California Environmental Protection Agency

Air Resources Board

PROPOSED FOR ADOPTION

Vapor Recovery Test Procedure

TP-201.1E

Leak Rate and Cracking Pressure of Pressure/Vacuum Relief Vent Valves

Adopted: _______________

Note: This method is proposed for adoption. As authorized by title 2, California Code of Regulations, section 8, the method is shown without underline. All text is proposed for adoption.

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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

The purpose of this procedure is to determine the pressure and vacuum at which a Pressure-Vacuum Vent Valve (PV Valve) actuates, and to determine the volumetric leak rate at a given pressure as specified by Certification Procedure 201 (CP-201). This procedure is applicable for certification and compliance testing of PV Valves.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

The volumetric leak rate of a PV Valve is determined by measuring the positive and negative flow rates at corresponding pressures. This is accomplished by using a flow metering device to introduce a known flow into a test stand while measuring pressure.

3. BIASES AND INTERFERENCES

3.1 Installing a PV Valve onto the test stand in a manner that is not in accordance with the manufacturer's recommended installation instructions can produce erroneous results.

3.2 Leaks in the test stand or test equipment can produce erroneous results.

4. SENSITIVITY, RANGE, AND PRECISION

4.1 Electronic Pressure Measuring Device. Sensitivity shall be 0.01 inches H_2O with a maximum full-scale range of 20 inches H_2O and minimum accuracy of 0.50 percent.

4.2 Electronic Flow Metering Device. Minimum sensitivity shall be 1.0 ml/min with a maximum full-scale range of 200 ml/min and minimum accuracy of ±1.0 percent of full-scale.

4.3 Flow Metering Device (i.e., Rotameters). Minimum sensitivity shall be 15 ml/min (.005 CFH) with a maximum full-scale range of 300 ml/min and minimum accuracy of

± 5 percent. The device scale shall be a minimum of 150mm (5.91 inches) tall to provide a sufficient number of graduations for accurate readability.

5. EQUIPMENT

5.1 Nitrogen. Use commercial grade gaseous nitrogen in a high-pressure cylinder equipped with a pressure regulator and one (1.00) psig pressure relief valve. As an alternative, compressed air may be used to pressurize to the minimum working pressure required by the Flow Metering device.

5.2 Ballast Tank. If required, use a commercially available air tank (2 gallon minimum), capable of being pressurized or evacuated (placed under vacuum) to the minimum working pressure required by the flow-metering device(s).

5.3 Vacuum Pump or Vacuum Generating Device. Use a commercially available vacuum pump or equivalent, capable of evacuating the steel ballast tank or test stand to the minimum working pressure required by the flow-metering device.

5.4 Electronic Pressure Gauge. Use a Dwyer Model 475 Mark III Series or equivalent, electronic pressure gauge that conforms to the minimum requirements listed in section 4 to measure the pressure inside of the test stand.

5.5 Flow Metering Device(s). Use either an electronic flow-metering device or Rotameter as described below to measure or introduce a volumetric flow rate. Although the use of either type of instrument is allowed, electronic flow metering devices provide higher accuracy and precision. For the purpose of certification testing, only electronic flow metering devices shall be used.

5.5.1 Electronic Flow Metering Device. Use a Mass Flow Meter, Aalborg GFM-05 or equivalent that conforms to the minimum requirements listed in section 4 to introduce nitrogen or compressed air into the test stand. The Mass Flow Meter shall be equipped with a high precision needle valve to accurately adjust the flow settings. The meter may be used for both positive and negative flow rates by reconfiguring the pressure or vacuum lines.

5.5.2 Rotameters. Two (2) devices required. Use two Aalborg Flow Meters, tube number 032-41C or equivalent with minimum specifications in Section 4 to measure or introduce flow rates. One meter shall use a needle valve oriented for introducing positive flow and the other using an inverted needle valve for introducing vacuum.

5.6 Test Stand. Use a test stand as shown in Figure 1 or equivalent, equipped with a 2-inch NPT threaded pipe on at least one end for attaching the PV Valve in an upright position. The test stand shall be equipped with at least two (2) ports used for introducing flow and measuring pressure. Test stands may be constructed of various materials or dimensions.

6. PRE-TEST PROCEDURES

6.1 All pressure measuring device(s) shall be bench calibrated using a reference gauge, incline manometer or NIST traceable standard at least once every six (6) months. Calibration shall be performed at 20, 50, and 80 percent of full scale. Accuracy shall be within five (5) percent at each of these calibration points.

6.2 Electronic pressure measuring devices shall be calibrated immediately prior to testing using the zero gauge pressure adjustment knob located on the instrument.

6.3 The Flow Metering device(s) shall be calibrated using a reference meter or NIST traceable standard. Calibrations shall be performed at 20, 50, and 80 percent of full-scale range and shall take place at a minimum of once every six (6) months.

6.4 Leak check the test stand prior to installing the PV Valve.

(a) Install a 2-inch cap onto the NPT threads in place of the PV Valve using pipe sealant or Teflon tape.

(b) Check all fittings for tightness and proper assembly.

(c) Slowly establish a stable gauge pressure in the test stand between 18.00 and 20.00 inches water column and allow pressure to stabilize.

(d) Check for leaks by applying a leak detection solution around all fittings and joints and by observing the pressure for pressure changes that may identify a leak.

(e) If soap bubbles form or the test stand pressure will not stabilize, repeat (a) through (d); it may be necessary to place the test apparatus in an environment that is free from the effects of wind or sunlight.

TEST PROCEDURE

7.1 Install the PV Valve on the test stand in an upright position following the installation instructions provided by the manufacturer. Incorrectly installing the valve on the test stand will invalidate any pressure versus flow rate measurement.

7.2 Two-inch Leak Rate. Slowly open the control valve on the Positive Flow Metering device until the pressure in the test stand stabilizes at positive two (2.00) inches H_2O. Maintain steady state pressure at 2.00 inches H_2O by using the control valve for at least thirty (30) seconds. Steady state flow is indicated by a pressure change of no more than 0.05 inches H_2O on the pressure gauge. Record the final flow rate on the data sheet and close the control valve.

7.3 Positive Cracking Pressure. Open the control valve on the Positive Flow Metering device to establish a flow rate of 120 ml/min. Observe the test stand pressure. The PV Valve should “crack” at a pressure of approximately 3.00 inches H_2O. This is marked by a sudden drop in pressure or at which pressure stabilizes. Allow the PV Valve to continue cracking for at least thirty (30) seconds while maintaining the flow rate. Record the final pressure on the data sheet and close the control valve.

7.4 Negative Four-inch Leak Rate. Open the control valve on the Negative Flow Metering device until the pressure in the test stand stabilizes at negative four (-4.00) inches H_2O. Maintain steady state pressure at -4.00 inches H_2O by using the control valve for at least thirty (30) seconds. Steady state flow is indicated by a pressure change of no more than 0.05 inches H_2O on the pressure gauge. Record the final flow rate on the data sheet and close the control valve.

7.5 Negative Cracking Pressure. Open the control valve on the Negative Flow Metering device to establish a negative flow rate of 200 ml/min. Observe the test stand pressure. The PV Valve should "crack" at a pressure of approximately –8.00 inches H_2O. This is marked by a sudden drop in vacuum or at which vacuum stabilizes. Allow the PV Valve to continue cracking for at least thirty (30) seconds while maintaining the flow rate. Record the final pressure on the data sheet and close the control valve.

8. POST-TEST PROCEDURES

8.1 Remove the PV Valve from the test stand.

8.2 Disassemble the pressure regulator from the compressed nitrogen cylinder (if used) and place the safety cap back on the cylinder.

8.3 Disassemble all remaining test equipment and store in a protected location.

9. CALCULATING RESULTS

9.1 Commonly used flow rate conversions:

1 CFH = 471.95 ml/min

Example: Convert 0.17 CFH to ml/min $0.17CFH(471.95) = 80ml/\min$

1 ml/min = 0.00212 CFH

Example: Convert 100 ml/min to CFH: $100ml/\min(0.00212) = 0.21CFH$

10. REPORTING RESULTS

10.1 Record the station or location name, address and time of test on Form 1.

10.2 Record the PV Valve manufacturer's name and model number on Form 1

10.3 Record the results of the test(s) on Form 1. Use additional copies of Form1 if needed to record additional PV Valve tests.

10.4 Alternate data sheets of Forms may be used provided they contain the same parameters as identified on Form 1.

10.5 Use the formulas and example equation provided in Section 9 to convert the flow measurements into units of cubic feet per hour (CFH).

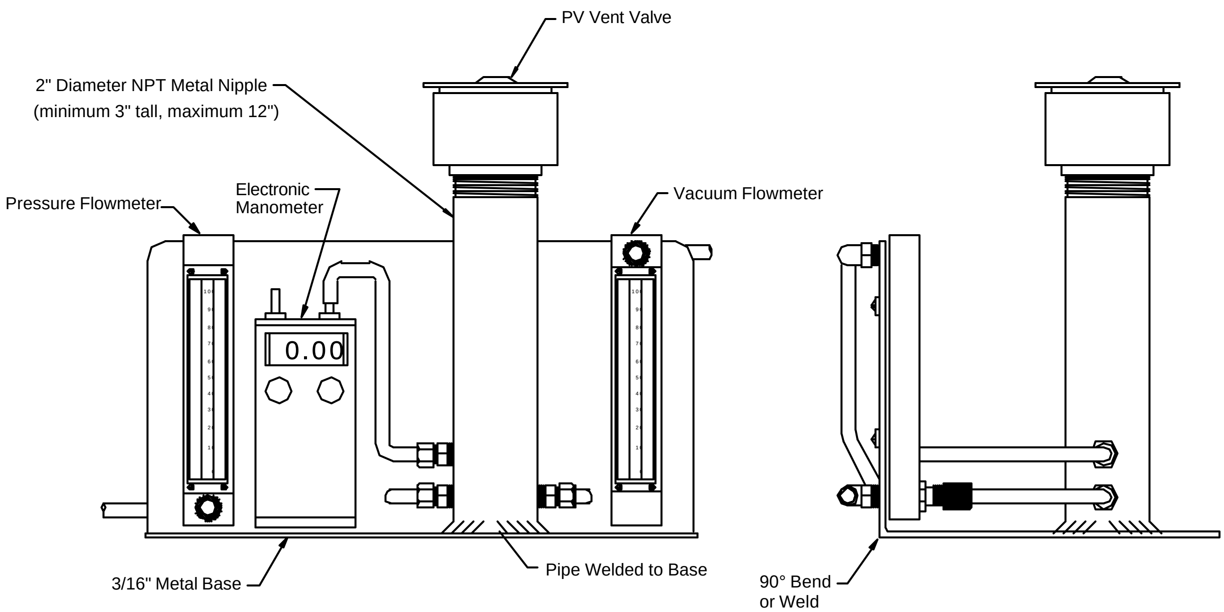
10.6 For certification testing, compare results to the performance standards listed in Table 3-1 of CP-201. For compliance testing, compare the results to the manufacturer's specifications listed on the PV Valve for both leak rate and cracking pressure. For volumetric leak rates less than the manufacturers specified leakrate and cracking pressures within the manufacturers specified range, circle Pass on the data sheet where provided. If either the volumetric leak rate or cracking pressure exceeds the manufacturers specifications, circle Fail on the data sheet where provided.

11. ALTERNATIVE TEST PROCEDURES

This procedure shall be conducted as specified. Any modifications to this test procedure shall not be used unless prior written approval has been obtained from the ARB Executive Officer pursuant to section 14 of Certification Procedure CP-201.

