

California Environmental Protection Agency



Vapor Recovery Test Procedure

TP-201.1D

**Pressure Integrity Leak Rate of
Drop Tube Overfill Prevention Devices
and Spill Container Drain Valves**

Adopted: February 1, 2001

Amended: July 3, 2002

Amended: October 8, 2003

Note: The text is shown in ~~strikeout~~ to indicate text that is proposed for deletion and underline to indicate text that is proposed for addition. [Bracketed text] is not part of the proposed amendments.

California Environmental Protection Agency
Air Resources Board

Vapor Recovery Test Procedure

TP-201.1D

Pressure Integrity Leak Rate of
Drop Tube Overfill Prevention Devices
and Spill Container Drain Valves

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 leak rate ~~pressure integrity~~ of overfill prevention devices located in the Phase I product drop tube on two-point Phase I systems. ~~It is also used to quantify the pressure integrity of spill container drain valves when the drain valve is installed so as to drain into the drop tube. When applicable, this procedure is also used to~~ quantify the leak rate of a spill container drain valve which passes liquid directly into the Phase I drop tube.

This procedure is applicable only to those Gasoline Dispensing Facilities (GDF) equipped with an overfill prevention device located in the Phase I product drop tube. It is used ~~during certification and to determine the compliance of~~ components devices at installed gasoline dispensing facilities with the performance specification for the maximum allowable leak rate as defined in ~~the CP-201 Vapor Recovery Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201).~~

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

~~2.1~~A compatible cap for a Phase I product cap adaptor is modified to allow the introduction of nitrogen into the Phase I drop tube. A ~~pressure-measuring device gauge~~ is connected to the modified cap and nitrogen is flowed into the drop tube. If the resulting ~~measured~~ nitrogen flow rate necessary to maintain a steady-state pressure of ~~2.00 inches H₂O~~ is less than, or equal to, ~~the maximum allowable leakrate~~ the specifications described in CP-201, the overfill prevention device is verified to be in compliance. In the case where a spill container drain valve that passes liquid directly into the Phase I drop tube is installed, the components are isolated from each other with use of an inflatable bladder in order to determine the leak rate of each component. If the leak rate of the drain valve cannot be quantified, the overfill prevention device cannot be tested.

~~2.2~~If the introduction of nitrogen, at a flowrate equal to the maximum allowable leakrate, does not result in a steady state pressure that meets, or exceeds, the value specified in CP-201, the

Phase I product adaptor is inspected and tested. Any leaks attributable to the Phase I product adaptor are corrected and the test is repeated to ensure the measured pressure versus flowrate is attributable only to the overfill prevention device or, if applicable, the spill container drain valve.

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. ~~This bias is eliminated by testing the Phase I product adaptor for leaks p~~Prior to a final determination of the noncompliance of the component(s), use leak detection solution on all visible components to verify the absence of leaks status of the overfill prevention device.

3.2 Refueling during the test may bias the results. No vehicle refueling or bulk deliveries to any of the tanks at the facility shall occur during ~~this test~~ testing.

3.3 Product levels less than four (4) inches above the highest opening at the bottom of the submerged drop tube may bias the ~~test results~~ toward noncompliance.

3.4 Pressure or vacuum in the storage tank headspace may bias the results. Use the Pressure Relief Adaptor in Section 5 to eliminate this potential bias.

3-43.5 Liquid levels in the drop tube that are above the location of the overfill prevention device will bias the results toward compliance.

3-53.6 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.

3-63.7 Use of this procedure to quantify the leak rate of spill container drain valves that drain liquid into the ullage of the storage tank rather than into the drop tube will yield invalid results.

4. SENSITIVITY, RANGE, AND PRECISION

4.1 Flow Meter. The measurable leak rates ~~are is~~ dependent upon the sensitivity, range and precision of the flow meter used for ~~the testing~~. ~~The recommended flowmeter range specified in Section 5.1 provides sufficient precision at the maximum allowable leakrate defined in CP-201. The flow meter minimum sensitivity shall be 12.5 ml/min (0.026 CFH) with a minimum accuracy of ±5 percent full-scale. The device scale shall be 150 mm (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 sensitivity of the pressure measuring device is 0.01 inches H₂O for electronic pressure measuring devices and 0.05 inches H₂O for mechanical pressure gauges. 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 H₂O. The minimum full-scale accuracy shall be ±3.0 percent and the gauge shall be readable to the nearest 0.10 inches H₂O. For electronic pressure gauges, the maximum pressure range of the device shall be -10 to 10 inches H₂O. The minimum accuracy shall be ±1.5 percent full-scale range and the pressure gauge shall be readable to the nearest 0.01 inches H₂O.

5. EQUIPMENT

~~5.1 Drop Tube Pressure Integrity Assembly. Use a product cap compatible with the Phase-I product adaptor. The cap shall be equipped with a pressure tap and a flowmeter capable of measuring flowrates equal to the maximum allowable leakrate specified in CP-201 and three times the maximum allowable leakrate. The maximum allowable full-scale range for the flowmeter shall be 1.0 CFH. The flowmeter shall be calibrated for use with nitrogen. An example of a Product Cap Test Assembly is shown in Figure 2.~~

~~5.25.1 Pressure Gauge Measuring Device. Use a pressure-measuring device gauge with minimum specifications listed in Section 4 to monitor the pressure in the drop tube.~~

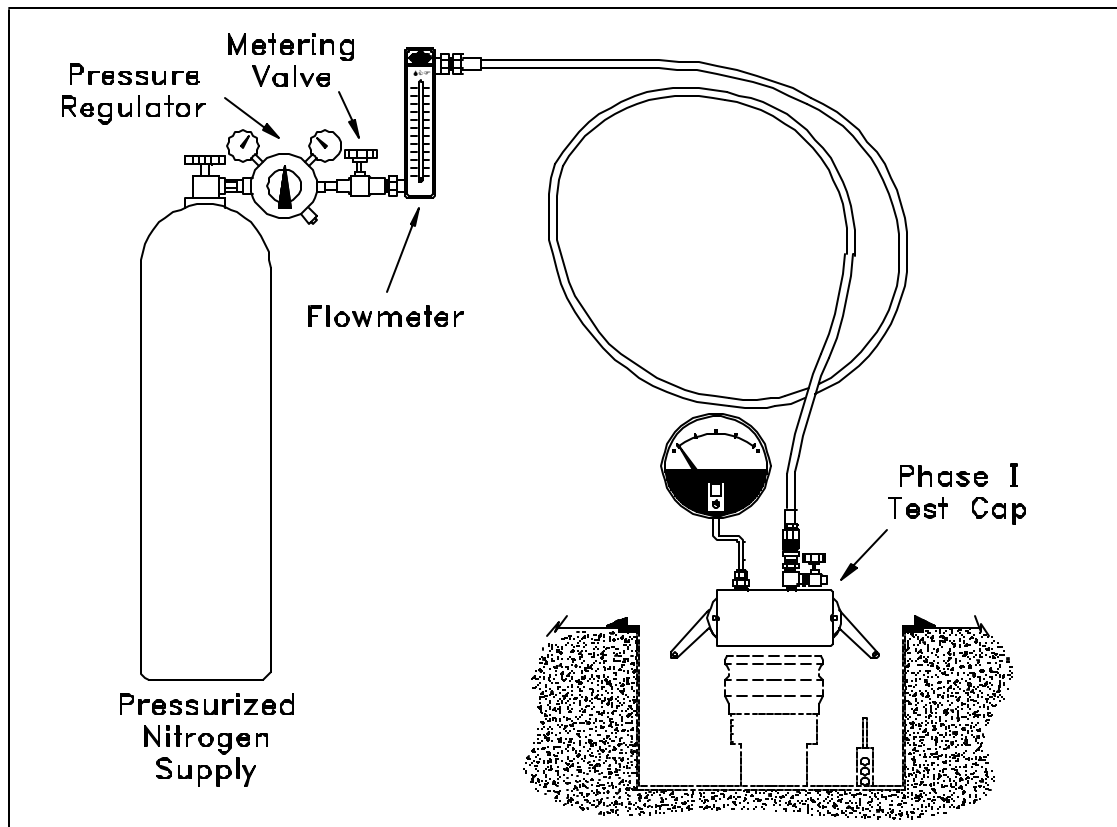
~~5.2.1 If an electronic pressure-measuring device is used, the maximum fullscale range of the device shall be 10 inches H₂O. The minimum accuracy shall be 0.5 percent and the pressure-measuring device shall be readable to the nearest 0.01 inches H₂O.~~

~~5.2.2 If a mechanical pressure-measuring device is used, the maximum fullscale range shall be 5 inches H₂O. The minimum accuracy shall be 1.0 percent and the minimum graduations shall be 0.05 inches H₂O. The minimum diameter of the pressure-gauge face shall be 4 inches.~~

[Figure 4 will be moved to be included in or follow section 7]

Figure 41

Drop-Tube Pressure-Integrity Leak Rate Test Assembly

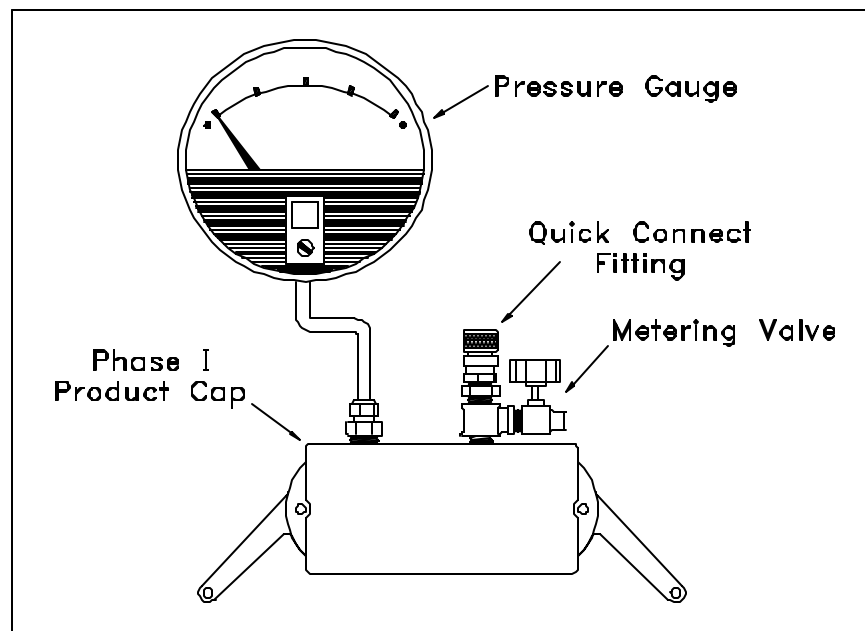


- 5.2 Flow Meter. Use a flow meter with minimum specifications listed in Section 4 to set the required nitrogen flow rate(s).
- 5.3 Nitrogen. Use commercial grade gaseous nitrogen in a high-pressure cylinder, equipped with a two-stage pressure regulator and a one psig pressure relief valve.
- 5.4 Stopwatch. Use a stopwatch accurate to within ± 0.10 seconds to time the duration of the test pressurization of the drop tube and pressure stabilization period.
- 5.5 Leak Detection Solution. Any commercial liquid solution designed to detect vapor leaks may be used to verify the pressure integrity of the Phase I product adaptor during this test.
- 5.6 Vapor Poppet-Adaptor Pressure Relief Assembly. Use an assembly a modified dust cap or a compatible vapor recovery elbow to open the Phase I vapor adaptor poppet during the test. This will ensure that the pressure on the underground storage tank (UST) side of the overfill prevention device is at zero gauge. An example of a Vapor Poppet-Adaptor Pressure Relief Assembly is shown in Figure 13. Screwdrivers or other devices that may damage the vapor adaptor or gasket seal shall not be used to open the Phase I vapor adaptor.

- 5.7 Inflation Plumber' Bladder. Use an "3-4" inch diameter inflatable plumber's bladder and extension hose equipped with a safety chain, as shown in Figure 42, to isolate the drain valve from the Overflow Prevention Device when applicable. ~~The safety ring must be removable, allowing the tester to remove the ring following inflation and attach the ring prior to deflation. Unless otherwise specified in the certification Executive Order for the system, a "3-4 model" inflatable plumber's bladder may be used.~~
- 5.8 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 example of a Product Adaptor Test Cap is shown in Figure 3.
- 5.8 Traffic Cones. Use traffic cones to encircle the area containing the Phase I manholes while the test is being conducted.
- 5.9 Tank Gauging Stick. Use a tank gauging stick, if required, of sufficient length to verify that the UST liquid level is at least four (4) inches above the highest opening at the bottom of the submerged drop tube. The tank gauging stick shall be equipped with a non-sparking "L" bracket at the end.

[Figure 3 will be moved to be included in or follow section 5]

Figure 32
Product Cap Test Assembly



6. PRE-TEST PROCEDURES

- 6.1 The flow meter(s) and pressure-measuring device gauge shall be calibrated within the 180 days prior to conducting the test. 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 are 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 Place the traffic cones around the perimeter of the Phase I spill containers allowing sufficient space to safely conduct the test.~~

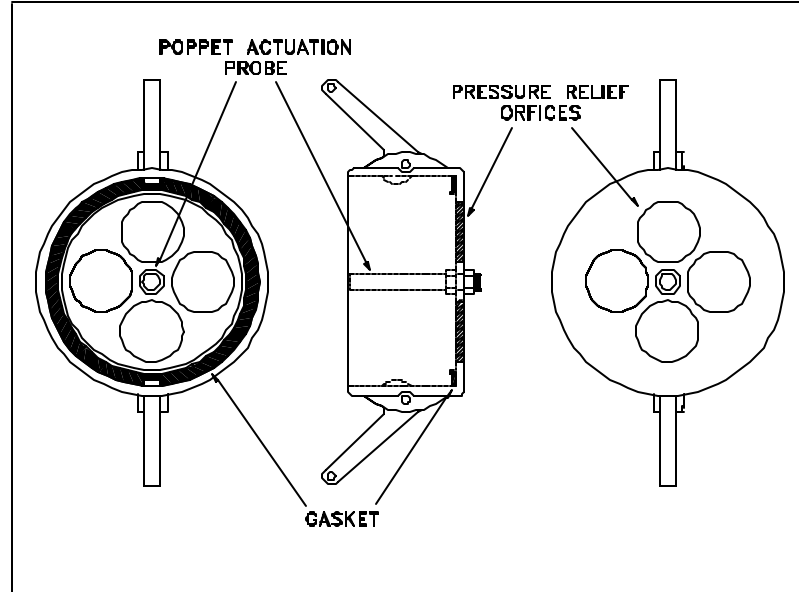
~~6.36.2 Remove the lids of the Phase I spill containers and product adaptor dust caps. Visually determine that the drop tube is equipped with an overfill prevention device. If the drop tube is not equipped with an overfill prevention device, and the drain valve does not drain into the drop tube, the test will only quantify leaks that occur at the Phase I adaptor.~~

~~6.46.3 Inspect the Phase I product adaptor to ensure that the gasket is intact installed and that the adaptor is securely attached to the Phase I product stem riser.~~

~~6.56.4 Verify that the liquid level in the storage tank is at least four (4) inches above the highest opening at the bottom of the submerged drop tube using the tank gauging stick.~~

[Figure 1 will be moved to be included in or follow section 5]

Figure 13
Vapor Poppet-Adaptor Pressure Relief Assembly

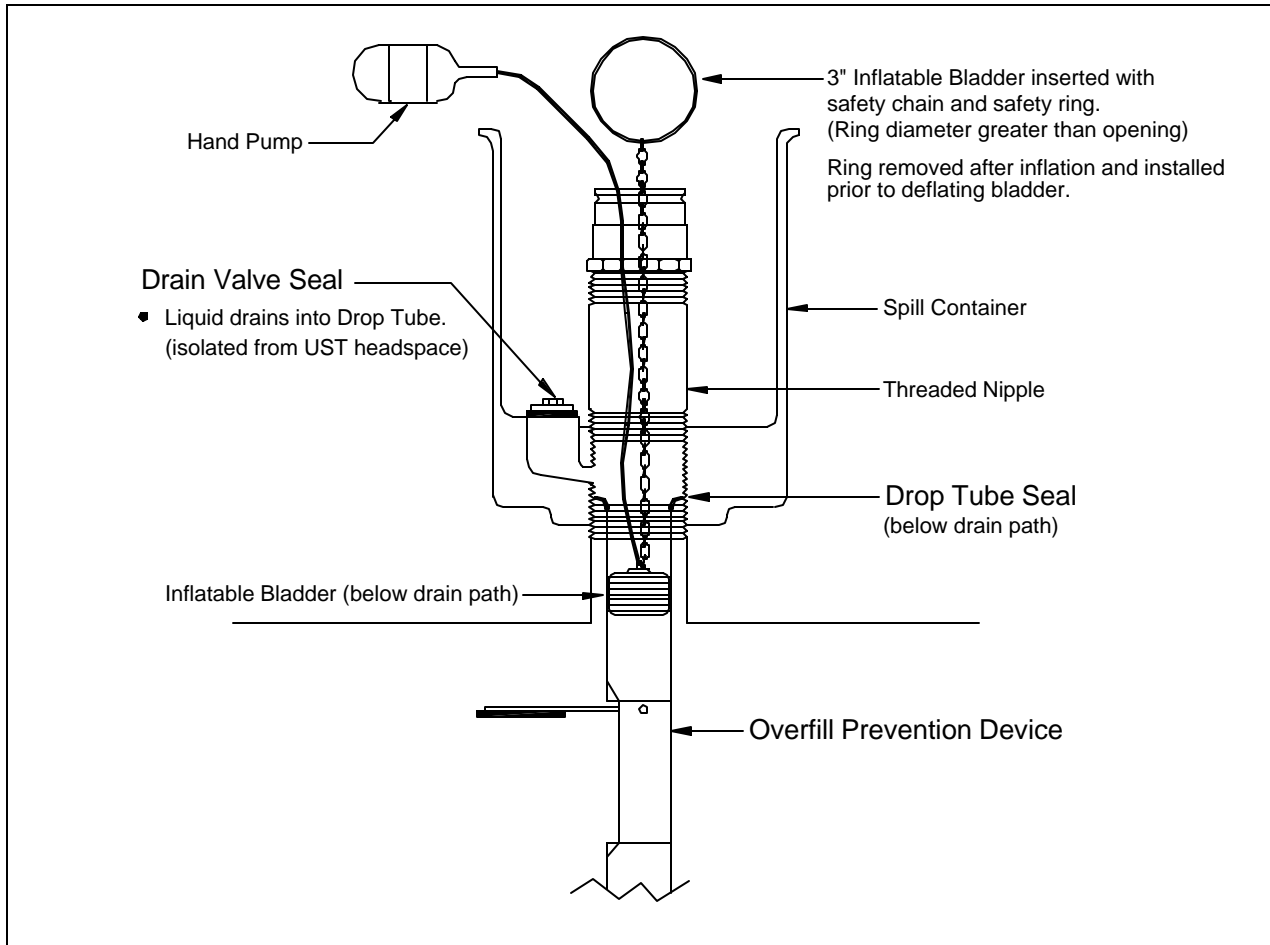


~~6.66.5 Inspect the drain valve configuration. Determine whether~~ Verify that the drain valve passes drains liquid directly into the drop tube ~~above the Overfill Prevention device, as shown in Figure 24, rather than into the underground storage tank ullage space. If the drain valve drains into the drop tube, the procedure will quantify the leak rate through both the Overfill Prevention Device and the drain valve, and the maximum allowable leak rate~~

for both devices is the sum of the two individual leak rates.

- 6.6** Remove the Phase I vapor adaptor dust cap for the tank to be tested. Connect the Vapor Adaptor Pressure Relief Assembly, or equivalent, to the Phase I vapor adaptor. Allow the UST ullage space to reach zero gauge pressure.

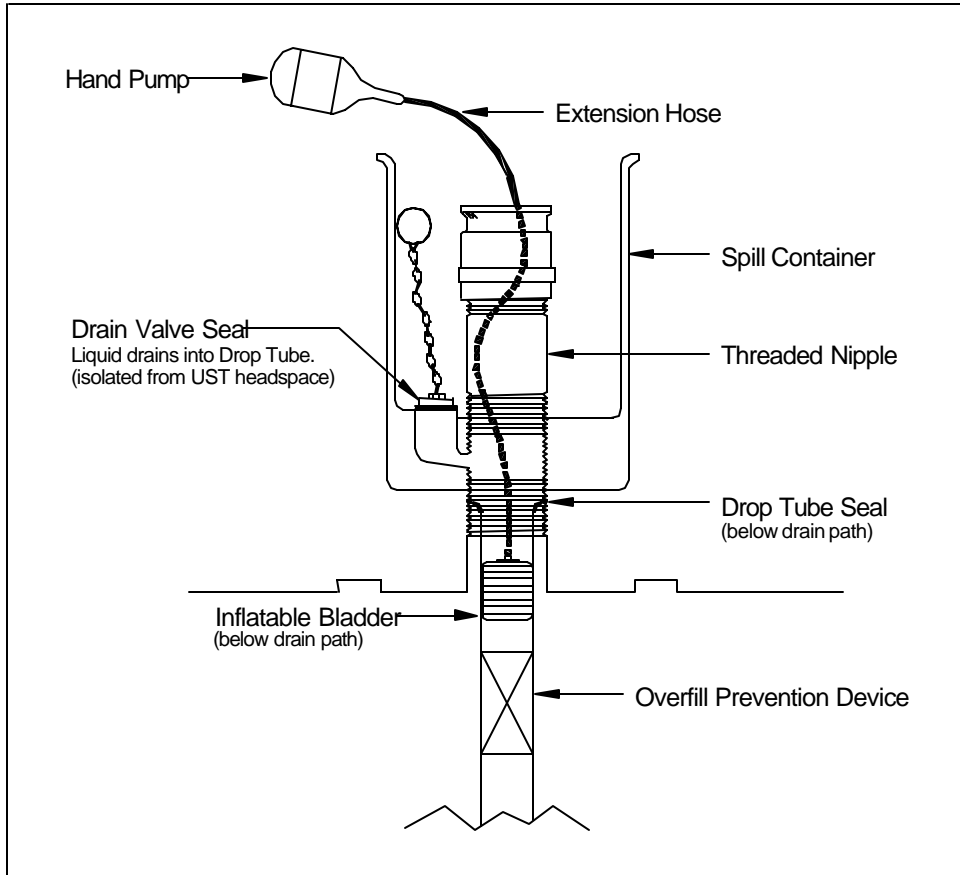
[DELETE FIGURE BELOW]
Figure 4
Inflatable Bladder Installation



[ADD FIGURE BELOW]

[Figure 2 will be moved to be included in or follow section 5]

Figure 2
Typical Inflatable Bladder Installation



7. TEST PROCEDURE

~~7.1~~ Connect the Drop Tube Pressure Integrity Assembly to the Phase I product drop tube as shown in Figure 1. Connect the nitrogen supply line to the inlet of the flowmeter.

~~7.2~~ Connect the Vapor Poppet Pressure Relief Assembly to the Phase I vapor poppet to bring the UST headspace to atmospheric pressure.

~~7.3~~ With no vehicle refueling occurring, open the nitrogen supply and adjust the nitrogen flowrate to at least three times the maximum allowable leakrate specified in CP-201, and start the stopwatch.

7.1 If a drain valve is not present, or does not pass liquid directly into the drop tube, proceed directly to Section 7.8.

7.2 Carefully install the inflatable bladder into the drop tube as shown in Figure 2 and inflate.

7.3 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 4.

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

7.4.5 Wait until the pressure measuring device records a pressure between 2.00 and 2.20 inches H₂O. 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 does not reach at least 2.00 inches H₂O within 180 seconds, the Drop Tube assembly does not comply with the maximum allowable leakrate.

~~7.4.2~~ If the pressure reaches at least 2.00 inches H₂O, reduce the introduction of nitrogen to the allowable leakrate specified in CP-201. Wait until the pressure reaches steady state conditions for at least thirty (30) seconds and record both the nitrogen flowrate and the steady state pressure. If the steady state pressure is less than 2.00 inches H₂O, the Drop Tube assembly does not comply with the maximum allowable leakrate.

7.5.1 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.

7.5.2 If the pressure gauge indicates the specified pressure within 5 minutes immediately reduce the nitrogen flow in order to stabilize at the specified pressure (± 0.5 inches H₂O) for 30 seconds.

7.5 Determine the leak rate through the drain valve alone, if applicable. This step may be used if the assembly did not meet the maximum allowable leak rate and to verify if the leak is attributed to the drain valve or the overfill prevention device.

- ~~7.5.1 Remove the Product Test Cap from the product adaptor.~~
- ~~7.5.2 Carefully install an inflatable plumber's bladder ("3-4" inch model) into the drop tube as shown in Figure 4 and inflate. Once inflated, carefully remove the safety ring allowing the chain to rest on top of the bladder and reinstall the Product Test Cap. The drain valve is now isolated from the overfill prevention device.~~
- ~~7.5.3 Conduct the procedure pursuant to sections 7.1 through 7.4.~~
- ~~7.5.4 Care must be taken to ensure that the safety ring is installed prior to deflating the bladder to avoid the bladder from falling down into the drop tube.~~
- 7.6 Record the flow rate required to stabilize at the pressure specified in CP-201.
- 7.6.1 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.
- 7.6.2 If the final flow rate is greater than the capacity of the flow meter, record the highest measurable flow rate and final pressure. No further testing shall be conducted until the leak rate of the drain valve can be determined.
- 7.7 Remove the Product Adaptor Test Cap. Deflate the inflatable bladder and carefully remove it from the drop tube.
- 7.8 Test the entire drop tube assembly, which includes the overfill prevention device and may include the spill container drain valve. 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 4.
- 7.9 Open the nitrogen supply and adjust the nitrogen flow rate to 200 ml/min (0.42 CFH) and start the stopwatch for a maximum of 5 minutes.
- 7.10 Wait until the pressure gauge indicates a pressure equal to the performance specification pressure for the overfill prevention device as defined in CP-201.
- 7.10.1 If the pressure gauge does not indicate the specified pressure within 5 minutes, the overfill prevention device does not comply with the maximum allowable leak rate specification.
- 7.10.2 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 H₂O) for 30 seconds.
- 7.11 Record the flow rate required to stabilize at the pressure specified in CP-201.
- 7.11.1 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.

7.11.2 If the final flow rate is greater than the capacity of the flow meter, record the highest measurable flow rate and final pressure. No further testing shall be conducted until the leak rate of the drain valve can be determined.

8. POST-TEST PROCEDURES

- ~~8.1~~ Carefully remove the ~~Drop Tube Pressure Integrity Assembly Product Adaptor Test Cap~~ and the Vapor ~~Poppet Adaptor~~ Pressure Relief Assembly from the Phase I connections.
- ~~8.2~~ Reinstall the safety ring and deflate the inflatable plumber's bladder.
- ~~8.23~~ Replace the ~~caps on the~~ appropriate caps on the Phase I adaptors, and the appropriate lids on the spill containers.
- ~~8.4~~ Remove the traffic cones from the Phase I area.
- ~~8.5~~ If the steady state pressure, at a nitrogen introduction rate equal to the allowable leakrate, was not equal to 2.00 inches H₂O, use Equation 9-1 to determine the leakrate at 2.00 inches H₂O.

