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ISD IN-USE EVALUATION PROTOCOL

February 16, 2006

1. Objectives

The overall objective is to determine whether performance of working ISD systems is similar to performance of the system tested in certification. As discussed in a March 1, 2005, meeting between CAPCOA and ARB, the evaluation will focus on the following:

- Vapor to Liquid (V/L) testing per Exhibit 5 of Executive Order VR-202-A (Attachment 1) to determine how closely the Veeder-Root ISD system compares to the V/L method, and to determine whether the V/L Malfunction Criteria for Gross and Degradation failures (Section 10.2.1 (b) and (c) of CP-201) can be tightened without compromising the reliability of the assessment.

- Determine if the Healy ISD System effectively identifies Onboard Refueling Vapor Recovery (ORVR) and non-ORVR vehicles such that V/Ls can be adequately identified per CP-201 criteria.

- Underground Storage Tank (UST) pressure monitoring per Determination of Pressure in Underground Gasoline Storage Tanks (Attachment 2) to determine how closely the Veeder Root ISD system pressure sensor value compares to the monitored value.

- Verification that the Veeder-Root ISD vapor pressure sensor and the vapor flow meter are operating properly.

2. Site Selection

Certification and Research and Development sites will be excluded from being an evaluation site. The minimum number of stations is six at the following districts with one site preferably having a throughput greater than 500,000 gallons per month:

- South Coast (minimum of 1 site)
- San Joaquin (minimum of 1 site)
- San Luis Obispo
- San Diego (minimum of 1 site)
- Glenn County
- Sacramento (minimum of 1 site)
- Bay Area (minimum of 1 site)

3. ISD Evaluation

CAPCOA and Air Resources Board (ARB) staff will work cooperatively during the time period between the ISD installation at the first site and the fifth site to evaluate the protocol and to collect data. Any changing or refining of the protocol will be done during this time jointly with ARB and CAPCOA. The evaluation will start when the sixth site becomes operational with at least five of those sites in the designated Districts or 12 months after the first evaluation site is installed, whichever comes first.

The study will be a collaborative effort between the ARB and CAPCOA. The field testing will be conducted by the Districts. Access to data will be obtained remotely and in cooperation with Veeder-Root.

4. Enforcement at the Evaluation Test Sites

Enforcement will be handled in accordance to local District policies and procedures.

5. Exhibit 5 of Executive Order VR-202 Testing – V/L Ratio

District staff should notify Vince Bunac of ARB, prior to performing a site visit to facilitate matching the field data with the electronic data. The TLS system data will be provided by Veeder-Root or remotely accessed by ARB and the districts. Upon arriving at a test site, testing staff should synchronize timepieces with the ISD system clock to ensure proper correlation of test data to ISD data.

ISD vapor collection accuracy is dependent upon vapor flow meter accuracy. Since there is a single flow meter in each dispenser, all hose vapor flows make use of the same flow sensor within a dispenser. Therefore it is only necessary to test V/L accuracy on one side of the dispenser. During each V/L test the opposite side of the dispenser must be inactive by coning off the fueling point to prevent dispensing during the test.

Throughout the evaluation period, testing will be performed monthly for 18 months in accordance with Attachment 1, Exhibit 5 of Executive Order VR-202. On each site visit, testing staff will randomly select the gasoline grade. Staff will perform at least 10 test runs during each site visit. A test run is conducting one V/L test per fueling point. If possible, Staff will conduct each test run at a different fueling point. Repeating test runs at the same fueling point may be necessary due to lack of available fueling points or other site-specific conditions.

Wait at least 1 minute after each test before beginning the next test to ensure that the ISD system recognizes it as a separate fueling. For each run, obtain an ISD fueling event V/L ratio by recording required information from the ISD system in the Healy V/L Field Data Sheet (found in Attachment 1).

ARB staff will compare the V/L results from the Healy V/L Field Data Sheet to the ISD system TLS V/L. Within two days after completing the V/L tests, fax the raw data sheets to Vince Bunac of the ARB at (916) 322-2444. ARB staff will compile the data from all testing agencies and forward the consolidated data to participants every three months.

Please note that pouring the gasoline back into the UST can result in pressure changes. These pressure changes may cause the TLS system to indicate a warning.

6. Identification of ORVR and non-ORVR vehicles

Vince Bunac of ARB at (916) 327-7420 should be contacted prior to performing a site visit to facilitate matching the field data with the electronic data. The TLS system data will be provided by Veeder-Root or remotely accessed by the ARB staff. Upon arriving at a test site, testing staff should synchronize timepieces with the ISD system clock to ensure proper correlation of test data to ISD data.

Each test site will be visited at monthly intervals for 18 months to determine the ISD system response to ORVR vehicles. Testing staff will witness a minimum of 20 refuelings per visit. Vehicle information shall be recorded on the ORVR Vehicle Determination Data Sheet (Form 1). At the end of the 18 months, the information recorded on the ORVR Determination Data Sheet must include information on a minimum of 100 ORVR vehicles and 100 non-ORVR vehicles. If the minimum number of ORVR vehicle and non-ORVR vehicle quotas is not met, testing staff will continue to visit the test site and record refueling information until they are met.

During vehicle refueling, the opposite side of the dispenser must be inactive by coning off the fueling point well enough to prevent dispensing during the test. Vehicle fuelings that are three gallons or less will not be counted.

Testing staff will determine if the vehicle is equipped with ORVR with the permission of the vehicle owner. If the owner refuses to provide permission, check the next vehicle. This determination is made by checking the emission label attached to the vehicle's hood or engine compartment. Look for the "Evap Family" code. If the fifth digit is an "E" or "V", it is Non-ORVR as shown in Sample A below. If the fifth digit is an "R", then the vehicle has ORVR as shown in Sample B below.

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Sample A

Non-ORVR

Sample B

ORVR

Staff must check the emissions label for all vehicles that fall under the EVAP Family Code Required column. Data from vehicles that fall into the EVAP Family Code Required column identified below in Table 1 that are not confirmed will not be counted. It is essential that ORVR and non-ORVR vehicles be identified conclusively.

Table 1: EVAP Family Code Requirements

Vehicle Class	non-ORVR Vehicles EVAP Family Code not Required	EVAP Family Code Required	ORVR Vehicles EVAP Family Code not Required
Passenger	< 1996	1997, 1998, 1999	> 2000
LD Trucks & MDV (<6000 lbs)	< 2000	2001, 2002	> 2003
MD Vehicles (6001-8500 lbs)	< 2003	2004, 2005	> 2006

After recording 20 vehicle fuelings for vehicles conclusively determined to be ORVR-equipped or non-ORVR-equipped, testing staff will forward the resulting data to ARB where ARB staff will match the beginning fueling time and the gallons dispensed data from the ORVR Vehicle Determination Data Sheet to the corresponding readings from the Veeder-Root TLS. Within two days of the field test, fax the raw data sheet to Vince Bunac of the ARB staff at (916) 322-2444. ARB will staff will compile data from all test sites and forward the compiled data to participants every three months.

7. Pressure Sensor Verification

Testing staff shall conduct UST pressure sensor verification testing once monthly, for 18 consecutive months, minimum. Vince Bunac of the ARB staff should be contacted at (916) 327-7420 prior to performing a site visit to facilitate matching the field data with the electronic data. The TLS system data will be provided by Veeder-Root or remotely accessed by ARB staff. Upon arriving at a test site, testing staff will synchronize timepieces with the ISD system clock to ensure proper correlation of test data to ISD data. Dispensing of gasoline can continue as usual during test.

Testing staff will record the vapor pressure at the vapor poppet (see Figure 1.)

The basic procedure is summarized below. For a more detailed description, which includes recommended pre-test procedures, equipment descriptions, and calibration procedures; see Attachment 2, Determination of Pressure in Underground Gasoline Storage Tanks.

A. Attach the dust cap or vapor coupler test assembly to the vapor adaptor (Figure 2). This equipment should be connected in a manner that will minimize bleeding down the ullage pressure.

Figure 1: Typical Modified Vapor Adaptor Dust Cap (Bottom View)

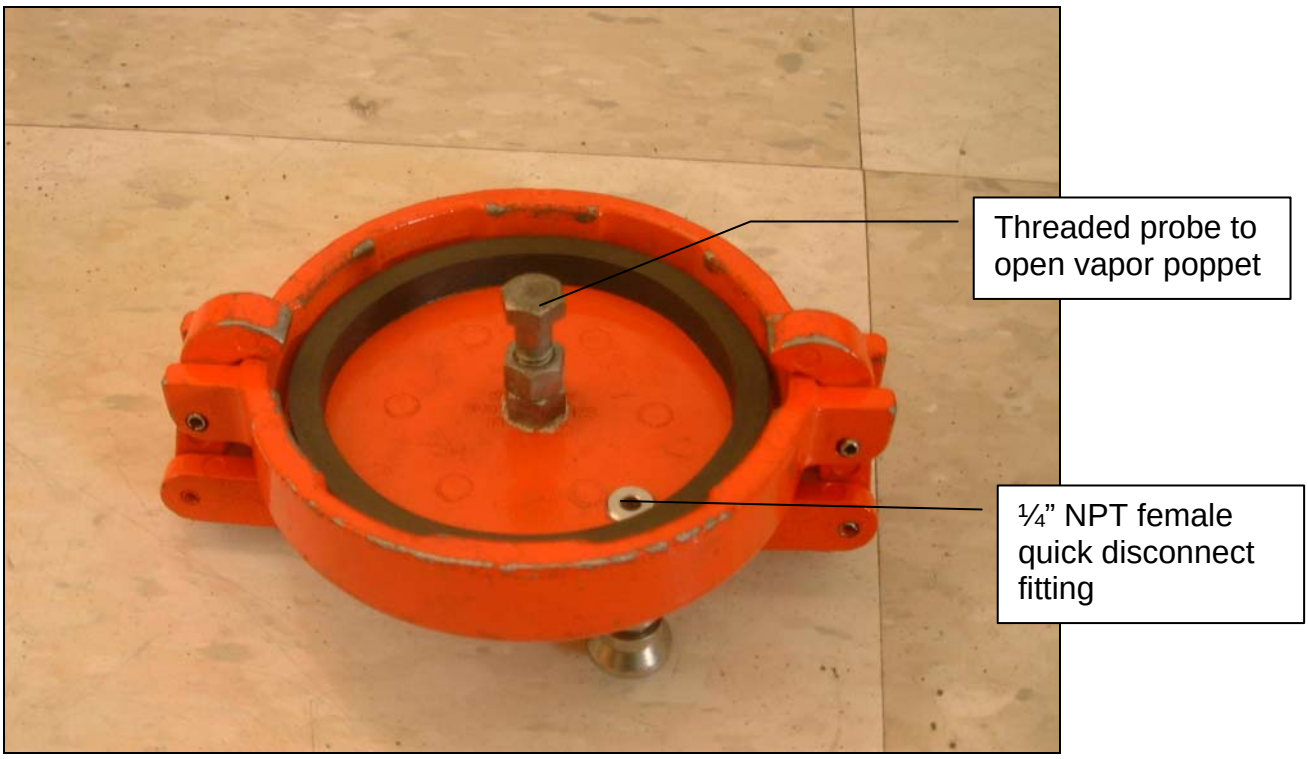
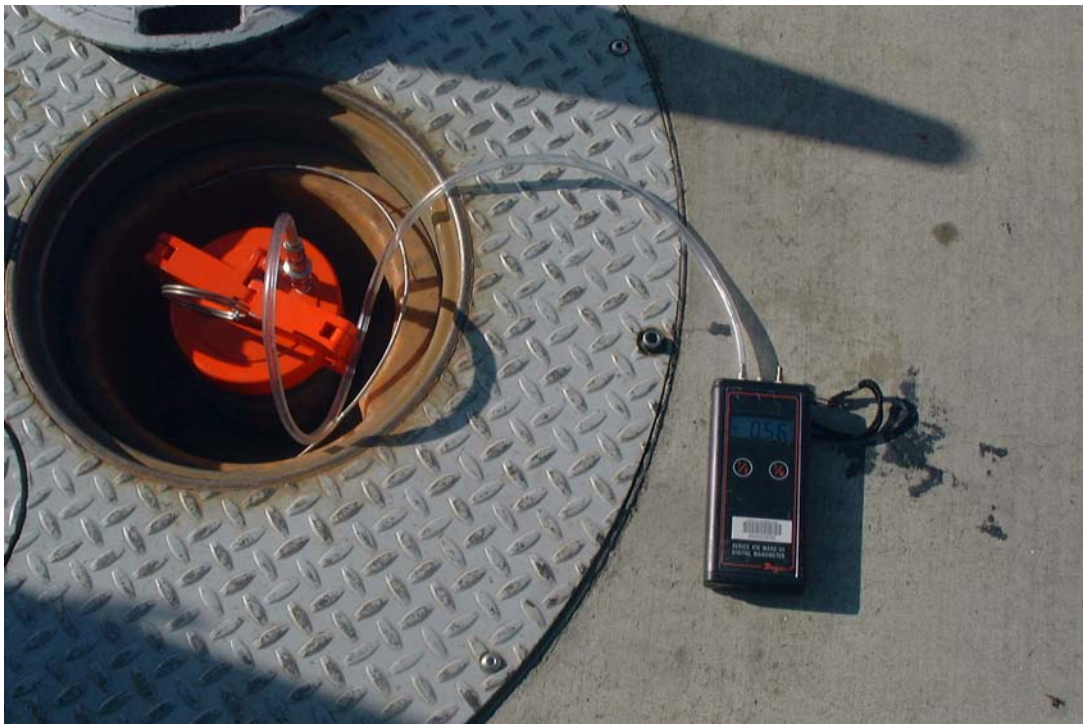


Figure 2: Typical Field Installation of UST Pressure Measurement Assembly



B. Apply soap solution to the dust cap or vapor coupler test assembly and vapor adaptor and check for visual leaks.

C. If no leaks are detected within two minutes after applying soap solution, proceed with monitoring pressure for ten minutes and record the final reading on Form 2. At a minimum, record pressure at beginning and end of test period.

D. Record temperature at the beginning and end of test period. This test will be invalid if temperature differential exceeds 5° F.

This pressure reading should be conducted prior to performing V/L testing. Within two days of the field test, fax the raw data sheet to Vince Bunac of the ARB staff at (916) 322-2444. ARB staff will compile data from all testing agencies and forward the compiled data to participants every three months.

8. Operability Test Procedure

Testing staff will conduct the ISD Operability Test once monthly, for 18 consecutive months, minimum. The ISD Operability Test consists of two procedures: the Vapor Sensor Ambient Reference Test, and the Vapor Flow Meter Operability Test; as defined in Exhibit 9 of Executive Order VR-202-A. These two procedures are defined below. The forms to check-off and record results from these procedures are enclosed.

Vapor Pressure Sensor Ambient Reference Test

The following procedure shall be used at field sites to determine if the Vapor Pressure Sensor is reading properly in accordance with Veeder-Root ISD specifications.

1. Access the Vapor Pressure Sensor in the dispenser. Record which dispenser contains the pressure sensor and record the pressure sensor serial number on the data form (Form 3).

2. Remove the cap from the ambient reference port of the Vapor Pressure Sensor valve and open the valve to atmosphere by turning it 90 degrees so that the flow arrows point to both the Vapor Pressure Sensor sensing port and the ambient reference port (see Figure 3).

3. Start at the ‘DIAG MODE” menu at the TLS Console front panel to enter the ‘Calibrate SmartSensor’ menu as shown in Figure 4 to view the non-calibrated pressure value.

4. Verify that the pressure value is between +0.2 and -0.2 inches water column (IWC). If the pressure value is not within this range, replace the cap on the ambient reference port of the Vapor Pressure Sensor valve.

Restore the Vapor Pressure Sensor valve by turning it 90 degrees so that the flow arrows point to both the Vapor Pressure Sensor sensing port and the UST vapor space sensing line (ref. Figure 3). Notify Station Owner that testing indicates Vapor Pressure Sensor should be replaced.