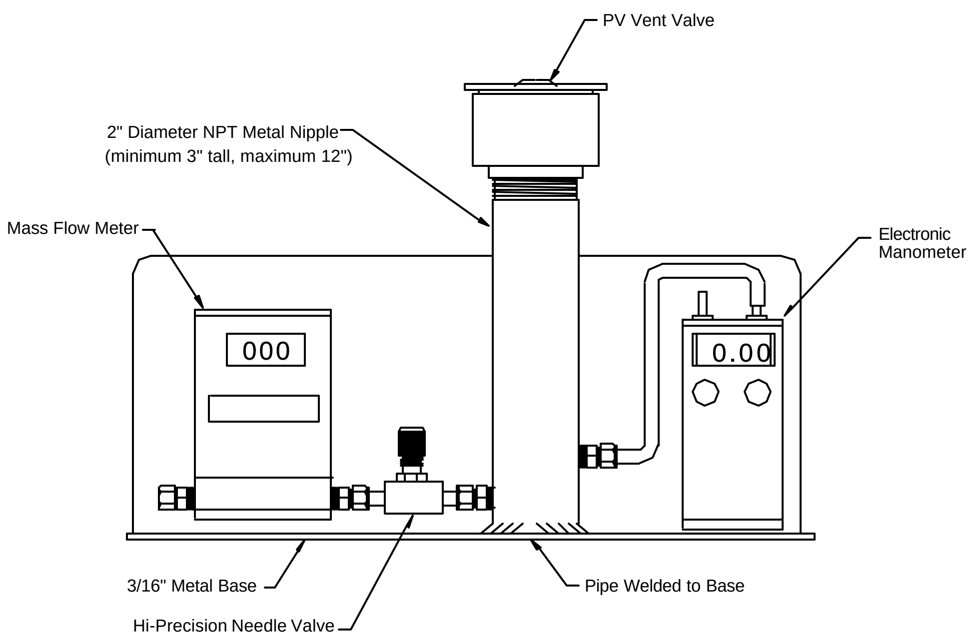
Figure 1

Example of Test Stand



FLOW METER CONFIGURATION

SIDE VIEW



MASS FLOW METER CONFIGURATION

Form 1

Pressure-Vacuum (PV) Vent Valve Data Sheet

Facility Name:	Test Date:
Address:	Time of Test:
City :	Other:

PV Valve Manufacturer:	**Model Number:** **Pass Fail**
Manufacturers Specified 2.00 inch Leak Rate (CFH):	**Manufacturers Specified -4.00 inch Leak Rate (CFH):**
Measured 2.00 inch Leak Rate (CFH):	Measured –4.00 inch Leak Rate (CFH):
Positive Cracking Pressure (in. H_2O):	Negative Cracking Pressure (in. H_2O):

PV Valve Manufacturer:	**Model Number:** **Pass Fail**
Manufacturers Specified 2.00 inch Leak Rate (CFH):	**Manufacturers Specified -4.00 inch Leak Rate (CFH):**
Measured 2.00 inch Leak Rate (CFH):	Measured –4.00 inch Leak Rate (CFH):
Positive Cracking Pressure (in. H_2O):	Negative Cracking Pressure (in. H_2O):

PV Valve Manufacturer:	**Model Number:** **Pass Fail**
Manufacturers Specified 2.00 inch Leak Rate (CFH):	**Manufacturers Specified -4.00 inch Leak Rate (CFH):**
Measured 2.00 inch Leak Rate (CFH):	Measured –4.00 inch Leak Rate (CFH):
Positive Cracking Pressure (in. H_2O):	Negative Cracking Pressure (in. H_2O):

PV Valve Manufacturer:	**Model Number:** **Pass Fail**
Manufacturers Specified 2.00 inch Leak Rate (CFH):	**Manufacturers Specified -4.00 inch Leak Rate (CFH):**
Measured 2.00 inch Leak Rate (CFH):	Measured –4.00 inch Leak Rate (CFH):
Positive Cracking Pressure (in. H_2O):	Negative Cracking Pressure (in. H_2O):