (SP)^{1/2}\left[\frac{Q_{actual}}{(P_{actual})^{1/2}}\right] \qquad \text{Equation 9 – 1}$$

Where:

Q_{SP} = The leak rate of the component at the specified pressure, cubic feet per hour
Q_{actual} = The actual flow rate of nitrogen, cubic feet per hour
P_{actual} = The actual measured steady-state pressure at Q_{actual}, inches H_2O
SP = Specified Pressure, defined in CP-201, inches H_2O

9.2 Commonly used flow rate conversions:

1 CFH = 471.95 ml/min

Example: Convert 0.17 CFH to ml/min: 0.17 CFH x 471.95 = 80 ml/min

1 ml/min = 0.00212 CFH

Example: Convert 100 ml/min to CFH: 100 ml/min x 0.00212 = 0.21 CFH

Commonly Used Flow Rate Conversions	
0.05 CFH = 24 ml/min	0.21 CFH = 100 ml/min
0.17 CFH = 80 ml/min	0.34 CFH = 160 ml/min

10. REPORTING RESULTS

Report the results of the quantification of the leak rate through the drop tube/drain valve assembly as indicated on Form 1. Districts may require the use of alternate forms, provided they include the same minimum parameters as identified on Form 1.

11. ALTERNATE PROCEDURES

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 CP-201 (Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities).

TP-201.1C Form 1
Drop Tube/Drain Valve Assembly Data Sheet

Facility:	Test Company:	Test Date:
Address:	Test Personnel:	
City:	State, Zip Code	
Overfill Prevention Make & Model:	Spill Container Make & Model:	
Date of Last Flow Meter Calibration:	Date of Last Pressure Gauge Calibration:	

Test Results

Device Type & Product Grade	Time to Pressurize	30-Second Flow rate (CFH)	30-Second Pressure (in. H_2O)

Comments: