California Environmental Protection Agency

Air Resources Board

Proposed for Adoption

Vapor Recovery Test Procedure

TP-206.2

Determination of Emission Factor for Standing Loss Control Vapor Recovery Systems Using Processors at Gasoline Dispensing Facilities with Aboveground Storage Tanks

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Determination of Emission Factor for Standing Loss Control Vapor Recovery Systems Using Processors at Gasoline Dispensing Facilities with Aboveground Storage Tanks

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 "ARB" refers to the Air Resources Board, and the term " Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

1. PURPOSE AND APPLICABILITY

The purpose of this procedure is to quantify the Standing Loss Control emission factor for a processor used to control gasoline vapors from an aboveground storage tank (AST). This procedure is applicable to the determination of compliance with the Standing Loss Control performance standards specified in Certification Procedure, CP-206, Certification and Testing Procedures for Gasoline Vapor Recovery Facilities Using Aboveground Storage Tanks.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

During episodes of no transfers (Phase I or Phase II), the emission factor is determined by direct measurement of the mass of hydrocarbons at the following test point locations: (1) emitted through the hydrocarbon processor, and (2) emitted from the pressure/vacuum (P/V) valve(s) on the AST vent pipe(s). Using the results of the direct hydrocarbon measurements, the Standing Loss Control mass emission factor (in units of pounds of hydrocarbon emissions per 1,000 gallons ullage per day) may be calculated. The testing shall be conducted during the summer months (June 1 to September 30). The test period shall consist of a minimum 24-hour testing episode in which hydrocarbon emissions are continuously measured when daily maximum ambient temperature is between 90°F and 105°F.

3. BIASES AND INTERFERENCES

3.1 Failure to test a Standing Loss Control system that does not meet the Static Pressure Performance test requirements (TP-206.3) may bias the test toward either compliance or noncompliance.

3.2 Phase I and Phase II transfers shall not be permitted during the 24-hour testing episode.

4. RANGE AND MEASUREMENT ERROR

4.1 This procedure can generate emission factors in the range of 0.00 to greater than 15.0 lbs/1000 gallons.

4.2 The maximum emission factor error is calculated to be 13%. The maximum efficiency error is calculated to be 1.0%.

5. EQUIPMENT

Alternatives to the required equipment shall only be used subject to prior written approval by the ARB Executive Officer.

5.1 Hydrocarbon (HC) Analyzer(s). The HC analyzer(s) shall have the following characteristics and capabilities:

5.1.1 Depending on the test point location of the HC measurement, the HC analyzer shall be capable of continuously measuring HC concentrations for 100 ppm to 80 percent by volume using propane as a calibration gas, or 75 ppm to 60 percent by volume using butane as a calibration gas.

5.1.2 Analyzers at test points 1 and 2 shall use a destructive detection principle, such as a flame ionization detector (FID) or non-dispersive infrared (NDIR). A sufficient number of hydrocarbon analyzers shall be used to provide for simultaneous and continuous measurements at all applicable test points. The Executive Officer may allow other measurement methods if it is determined that equivalent results can be obtained.

5.1.3 Hydrocarbon Calibration Gases. Cylinders of certified, or NIST traceable, calibration gases using propane (or butane) in nitrogen capable of providing calibration for the analyzer ranges recommended in Table 5-1.

Table 5-1
Recommended Continuous Analyzer Concentration Ranges

Test Point (Fig.1)	Pollutant	Operating Priciple	Ranges	Usable Concentration Range
1	HC	FID or NDIR	0 to10 ppm	1.0 to 9.5ppm
			0 to 100 ppm	10 to 95 ppm
			0 to 1,000 ppm	100 to 950 ppm
			0 to 5,000 ppm	500 to 4,750 ppm
			0 to 1.0%	1,000 to 9,500 ppm
			0 to 5.0%	5,000 ppm to 4.75%
2	HC	FID or NDIR	0 to 1,000 ppm	100 to 950 ppm
			0 to 5,000 ppm	500 to 4,750 ppm
			0 to 1.0%	1,000 to 9,500 ppm
			0 to 5.0%	5,000 ppm to 4.75%
			0 to 10.0%	1.0% to 9.5%
			0 to 50.0%	5% to 48%
1*	CO	NDIR	0 to 500 ppm	50 to 475 ppm
1*	CO_2	NDIR	0 to 5.0%	5,000 ppm to 4.75%
			0 to 10.0%	1.0% to 9.5%
1*	HC	FID or NDIR	0 to 1.0%	1,000 ppm to 9500 ppm
			0 to 5.0%	5000 ppm to 4.75%

* destructive processor only

Each range requires three calibration gases:

(1) High-Range Gas: Concentration between 80 and 100% of range.
(2) Mid-Range Gas: Concentration between 40 and 60% of range.
(3) Zero Gas: Nitrogen with a hydrocarbon concentration less than 0.25% of range.

5.1.4 Gas Dilution System. A gas dilution system which meets the requirements of EPA Method 205, Verification of Gas Dilution Systems for Field Instrument Calibrations, CFR 40, Part 51, Appendix M (62 FR 32502, June 16, 1997) may be used to provide low-level calibration gases from a high-level calibration gas. The calibration gas used with a gas dilution system shall be an EPA Protocol gas. A gas dilution system which meets the requirements of EPA Method 205 may be used for all analyzer calibrations and sampling system bias checks. If a diluter is used, it must be included in the calibration of the analyzer(s).

5.1.5 Sample lines shall be constructed of Teflon or other material that does not absorb or otherwise alter the sample gas.

5.1.6 Additional Analyzers for Systems with Destructive Vapor Processors: If processor exhaust flowrate is to be determined by USEPA Method 2B 40 CFR, Part 60, App.A-1 (36 FR 24877, December 23, 1971), then the following additional analyzers are needed for Test Point 1.

5.1.6.1 Carbon Monoxide (CO) analyzer: As specified in ARB Method 100, title 17, CCR, section 94114, or alternative test procedures approved by the Executive Officer.

5.1.6.2 Carbon Dioxide (CO_2) analyzer: As specified in ARB Method 100 or other alternative test procedures approved by the Executive Officer.

5.2 Data Acquisition System/Data Recorder: Provide a permanent record of hydrocarbon analyzer data using a strip chart recorder. A datalogger or another electronic data acquisition is also recommended. Data shall be collected at intervals not to exceed one second. Any electronic data acquisition system must be capable of integration at a ten-second interval. The strip chart, as well as the data acquisition system, must have a resolution of 0.5 percent of the analyzer range.

5.3 Volumetric Flow Rate Meters. Recommended volume meter ranges for each test point are shown in Table 5-2.

Table 5-2
Volume Meter Specifications

Test Point	Typical Range Measured (cfm)	Recommended Meter Range (cfh)
1	System specific	Determined during evaluation
2	Vent sleeve sweep: 2 to 20 Vent : 0 to 5	0 to 800 0 to 800

The volume meters are positive displacement or turbine meters that meet the following requirements:

5.3.1 Backpressure limits (BPL):

(a) Meters with a manufacturer specified maximum flow rating of greater than 1000 CFH shall demonstrate BPL < 1.10 inches WC at a flow rate of 3,000 CFH or the maximum flow rating specified by the manufacturer, whichever is less, and BPL < 0.05 inches WC at a flow rate of 30 CFH.

(b) Meters with a manufacturer specified maximum flow rating of less than 1000 CFH shall demonstrate BPL < 0.70 inches water column at a flow rate of 800 CFH and BPL < 0.04 inches WC at a flowrate of 16 CFH.

5.3.2 The error of the meter shall be less than 2% of the true volume over the entire range of flow rates for which it will be used.

5.3.3 The meter shall be equipped with taps to accommodate the following as applicable for the specific Test Point:

(a) Test Point 1: differential pressure gauge with a full-scale range of less than or equal to four times the backpressure limit.

(b) Test Point 2: differential pressure gauge with a full-scale range of less than or equal to four times the backpressure limit.

5.3.4 Pressure Measurement Devices for Volume Meters

Transducers, liquid manometers, Magnahelic gauges, electronic manometers, or equivalent with a design range suitable for the pressure being measured. The error of the pressure measuring device shall not exceed 3% of the true pressure over the range of pressures to be quantified.

5.3.5 Temperature Measurement Device for Volume Meters

Thermocouple or thermometer with a design range suitable for the temperature being measured. The error in the temperature measurement shall not exceed 4 degrees Fahrenheit.

5.4 Vapor Processor (Test Point 1)

5.4.2 Processor outlet sample probe: Use equipment specified in TP-201.1A.

5.4 Ambient Temperature Measurement: Use a temperature measurement device capable of measuring ambient temperature with a resolution of 2 deg F.

5.5 Ambient Pressure Measurement: Use a pressure measurement device capable of measuring atmospheric pressure to within 2.5 mm Hg.

5.6 Gasoline Containers for RVP Samples: As specified in Section 2296 of title 13, CCR.

6. CALIBRATIONS

All measurement devices shall be calibrated as described below. A record of all calibrations shall be maintained.

6.1 Analyzers: Calibration curves shall be produced no longer than six months before testing using ARB's SOP 054, "Standard Operating Procedure for the Multilevel Calibrations of Pollutant Gas Analyzers" (September 1997). Field calibrations during testing shall be conducted as described in Section 8.1.1.

6.2 Calibration Gases:

6.2.1 Certification. The calibration gases shall be certified according to one of the following options:

6.2.1.1 The EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (EPA-600/R-97/121, September 1997), or

6.2.1.2 To an analytical accuracy of ± 2% percent, traceable to a reference material approved by the National Institute of Standards and Technology (NIST) and recertified annually.

6.2.2 Documentation. Information on calibration gas cylinders shall be entered into a log identifying each cylinder by serial number. Sufficient information shall be maintained to allow a determination of the certification status of each calibration gas and shall include: (1) the data put in service, (2) assay result, (3) the dates the assay was performed, (4) the organization and specific personnel who performed the assay, and (5) the date taken out of service.

6.3 Volume Meters: All volume meters shall be calibrated on an annual basis against a bell type spirometer at flow rates representing 1, 10, 30, 60, and 90% of the meter capacity. The bell type spirometer shall be calibrated against a NIST traceable standard or a transfer standard traceable to NIST. The accuracy of the meter shall be 2% of the true volume measured over the range of flow rates encountered in application of this test procedure. Alternatively, the field volume meter may be calibrated against a transfer standard traceable to NIST. The transfer standard shall be calibrated against the bell type spirometer or wet test meter and may not be used in the field as a working meter.

6.4 Pressure Measurement Devices: All pressure measurement devices shall be tested for accuracy using a reference gauge, incline manometer, NIST traceable standard, or static pressure calibrator, for five points (e.g. 10, 25, 50, 75, and 90% of full scale) to verify that the accuracy is within 5 percent. This test for accuracy shall be conducted prior and immediately following the test period. Alternatively, pressure measurement devices may be calibrated in accordance with manufacturer's specifications. The certification report shall provide documentation on the calibration of pressure measurement devices.

6.5 Temperature Measurement Devices: Temperature measurement devices shall be checked semi-annually using an ice bath, ambient air, and boiling water. This accuracy check shall be conducted by comparison to a NIST traceable measurement device.

7. PRE-TEST REQUIREMENTS

7.1 Pre-test Static Pressure Performance Test. TP-206.3 shall be conducted preceding test equipment installation. First, check UST pressure. If at a vacuum, add N_2 gas to bring AST pressure up to zero gauge pressure then proceed with TP-206.3. Document test results.

7.2 Test Point 2 – Vent Pipe: See Figure 1. Assemble the vent sleeve and sampling equipment. All test sites are required to manifold their vent pipes to one P/V valve. Determine the positive and negative cracking pressures, positive leak rate, and negative leak rate in accordance with TP-201.1E CERT to verify that the P/V valve complies with specifications listed in CP-206, or with specifications requested by the applicant and approved by the Executive Officer.

7.3 Test Point 1 - Vapor Processor: Install sampling equipment downstream (outlet) of the vapor processor.

7.3.1Outlet of Vapor Processor: Sampling points at the processor ideally should be at least eight stack diameters downstream and two stack diameters upstream of any flow disturbance. If these criteria cannot be met without altering the stack, a sampling point which is at least two stack diameters downstream and one diameter upstream of any flow disturbance may be used. Sampling locations that do not meet these minimum criteria shall be approved in advance of testing by the ARB Executive Officer. Hydrocarbon concentrations are measured at this test point for all vapor processors. CO and CO_2 concentrations are also measured for destructive processors by using USEPA Method 2B, "Determination of Exhaust Gas Volume Flow Rate from Gasoline Vapor Incinerators", 40 CFR Part 60, App. A-1 (36 FR 24877, December 23, 1971).

7.4 The certification engineering evaluation may have identified additional parameters beyond those listed in TP-206.2 to be monitored during the test. Verify that all equipment needed to monitor any additional parameters is calibrated and installed. Prepare additional data forms if necessary.

7.5 Post-Installation Facility Leak Test: After all test equipment is installed, conduct a pressure decay test in accordance with TP-206.3. Corrective action shall be taken as necessary until facility meets TP-206.3 requirements.

7.6 System Equilibration. After completing 7.4, wait at least 16 hours before data collection. Take steps to ensure facility and system operations are minimally disturbed by the test equipment in the period between equipment installation and the start of the test.

8. DAILY PRE-TEST PROCEDURES

8.1 Field Calibration

8.1.1 Hydrocarbon Analyzers: Follow manufacturer's instructions concerning warm-up time and adjustments. On each test day, prior to data collection, zero the analyzer with a zero gas and span with known concentrations of calibration gases at levels which are 40 to 60% and 80 to 100% of the concentration ranges to be used for the test.

Conduct the analyzer calibration error check by sequentially introducing the three calibration gases (high-range, mid-range and zero gas) and recording the analyzer response to each calibration gas. Make no adjustments to the sampling/analysis system except those necessary to achieve the proper calibration gas flowrate. The analyzer calibration error for any calibration gas shall not exceed ±2 percent of the range. If needed, take corrective action until acceptable performance is achieved.

Perform a leak check on the vacuum side of the assembly at the maximum pump vacuum. Correct any leaks found and repeat the leak check and correction procedure until no leak is detected.

8.1.2 CO and CO_2 Analyzers: Repeat instructions in 8.1.1 for CO and CO_2 analyzers if applicable.

8.1.3 Pressure Measurement Device: Prior to and immediately following each day of testing, record the pressure measuring device(s) response to the pressure generated by a static pressure calibrator at 0, 40, and 80% of the specified range of operation. If pressure differs more than 5%, recalibrate the device. Document instrument response before and after adjustment.

8.1.4 Temperature Measurement Device. Check the accuracy of the temperature measurement device(s) against an NIST traceable mercury-glass thermometer at ambient temperature prior to and immediately following each day of testing. If necessary, adjust the temperature read-out in accordance with manufacturer's instructions. Provide a copy of these instructions and document the instrument response before and after adjustment in the test report.

8.2 Initiate Test Documentation:

8.2.1 Photographs shall be taken at each test point to document the equipment set-up. Any changes in configuration during the test shall also be documented by photographs, along with the date and time of the modification.

8.2.2 Testers shall maintain a test log which shall document activities at the test site, such as modifications to equipment and the reasons for testing decisions. The tester shall update the test log at least twice a day.

8.3 RVP Sample: If required by the ARB Executive Officer, collect gasoline samples of each grade as described in title 13, CCR, Section 2296.

8.4 Determine the ullage in gallons of gasoline in the test tank through the gauging port, measurement stick, or other means approved by the Executive Officer.

9. TEST PROCEDURE

Collect data during periods of no transfers (Phase I and Phase II). Hydrocarbon emissions and volume measurements at test points 1 (processor) and 2 (vent), if applicable, are to be monitored continuously for a minimum 24 hours during the testing episode.

9.1 Testing requirements:

9.1.1 Testing shall be conducted during the summer months (June 1 to September 30). The Executive Officer may allow testing outside the summer months if the criteria of section 9.1.2 are met.

9.1.2 Minimum one testing episode during the test period when the ambient temperature is between 90°F and 100°F.

9.1.3 The testing episode shall be a minimum 24 hours in duration. Record the start date and time.

9.1.4 No Phase I or Phase II transfers are permitted during the testing episode.

9.2 Data Recording: In addition to the data collection described above, the tester shall record the following parameters at the minimum frequency set forth below.

9.2.1 Ambient Temperature: Hourly

9.2.2 Ambient Barometric Pressure: Hourly

10. END OF TEST DAY PROCEDURES

These procedures are required at the end of each test day.

10.1 Zero and Calibration Drift: The test run shall be considered invalid if the difference of zero or calibration gas measured for the bias check in section 10.1 and the zero or calibration gas bias check measured in section 10.1 exceeds ±3% of the range as determined by equation 10-1 below.

Equation 10-1

$$\text{Drift} = \frac{\left(C_{ib} - C_{fb}\right)}{R} x100$$

Where:

C_{fb} = analyzer response for the zero or upscale calibration gas for post run sampling system bias check

C_{ib} = analyzer response for the zero or upscale calibration for initial system bias check

R = analyzer range

10.2 Pressure Measurement Devices: Following each day of testing, record the pressure measuring device(s) response to the pressure generated by a static pressure calibrator at 0, 40, and 80% of the specified range of operation. If necessary, adjust the instrument response in accordance with the manufacturer's instructions. Provide a copy of these instructions and document the instrument response before and after adjustment in the Certification Test Report.

10.3 RVP Samples. If required by the Executive Officer, take samples of each gasoline grade in accordance with Section 2296 of title 13, CCR.

10.4 Log. Summarize the day's testing activities and document any problems encountered during testing in the testing log.

10.5 Record end date and time.

11. POST-TEST PROCEDURES

The test is completed when valid measurements have been recorded for each 24-hour test episode. After completing the daily post-test activities in Section 10, continue as follows:

11.1 Dismantle equipment. Remove testing apparatus and carefully reconnect system plumbing to original configuration.

11.2 Static Pressure Performance Test. Conduct a static pressure performance test using TP-206.3.

12. CALCULATING RESULTS

Data from each test point is used to determine an emission factor in lbs/1000 gallons ullage/day.

12.1 An emission factor in lbs hydrocarbon/1000 gallons ullage/day is calculated for each 24 hour testing episode.

12.1.1 The sample volumes shall be corrected to standard conditions for each testing episode as shown in Equation 12.1.1.

Equation 12.1.1

$$Q_i = \frac{V_m}{t} \text{ x } \left(\frac{528}{T}\right) \text{ x } \left[\frac{P_{bar}\left(\frac{P}{13.6}\right)}{29.92}\right]$$

where:

Q_i = volumetric flowrate corrected to standard conditions (ft^3/day).

V_m = measured volume (ft^3).

P_{bar} = barometric pressure (in. Hg).

P = meter pressure (inches water column).

T = meter temperature (^oR).

t = time period of testing in days (e.g. 32 hours = 1.33 days)

12.1.2 The mass emission factor for each testing episode shall be calculated as follows:

Equation 12.1.2

$$M_i = \frac{(Q_i)(C_i)(MW)(1{,}000)}{(385)(G_i)}$$

where:

M_i = emission factor for testing episode *i* (lb HC/1,000 gallons ullage/day)

Q_i = volumetric flowrate for testing episode *i* corrected to standard conditions (ft^3/day).

C_i = hydrocarbon concentration for testing episode *i* (volume fraction, i.e. ppm_v / 10^6 or Volume % / 10^2)

MW = molecular weight of HC analyzer calibration gas (lb/lb-mole). For example, if propane is used as a calibration gas, the molecular weight is 44 lb/lb-mole.

385 = standard volume (ft^3) of one lb-mole of ideal gas at standard temperature and pressure (528^oR and 29.92 in. Hg)

G_i = ullage of test tank for testing episode *i* (gallons).

1,000 = Conversion factor to 1,000 gallons

12.2 Test Point 2 Vent Sleeve

The vent emissions shall be calculated over the testing episode. Knowledge of the total station gasoline throughput for the specified time period is necessary to calculate the emission factor.

12.1.1 Calculate the standard volumetric flowrate over the testing episode using Equation 12.1.1.

12.1.2 Calculate the M_2 emission factor in lbs/1000 gallons ullage/day over the testing episode using Equation 12.1.2.

12.3 Test Point 1 Processor

12.3.1 If a volume meter is used at Test Point 1, calculate the standard volumetric flowrate of the testing episode using Equation 12.1.1.

12.4 Standing Loss Control System Emission Factor: Calculate the Phase II system emission factor using Equation 12-4.

Equation 12-4

$$EF_{HC} = M_1 + M_2$$

Where:

EF_{HC} = Standing Loss Emission Factor in lbs/1000 gallons ullage/day
M_1 = Mass emission factor at Test Point 1 (processor), lbs/1000 gallons ullage/day
M_2 = Mass emission factor at Test Point 2 (P/V vent valve), lbs/1000 gallons ullage/day

13. REPORTING RESULTS

Data are collected by ARB. All data forms, equipment calibrations, completed forms, results, and other test documentation shall be included in a test report.

In cases of conflict between hard copy and electronic format, the hard copy shall be presumed correct, unless the ARB Executive Officer specifies otherwise in writing.

14. ALTERNATIVE PROCEDURES

14.1 This procedure shall be conducted as specified. Any modifications to this test procedure shall not be used for certification unless prior written approval has been obtained from the ARB Executive Officer, pursuant to Section 15 of Certification Procedure CP-206.

Figure 1
Vent Pipe Sleeve