California Environmental Protection Agency

Air Resources Board

Vapor Recovery Test Procedure

TP - 201.3B

Determination of Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities with Above-Ground Storage Tanks

Adopted: April 12, 1996

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1 APPLICABILITY

Definitions common to all certification and test procedures are 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 applicability of test procedures for static pressure performance is:

TP-201.3 (for new installations of systems certified by CP-201)

TP-201.3A (for existing installations of systems certified by earlier versions of CP-201)

TP-201.3B (for aboveground storage tanks)

This test procedure is used to quantify the vapor tightness of any aboveground storage tanks installed at a gasoline dispensing facility (GDF). Leaks in a balance Phase II system may cause excessive vapor emissions. Leaks in a vacuum assist Phase II system may decrease the efficiency of the vapor collection and/or processing system.

This test procedure is used to determine the static pressure performance standard of a vapor recovery system during the certification process and subsequently to determine compliance with that performance standard for any installations of such a system.

2 PRINCIPLE AND SUMMARY OF TEST PROCEDURE

Nitrogen is introduced via the vent pipe until the entire vapor recovery system is pressurized to two (2.0) inches water column. The pressure is then allowed to decay for five (5) minutes.

The acceptability of the final pressure is based upon the vapor system ullage.

3 BIASES AND INTERFERENCES

For vaulted aboveground tanks equipped with vacuum-assist Phase II systems, the processor must be isolated and the vapor system capped. Leakage at these points will indicate a system component leak.

4 SENSITIVITY, RANGE, AND PRECISION

4.1 Sensitivity

4.1.1 Inclined Liquid Manometers and Electronic Pressure Meters

Maximum incremental graduations at, above, and below a pressure observation shall be 0.01 inches water column ("WC).

Each such graduation shall be defined as the resolution, P_{Res}, of a pressure observation.

The maximum bias shall be plus-or-minus one-half percent (±0.5%) of full-scale.

4.1.2 Mechanical Spring Diaphragm Pressure Gauges

The minimum diameter of the pressure gauge face shall be 4 inches.

Maximum incremental graduations at, above, and below a pressure observation shall be 0.05 "WC.

Each such graduation shall be defined as the resolution, P_{Res}, of a pressure observation.

The maximum bias shall be plus-or-minus two percent (±2%) of full-scale.

4.2 Range

4.2.1 Pressure

The pressure range in Table 1 is 0.16 to 1.93 inches water column ("WC).

4.2.2 Volume Flow

The minimum and maximum nitrogen feed-rates, into the system, shall be one (1) and five (5) CFM, respectively.

4.3 Precision

The precision of a pressure observation shall affect the compliance status of a system as described below, where:

$P_{req@t}$ = pressure requirement, at a specified time, per the appropriate certification procedure, rounded to the nearest integral

multiple of P_{Res},

and

$P_{obs@t}$ = pressure observation, at the specified time.

The precision for a pressure observation shall be one-half of P_{Res}.

$P_{obs@t}$ shall be an integral multiple of P_{Res}.

Non-Compliance with a pressure requirement shall be determined when, at a specified volume flow:

$$P_{Req@t} - P_{Obs@t} \geq P_{Res}.$$

5 EQUIPMENT

5.1 Pressure Meters

At least two types of pressure meters can meet the specifications of § 4:

(1) inclined liquid manometers and

(2) electronic meters using pressure transducers.

5.2 Nitrogen

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

5.3 Vent Pipe Pressure Assembly

See Figure 1 for example.

5.4 Stopwatch

Use a stopwatch accurate and precise to within 0.2 seconds.

6 CALIBRATION PROCEDURE

Follow manufacturers instructions.

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 Specification of Test, Challenge, and Failure Modes

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.

7.3 System and Facility Preparation

System equipment and components shall be completely operational and any storage tanks involved in the test shall be 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 Specific Pre-Test Protocol Items

(1) Dispensing shall not take place during the test. There shall have been no bulk drops into the storage tanks within the three hours prior to the test.

(2) Measure the gasoline volume in each aboveground storage tank and determine the actual capacity of each storage tank. Calculate the ullage space for each tank by subtracting the gasoline volume present from the actual tank capacity. The minimum ullage during the test shall be 25 percent of the tank capacity or 300 gallons, whichever is greater. If applicable, the vent pipes may be manifolded during the test to achieve the required ullage.

(3) For two-point Phase I systems this test shall be conducted with the dust cap removed from the vapor coupler. This is necessary to insure the vapor tightness of the vapor poppet.

(4) For coaxial Phase I systems this test shall be conducted with the dust cap removed from the Phase I coupler. This is necessary to insure the vapor tightness of the vapor poppet.

(5) If the Phase I containment box is equipped with a drain valve, the valve assembly may be cleaned and lubricated prior to the test. This test shall, however, be conducted with the drain valve assembly installed.

(6) Carefully remove the vent pipe pressure/vacuum valve. Install the vent pipe pressure assembly (see Figure 1).

8 TEST PROCEDURE

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

This test procedure is based on direct measurements only; no sampling, recovery, or analysis is involved.

(1) Open the nitrogen gas supply valve, regulate the delivery pressure to at least 5 psig, and pressurize the vapor system (or subsystem for individual vapor return line systems) to or slightly above 2 inches water column. It is critical to maintain the nitrogen flow until both flow and pressure stabilize, indicating temperature and vapor pressure stabilization in the tanks. Close the nitrogen supply valve.

(2) Check the vent pipe pressure assembly using leak detecting solution to verify that the test equipment is leak tight.

(3) Re-open the nitrogen supply valve, and reset the tank pressure to reestablish a pressure slightly greater than 2 inches water column. Close the nitrogen supply valve and start the stopwatch when the pressure reaches an initial pressure of 2.0 inches of water column.

(4) At one-minute intervals during the test, record the system pressure. After five minutes, record the final system pressure. See Equation 11.1 or Table 1 to determine the acceptability of the final system pressure results.

(5) If the system failed to meet the criteria set forth in Table 1, repressurize the system and check all accessible vapor connections using leak detector solution or a combustible gas detector. If vapor leaks in the system are encountered, repair or replace the defective component and repeat the test.

(6) If the compartments in the vaulted tanks are not manifolded, repeat the test for each of the compartments, using the appropriate vent pipe.

(7) Carefully remove the vent pipe pressure assembly. Allow any remaining pressure to be relieved through vent pipe(s) to minimize exposure to benzene. Keep all potential ignition sources away from the vent pipe(s). Carefully reinstall the pressure/vacuum relief valve.

(8) Use Equation 11.1 or Table 1 to determine the compliance status of the facility by comparing the final five minute pressure with the minimum allowable pressure.

9 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

10 RECORDING DATA

This section is reserved for future specification.

11 CALCULATING RESULTS

Minimum Allowable Pressure

The minimum allowable pressure after five (5) minutes, with an initial pressure of 2.0 inches H_2O, shall be calculated as shown below, or obtained from Table 1:

$$P_2 = 2e^{(-760.490/Vu)}$$

where:

P_2	=	The minimum pressure after 5 minutes, inches H_2O
V_u	=	The ullage of the system, gallons
e	=	Constant equal to 2.71828
2	=	The initial starting pressure, inches H_2O
-760.490	=	Decay constant for a 5 minute test

12 REPORTING RESULTS

The calculated ullage and system pressures for each five minute vapor recovery system test shall be reported as shown in Figure 2. Be sure to include the Phase II system type, whether the system is manifolded, and the one-minute pressures during the test.

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 EXAMPLE FIGURES, FORMS AND TABLES

See TP-201.3 for figures.

Note:
Further procedural details, figures, forms, and tables are provided in the other test procedures; such can be used after appropriate modifications for novel aspects of a tested system have been made, on a case-by-case basis, subsequent to an engineering evaluation.

Form 1 and Table 1 are attached for exclusive use in this procedure.

FORM 1

SUMMARY OF SOURCE TEST DATA

SOURCE INFORMATION		FACILITY PARAMETERS
GDF Name and Address _____ _____ _____	GDF Representative and Title GDF Phone No. ( )	PHASE II SYSTEM TYPE (Check One) Balance _____ Hirt _____ Red Jacket _____ Hasstech _____ Healy _____ Other _____
Permit Conditions	Source: GDF Vapor Recovery System GDF # _____ A/C # _____	Manifolded? Y or N
Operating Parameters Number of Nozzles Served by Tank #1 _____ Number of Nozzles Served by Tank #3 _____ Number of Nozzles Served by Tank #2 _____ Number of Nozzles Served by Tank #4 _____		
Applicable Regulations:		VN Recommended:

Source Test Results and Comments

Tank #:	1	2	3	4
1. Product Grade				
2. Actual Tank Capacity, gallons				
3. Gasoline Volume				
4. Ullage, gallons (#2-#3)				
5. Initial Pressure, inches H_2O				
6. Pressure After 1 Minute, inches H_2O				
7. Pressure After 2 Minutes, inches H_2O				
8. Pressure After 3 Minutes, inches H_2O				
9. Pressure After 4 Minutes, inches H_2O				
10. Final Pressure After 5 Minutes, inches H_2O				
11. Allowable Final Pressure				

Test Conducted by:	Test Company:	Date of Test:

TABLE 1

Leak Rate Criteria

ULLAGE (GALLONS)	MINIMUM PRESSURE AFTER 5 MINUTES, (INCHES OF H_2O)
300	**0.16**
350	0.23
400	**0.30**
450	0.37
500	**0.44**
550	0.50
600	**0.56**
650	0.62
700	**0.67**
750	0.73
800	**0.77**
850	0.82
900	**0.86**
950	0.90
1,000	**0.93**
1,200	1.06
1,400	**1.16**
1,600	1.24
1,800	**1.31**
2,000	1.37
2,200	**1.42**
2,400	1.46
2,600	**1.49**
2,800	1.52
3,000	**1.55**
3,500	1.61
4,000	**1.65**
4,500	1.69
5,000	**1.72**
6,000	1.76
7,000	**1.79**
8,000	1.82
9,000	**1.84**
10,000	1.85
15,000	**1.90**
20,000	1.93