

California Environmental Protection Agency

---



**Vapor Recovery Test Procedure**

**TP-206.1**

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

Adopted: May 2, 2008

**California Environmental Protection Agency  
Air Resources Board**

**Vapor Recovery Test Procedure**

**TP-206.1**

**Determination of Emission Factor for Standing Loss Control Vapor Recovery  
Systems Using Temperature Attenuation Factor 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 California Air Resources Board, and the term "Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

**1. APPLICABILITY**

This test procedure is used to determine the temperature attenuation factor which is used to calculate the emission factor for Standing Loss Control vapor recovery systems installed at gasoline dispensing facilities (GDF) with aboveground storage tanks (AST). The temperature attenuation factor is the average daily ratio of fuel surface temperature range to the average ambient temperature range over a time period of at least 30 days during the summer months.

**2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE**

- 2.1 The AST shall be equipped with a thermocouple capable of floating on the fuel surface. An additional thermocouple or temperature probe shall be installed outside the tank and in the shade to measure ambient temperature. The system shall be continuously monitored at one minute intervals for a minimum of 30 days. The test period shall include a minimum of seven days when the maximum daily ambient temperature is between 90°F and 105°F. Daily maximum and minimum fuel surface and ambient temperatures shall be used to determine the fuel surface and ambient temperature ranges (difference between daily minimum and maximum). The ratio of these temperature ranges produces the Temperature Attenuation Factor, or  $A_f$ . The temperature attenuation factor is then used to calculate the emission factor. The test shall be conducted after proper installation of P/V valves and other components to maintain pressure integrity.

### 3. RANGE

- 3.1 The full-scale range of the Type K thermocouples shall be -328 to +2282°F with a minimum accuracy of  $\pm 2.0$  °F.

### 4. INTERFERENCES

- 4.1 Other Phase I and Phase II certification and test procedures and fuel transfers (Phase I and II) may bias the results of this test. During the performance of other certification and test procedures, fuel surface temperatures will be invalidated for the 24 hour period following the running of these other procedures. Invalidated 24-hour periods will not be considered part of the minimum 30 day test duration.
- 4.2 All Standing Loss Control vapor recovery components that are part of the system shall be in place and operating properly during the collection of fuel surface and ambient temperature data. If any part of the vapor recovery system is not operating properly, fuel surface temperature data shall be invalidated for each 24-hour period that the system is in non-compliance with the certification and test procedures.
- 4.3 Thermocouples and temperature probes shall not be placed in direct sunlight as this may bias the results. Ambient temperature probes shall be shaded using a solar radiation shield to minimize the effects of solar and terrestrial radiation and provide accurate measurements.

### 5. APPARATUS

- 5.1 Thermocouples, Temperature Probes and Associated Wiring

Thermocouple and temperature probe shall be compatible with gasoline and water. Thermocouples will be fixed on floats attached to stainless steel guide rods that float on top of the fuel surface in each tank to be tested to measure fuel surface temperature (Figure 1). An additional thermocouple or temperature probe will be collocated with the test tank to measure ambient air temperature; this thermocouple or temperature probe shall be equipped with a radiation shield to prevent bias from direct sunlight. Associated wiring shall be used to connect the thermocouples and/or temperature probes to the data logger. All wiring and components used for testing will be intrinsically safe.

- 5.2 Data Logger

A data logger capable of recording continuous (minimum one-second interval) and storing (minimum one-minute average) temperature data will be attached to the thermocouples and temperature probes. Thermocouple and temperature probe compatibility with the data logger shall be established prior

to the beginning of the test.

## **6. PRE-TEST PROCEDURES**

- 6.1 The tank with standing loss control shall be filled to 50% of the total ullage through the top or side mounted product adaptor using a camlock fitting.
- 6.2 Each thermocouple shall be calibrated with the data logger with water baths consist of an ice bath (~32 °F), an ambient bath (~ 77 °F), and a hot bath (~100 °F). A National Institute of Standards and Technology (NIST) traceable thermometer is placed in each water bath within one inch of the thermocouple. The temperatures are compared, recorded, and the difference calculated. The temperature difference between the NIST traceable thermometer and thermocouple shall not exceed  $\pm 2.0$  °F

Inspect thermocouples for dirty components and loose, worn, or broken parts. Correct and document any problem noted.

- 6.3 Install thermocouple and float apparatus near the center of the tank opening and attach wiring to data logger. Install additional thermocouple or temperature probe with radiation shield within 10 linear feet of the tank and attach wiring to the data logger.
- 6.4 After the thermocouples and temperature probes are installed, TP-206.3 shall be conducted to verify the system complies with the static pressure decay test procedures. No fuel surface temperature data will be valid without the system successfully passing the requirements of TP-206.3.
- 6.5 The test shall be conducted with the facility in normal operating mode, but without any dispensing or delivery. This includes all nozzles, if used, properly hung up in the dispenser boots and all dispenser cabinet covers in place.
- 6.6 When other certification and test procedures are run to evaluate the vapor recovery system, fuel surface temperature data shall be invalidated for the 24-hour period immediately after these tests.
- 6.7 Reid Vapor Pressure (RVP) of the fuel used to test the tank may be measured at least 24 hours prior to the 30 day test period.