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 ~~2.00 inches H₂O the specified pressure~~, but was greater than 0.00 inches H₂O, the actual leak rate at a pressure of 2.00 inches H₂O specified pressure shall be calculated as follows:

$$Q_{2.00} = (2.00)^{1/2} \left[\frac{Q_{\text{actual}}}{(P_{\text{actual}})^{1/2}} \right] \quad \text{Equation 9-1} \quad [\text{delete equation}]$$

$$Q_{\text{SP}} = (\text{SP})^{1/2} \left[\frac{Q_{\text{actual}}}{(P_{\text{actual}})^{1/2}} \right] \quad \text{Equation 9-1} \quad [\text{adopt equation}]$$

Where:

$Q_{2.00\text{SP}}$ = The leak_rate of the ~~drop tube assembly component at 2.00 inches H₂O the specified pressure~~, cubic feet per hour

Q_{actual} = The actual ~~introduction~~ flow rate of nitrogen, cubic feet per hour

P_{actual} = The actual measured steady-state pressure at Q_{actual} , inches H₂O

2.00SP = Specified Pressure, defined in CP-201, inches H₂O

- 9.2 If both a drain valve and a drop tube overflow prevention device were tested, and if a leak rate could be quantified for both components, the leak rate of the overflow prevention device shall be calculated as follows:

$$Q_{OPD} = Q_{Assembly} - Q_{Drain} \quad \text{Equation 9-2}$$

Where:

Q_{OPD} = The leak rate of the overfill prevention device, cubic feet per hour

$Q_{Assembly}$ = The leak rate of the drop tube assembly, cubic feet per hour

Q_{Drain} = The leak rate of the drain valve, cubic feet per hour

9.3 Commonly used flow rate conversions:

1 CFH = 471.95 ml/min

Example: Convert 0.17 CFH to ml/min: $0.17 \text{ CFH} \times 471.95 = 80 \text{ ml/min}$

1 ml/min = 0.00212 CFH

Example: Convert 100 ml/min to CFH: $100 \text{ ml/min} \times 0.00212 = 0.21 \text{ CFH}$

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

~~10.1~~ Report the results of the quantification of the leak rate through the drain valve and the drop tube overfill prevention assembly device as shown in indicated on Form 1. Districts may require the use of alternate forms, provided they include the same minimum parameters identified on Form 1.

11. ALTERNATE PROCEDURES

~~11.1~~ 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 ARB Executive Officer, pursuant to Section 14 of CP-201 Vapor Recovery Certification Procedure for Gasoline Dispensing Facilities-CP-201.

Form 1 [Form 1 is to be replaced with new Form 1 shown on next page]

**Field Data Sheet
Drop Tube Overfill Prevention**

Facility:		Test Date:		Tester(s):	
Address:			City:		Zipcode:
Make & Model of Overfill Prevention:				Phase II System Type:	
Date of Last Flowmeter Calibration:			Date of Last Pressure Device Calibration:		

Test Results

Product Grade	N ₂ Flowrate (Overfill Only) (CFH)	Pressure (in. H ₂ O)		N ₂ Flowrate (Overfill + Drain Valve) (CFH)	Pressure (in. H ₂ O)	N ₂ Flowrate (Drain Valve Only) (CFH)	Pressure (in. H ₂ O)	Difference (Overfill Leakrate) (CFH)

Comments:

TP-201.1D Form 1

Drop Tube Overfill Prevention Device and Spill Container Drain Valve Test Procedure

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

Test Results

<u>Device Type & Product Grade</u>	<u>Time to Pressurize</u>	<u>30-Second Flow Rate (CFH)</u>	<u>30-Second Pressure (in. H₂O)</u>	<u>Corrected Flow Rate For Overfill Device Only (See Section 9.2)</u>

Comments:
