California Environmental Protection Agency

Air Resources Board

Vapor Recovery Test Procedure

TP - 201.3A

Determination of 5 Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities

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 purposes 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 vapor recovery system installed at a gasoline dispensing facility (GDF). Leaks in a balance system may cause excessive vapor emissions. Leaks in a vacuum-assist 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

The entire vapor recovery system is pressurized to five (5.0) inches water column and then allowed to decay for five (5) minutes. The acceptability of the final pressure is based upon

the vapor system ullage. For the purpose of compliance determination, this test shall be conducted after all back-filling and paving has been completed.

3 BIASES AND INTERFERENCES

On vacuum-assist Phase II systems the processor must be isolated and the vapor system connection 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 for Tables 1 and 2 is 1.70 to 4.91 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 Cap Assembly

See Figure 1 for example.

5.4 "T" Connector Assembly

See Figure 2 for example.

5.5 Vent Pipe Pressure Assembly

See Figure 3 for example.

5.6 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 Check Facility Operating Mode

(1) Dispensing shall not take place during the test. There shall have been no Phase I deliveries into or out of the storage tanks within the three hours prior to the test.

(2) Measure the gasoline volume in each underground 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 500 gallons, whichever is greater. The total ullage shall not exceed 15,000 gallons. 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.

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. Verify that the liquid level in the storage tank is at least five inches above the bottom of the submerged drop tube.

(4) 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 installed.

(5) If the nitrogen is to be introduced at a dispenser, disconnect the dispenser end of one vapor recovery hose and install the "T" connector assembly (see Figure 2). Connect the nitrogen gas supply (do not use air), and the pressure gauge to "T"

connector.

(a) For those Phase II systems utilizing a remote vapor check valve, the "T" connector assembly shall be installed on the vapor riser side of the check valve.

(b) Install the vent cap assembly(s) (see Figure 1). For manifolded systems all storage tank vent pipes shall be capped during the test. If the vent pipe is equipped with a pressure/vacuum relief valve, the valve shall be removed or "bagged" during the test.

(6) If the nitrogen is to be introduced at a vent pipe, a modified version of the "T" connector may be installed at the vent pipe (see Figure 3). This will allow the test to be conducted without any dispenser modifications. This may be advantageous at facilities using coaxial Phase II systems.

(7) If the vent pipe(s) is equipped with a pressure/vacuum valve, the valve shall be removed during the test.

7.5 Check Equipment and Supplies

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 5 inches water column initial pressure. It is critical to maintain the nitrogen flow until both flow and pressure stabilize, indicating temperature and vapor pressure stabilization in the tanks. Check the vent cap assembly(s) and "T" connector assembly using leak detecting solution to verify that the test equipment is leak tight.

(2) Close the nitrogen supply valve and start the stopwatch when the pressure decreases to the initial starting pressure of 5.0 inches water column.

(3) At one-minute intervals during the test, record the system pressure. After five minutes, record the final system pressure. See Tables I and 2 to determine the acceptability of the final system pressure results.

(4) If the system failed to meet the criteria set forth in Tables I or 2, 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. Potential sources of leaks include nozzle check valves, containment box drain assemblies, and plumbing connections at the risers.

(5) Carefully remove the vent cap assembly(s). 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).

(6) After the pressure has been relieved, remove the "T" connector assembly and reconnect the vapor recovery hose, if applicable.

(7) If the vapor recovery system utilizes individual vapor return lines, repeat the leak test for each of the other gasoline grades. If applicable, avoid leaving any vapor return line open longer than is necessary to install or remove the "T" connector assembly.

(8) If applicable, replace the vent pipe pressure/vacuum valve(s) removed during this test.

9 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

10 RECORDING DATA

The calculated ullage and system pressures for each five minute vapor recovery system test shall be reported as shown in Figure 4. Be sure to include the Phase II system type, whether the system is manifolded, and the one-minute pressures during the test.

11 CALCULATING RESULTS

See Tables 1 and 2 to determine the acceptability of the final system pressure results.

11.1 For balance Phase II systems use Table 1 to determine compliance.

11.2 For vacuum-assist Phase II systems use Table 2 to determine compliance.

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 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 Tables 1 and 2 are attached for exclusive use in this procedure.

TABLE 1

Phase II Balance Systems

ULLAGE (GALLONS)	NUMBER OF AFFECTED NOZZLES				
	01-06	07-12	13-18	19-24	>24
	MINIMUM PRESSURE AFTER 5 MINUTES (INCHES OF H_2O)				
500	1.70	1.59	1.50	1.41	1.35
550	1.88	1.77	1.68	1.59	1.52
600	2.04	1.93	1.83	1.75	1.68
650	2.19	2.07	1.98	1.89	1.82
700	2.32	2.21	2.12	2.03	1.96
750	2.44	2.33	2.24	2.16	2.09
800	2.55	2.45	2.36	2.27	2.20
850	2.66	2.55	2.46	2.38	2.31
900	2.75	2.65	2.56	2.48	2.41
950	2.84	2.74	2.65	2.57	2.51
1,000	2.92	2.82	2.74	2.66	2.60
1,200	3.19	3.10	3.03	2.96	2.90
1,400	3.41	3.32	3.25	3.19	3.13
1,600	3.57	3.50	3.43	3.37	3.32
1,800	3.71	3.64	3.58	3.52	3.47
2,000	3.82	3.76	3.70	3.65	3.60
2,200	3.92	3.86	3.80	3.75	3.71
2,400	4.00	3.94	3.89	3.84	3.81
2,600	4.07	4.01	3.97	3.92	3.89
2,800	4.13	4.08	4.03	3.99	3.96
3,000	4.18	4.13	4.09	4.05	4.02
3,500	4.29	4.25	4.21	4.18	4.15
4,000	4.37	4.33	4.30	4.27	4.24
4,500	4.44	4.40	4.37	4.35	4.32
5,000	4.49	4.46	4.43	4.41	4.39
6,000	4.57	4.55	4.52	4.50	4.48
7,000	4.63	4.61	4.59	4.57	4.55
8,000	4.68	4.66	4.64	4.62	4.61
9,000	4.71	4.69	4.68	4.66	4.65
10,000	4.74	4.72	4.71	4.69	4.68
15,000	4.82	4.81	4.80	4.79	4.79
20,000	4.87	4.86	4.85	4.85	4.84
30,000	4.91	4.91	4.90	4.90	4.89

Note: For manifolded Phase II Balance Systems, the "Number of Affected Nozzles" shall be the total of all gasoline nozzles. For dedicated return configurations, the "Number of Affected Nozzles" shall be the total of those nozzles served by the tank being tested.

TABLE 2

Phase II Assist Systems

	NUMBER OF AFFECTED NOZZLES				
	01-06	07-12	13-18	19-24	>24
ULLAGE (GALLONS)	MINIMUM PRESSURE AFTER 5 MINUTES (INCHES OF H_2O)				
500	1.94	1.86	1.78	1.72	1.66
550	2.15	2.03	1.96	1.89	1.84
600	2.27	2.19	2.12	2.05	2.00
650	2.41	2.33	2.26	2.20	2.14
700	2.54	2.46	2.40	2.33	2.28
750	2.66	2.58	2.52	2.45	2.40
800	2.77	2.69	2.63	2.56	2.51
850	2.87	2.79	2.73	2.67	2.62
900	2.96	2.88	2.82	2.76	2.71
950	3.04	2.97	2.91	2.85	2.80
1,000	3.11	3.05	2.99	2.93	2.88
1,200	3.37	3.31	3.25	3.20	3.16
1,400	3.57	3.51	3.46	3.41	3.37
1,600	3.72	3.67	3.62	3.58	3.54
1,800	3.84	3.80	3.76	3.72	3.68
2,000	3.95	3.90	3.86	3.83	3.80
2,200	4.03	3.99	3.96	3.92	3.89
2,400	4.11	4.07	4.03	4.00	3.97
2,600	4.17	4.13	4.10	4.07	4.05
2,800	4.22	4.19	4.16	4.13	4.11
3,000	4.27	4.24	4.21	4.18	4.16
3,500	4.37	4.34	4.32	4.29	4.27
4,000	4.44	4.42	4.40	4.37	4.36
4,500	4.50	4.48	4.46	4.44	4.42
5,000	4.55	4.53	4.51	4.49	4.48
6,000	4.62	4.60	4.59	4.57	4.56
7,000	4.67	4.66	4.65	4.63	4.62
8,000	4.71	4.70	4.69	4.68	4.67
9,000	4.74	4.73	4.72	4.71	4.70
10,000	4.77	4.76	4.75	4.74	4.73
15,000	4.85	4.84	4.83	4.83	4.82
20,000	4.88	4.88	4.87	4.87	4.86
30,000	4.92	4.92	4.92	4.91	4.91

Note: For manifolded Phase II Assist Systems, the "Number of Affected Nozzles" shall be the total of all gasoline nozzles. For dedicated return configurations, the "Number of Affected Nozzles" shall be the total of those nozzles served by the tank being tested.