## **7. TESTING**

- 7.1 Turn on data logger and check in-put from each of the thermocouples and/or temperature probes to ensure they are functioning.
- 7.2 Record start date and time.

- 7.3 Daily fuel surface and ambient temperature measurement data shall be recorded continuously a minimum 22 out of 24 hours beginning and ending at midnight during the same time period to maintain data set completeness.
- 7.4 Collect fuel surface and ambient temperature data on Form 1 or equivalent for a minimum of 30 days during the summer months (June 1 through September 30) or a period outside the summer months if approved by the Executive Officer.
- 7.5 On a weekly basis or an alternative period specified by the Executive Officer, download the data onto a computer for data reduction, validation, and analysis.
- 7.6 No deliveries or dispensing shall be allowed during the minimum 30-day testing duration. If a delivery or dispensing occurs the test shall be terminated.

## **8. POST-TEST PROCEDURES**

- 8.1 Verify data completeness. A valid data set shall include:
  - 8.1.1 A minimum of 30 days of 24-hour fuel surface and ambient temperature data that meet the conditions of sections 6 and 7 of these test procedures.
  - 8.1.2 A minimum of 30 days of valid data obtained during the summer months (June 1 to September 30) or period outside the summer months approved by the Executive Officer as provided by section 3.3.1 of CP-206.
  - 8.1.3 At least seven days where the daily maximum ambient temperature shall be between 90°F and 105°F in order for data to be considered valid.
- 8.2 Remove temperature probe from the tank and replace with appropriate dust caps.
- 8.3 Conduct a post calibration of each thermocouple in accordance with the procedure specified in Section 6.2. If the thermocouple does not comply with the temperature difference requirement of Section 6.2, the data shall be invalidated unless approved by the Executive Officer.

## **9. CALCULATIONS**

- 9.1 Determine the daily fuel surface temperature range (difference between daily minimum and maximum temperatures) for a minimum of 30 days as follows:

Equation 9-1

$$T_f^{Range} = T_f^{Max} - T_f^{Min}$$

where:

$T_f^{Range}$  = The daily fuel surface temperature range

$T_f^{Max}$  = The daily maximum fuel surface temperature

$T_f^{Min}$  = The daily minimum fuel surface temperature

- 9.2 Determine the average ambient temperature range (difference between daily minimum and maximum temperatures) for a minimum of 30 days as follows:

Equation 9-2

$$T_a^{Range} = T_a^{Max} - T_a^{Min}$$

where:

$T_a^{Range}$  = The daily ambient temperature range

$T_a^{Max}$  = The daily maximum ambient temperature

$T_a^{Min}$  = The sum of the daily minimum fuel surface temperatures

- 9.3 Determine the attenuation factor as follows:

Equation 9-3

$$A_f = \frac{(\sum_1^n T_f^{Range} / n)}{(\sum_1^n T_a^{Range} / n)}$$

where:

$A_f$  = Temperature Attenuation Factor

$$\sum_1^n T_f^{Range} = \text{sum of daily fuel surface temperature range}$$

$$\sum_1^n T_a^{Range} = \text{sum of daily ambient temperature range}$$

$$n = \text{number of data sets (days)}$$

## 10. REPORTING

10.1 The temperature Attenuation Factor can be applied to the equation in section 3.3.1 of CP-206 to determine the emission factor (pounds HC/1000 gallons/day) of the technology being tested.

10.2 Data shall be entered on the "Summary of Temperature Attenuation Factor Test Data" form (Form 1).

## 11. ALTERNATIVE TEST PROCEDURES

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.

# FORM 1

## SUMMARY OF TEMPERATURE ATTENUATION FACTOR TEST DATA

SOURCE INFORMATION							
GDF Name and Address _____ _____ _____			Applicant Representative and Title:  Contact Phone No. (    )				
Product Grade/RVP:  Tank Capacity (gallons):  Gasoline Volume (gallons):  Ullage (gallons):			Standing Loss System Description:  GDF # _____ A/C # _____				
Static Pressure Test Conducted: _____ (pre)						Pass <input type="checkbox"/>	Fail <input type="checkbox"/>
Temperature Attenuation Factor Data				$T_f$ (°F)		$T_a$ (°F)	
Day	Comments	Hours of valid data	Min	Max	Min	Max	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Static Pressure Test Conducted: _____ (post)						Pass <input type="checkbox"/>	Fail <input type="checkbox"/>
Test Conducted by:		Test Company:			Date of Test:		



**Figure 1**  
**Fuel Surface Thermocouple on Float**