5. Press the <MODE>key to leave the “Calibrate SmartSensor’ menu. Note: Do not calibrate the sensor!

Figure 3: Vapor Pressure Sensor Valve position

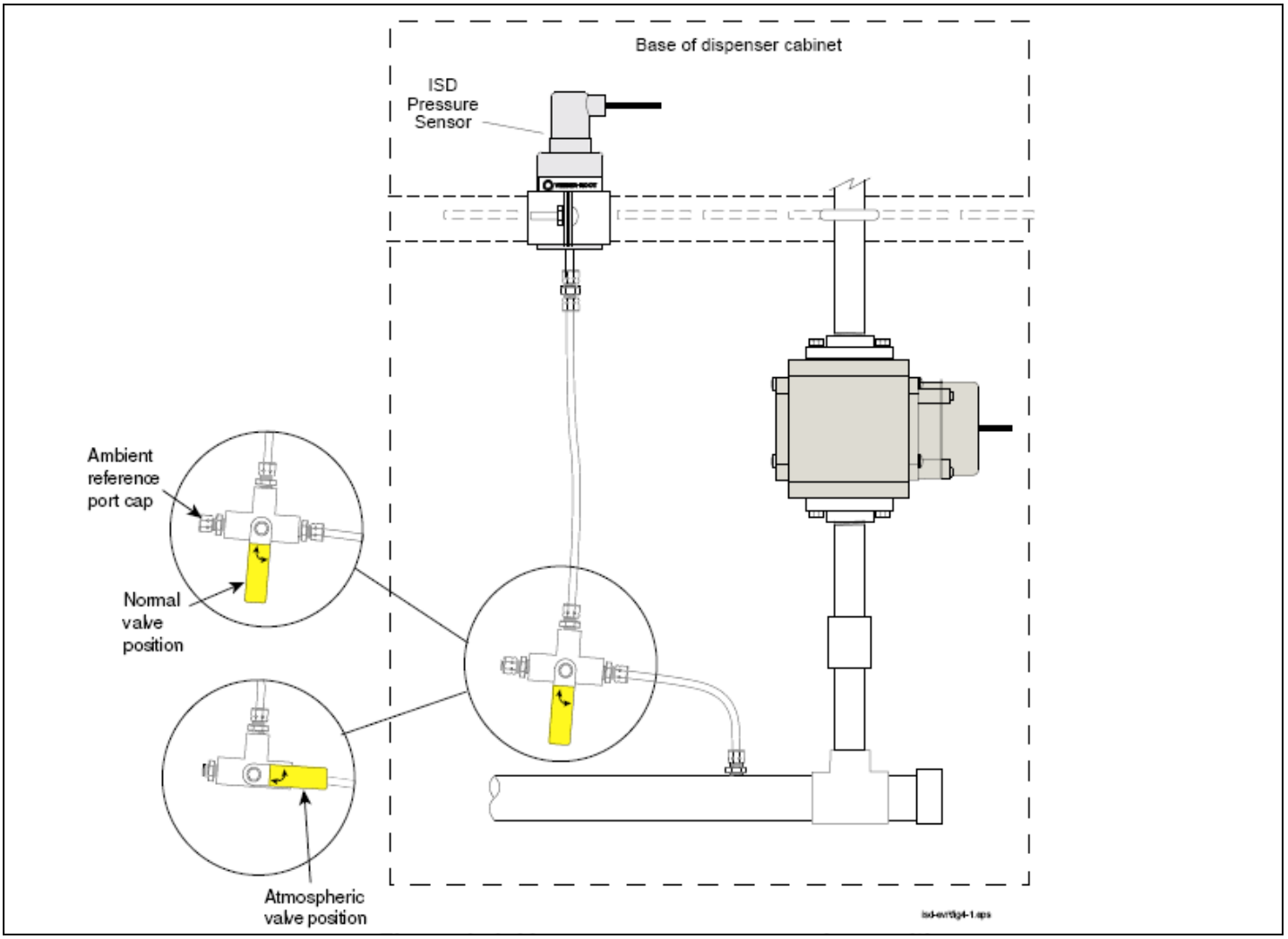
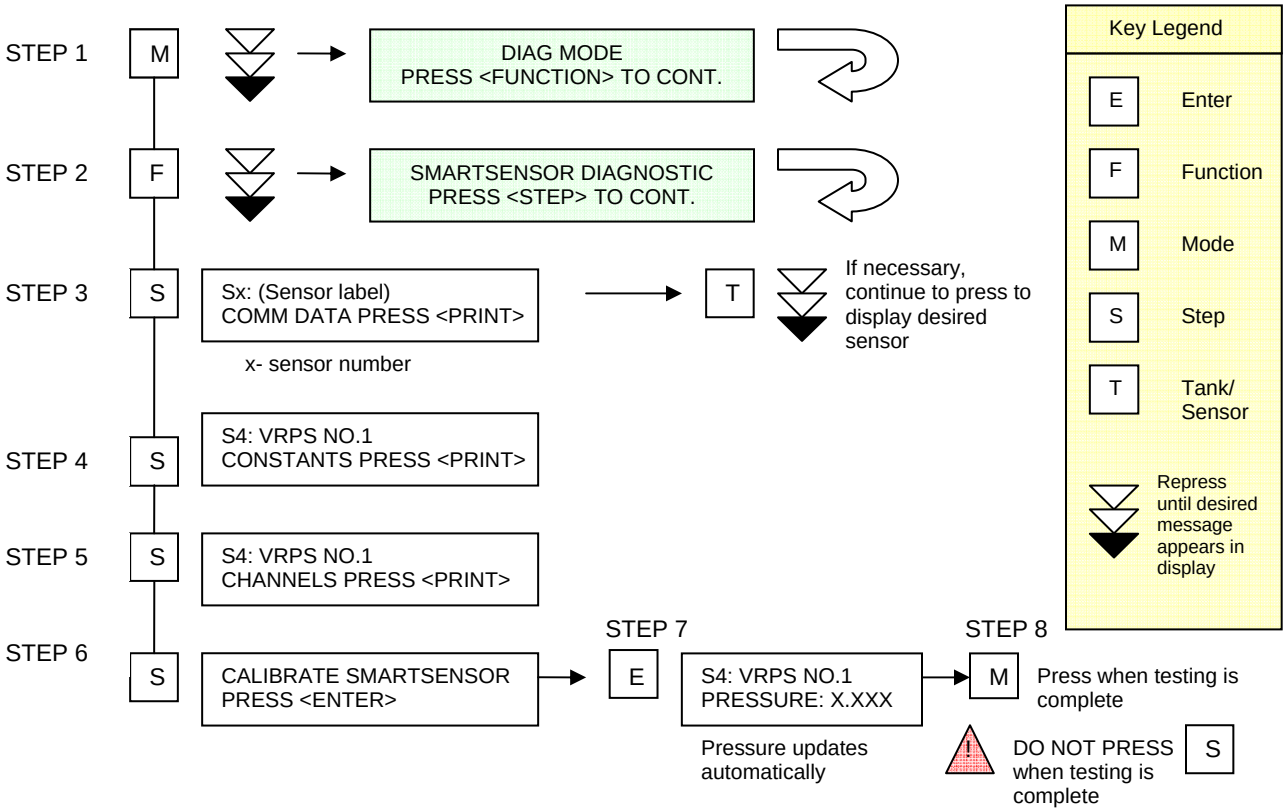


Figure 4: Accessing Calibrate SmartSensor Diagnostic Menu



Vapor Flow Meter Operability Test

1. Obtain an ISD Daily Report printout with current Gross ISD V/L values from the TLS (see “Reports” on page 5-5 of the ISD Install, Setup and Operation Manual).

2. Select a dispenser and note the fueling point numbers on the data form (Form 4). Obtain the vapor flow meter serial number (available from the EVR/ISD Setup Printout – see Figure 3-6 in the ISD Install, Setup and Operation Manual). Conduct a Healy EVR Phase II system V/L test per Exhibit 5 of VR-202-A with the lowest grade fuel available on that dispenser.

3. Compare the ISD Daily Report Gross V/L value for that dispenser hose to the V/L test result (subtract ISD V/L value from V/L test value and note difference on Form4).

   Pass: If the difference is between -0.15 and +0.15, then the ISD V/L value is within +/- 0.15 of the V/L test value. Circle “Pass” to document that the ISD flow meter in that dispenser passes and repeat the procedure beginning at Step 2 for the next dispenser.

   Continue: If the ISD V/L value is NOT within +/- 0.15 of the V/L test value, then go to Step 4.

4. Run two more V/L tests per Exhibit 5 with lowest grade fuel on the same hose and average the two results with the first V/L test result from Step 2.

5. Compare the ISD V/L value for that hose to the average of the three V/L test results (subtract ISD V/L value from average V/L test value and note difference on Form 4).

   Pass: If the ISD V/L value is within +/- 0.15 of the average of the 3 V/L test results, the ISD flow meter in that dispenser passes the operability test. Go to the next dispenser and repeat the procedure beginning at Step 2.

   Continue: If the ISD V/L value is NOT within +/- 0.15 of the average of the 3 V/L test results, then go to Step 6.

6. If a second fueling position is available on the dispenser, repeat the tests beginning at Step 2 for the second fueling position. If the second fueling position tests do not pass Steps 2 through 5, notify Station Owner that testing indicates vapor flow meter should be replaced.

9. Summary of Testing Requirements

The testing requirements and recommended frequency of each test are summarized in Table 2.

Table 2: Summary of Required Tests

TEST	Protocol Section Reference	Attached Report Form #	Number of Events per Month	Number of Months	Total Number of Events
V/L Ratio Verification	5	Included in Attach. 1	10 (test runs)*	18	180
Identification of ORVR Vehicles Verification	6	1	20 (refueling observed)	18	360**
UST Pressure Sensor Verification	7	2	1 (test run per UST)	18	18 (per UST)
Vapor Pressure Sensor Ambient Reference Test	8	3	1	18	18
Vapor Flow Meter Operability Test	8	4	1 to 6 (V/L test runs per dispenser, depending on results)	18	18-108 (per dispenser)

* Can be used for Vapor Flow Meter Operability Test if done using lowest grade.
** Minimum 100 ORVR and 100 non-ORVR

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Attachment 1

Exhibit 5 of Executive Order VR-202-A

Vapor Recovery Test Procedure

Exhibit 5

Vapor to Liquid Volume Ratio for
Healy Phase II EVR System
Including Veeder-Root ISD System

California Environmental Protection Agency
Air Resources Board

Vapor Recovery Test Procedure

Exhibit 5

Vapor to Liquid Volume Ratio for
Healy Phase II EVR System
Including Veeder-Root ISD System

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. PURPOSE AND APPLICABILITY

1.1 This test procedure is used to quantify the Vapor to Liquid (V/L) Volumetric Ratio of the Healy Phase II EVR System Including Veeder-Root ISD installed at gasoline dispensing facilities (GDF). This procedure provides a method to determine compliance with the V/L requirements specified in the ARB Executive Order (EO) VR-202-A.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

2.1 A tight fitting adaptor is placed on the spout of a dispensing nozzle. The adaptor, which isolates vapor flow to the nozzle vapor collection ports, is connected to a volume gas meter. Gasoline is dispensed through the nozzle and the volume of vapors drawn through the vapor collection boot by the Phase II system vacuum pump is measured. The volume of vapor is recorded and compared with the volume of gasoline dispensed to determine the V/L Volumetric Ratio.

2.2 The test is conducted with the pressure/vacuum (P/V) vent valve(s) on the storage tank vent pipes installed.

2.3 The test procedure requires no modifications to the GDF being evaluated.

2.4 The test procedure may be conducted on a fueling point on one side of the dispenser with the other side of the dispenser either authorized to dispense fuel (but not dispensing), or with the other side dispensing fuel into a vehicle or another portable test tank. Conducting the test this way will be evaluating the V/L of the fueling point with the VP1000 vacuum pump running on its high speed setting.

3. BIASES AND INTERFERENCES

3.1 Nozzle spouts that are damaged such that the V/L adaptor cannot fit over the nozzle spout preclude the use of this test.

3.2 Refueling points not capable of achieving dispensing rates required for conducting the V/L test, as specified in Exhibit 2 of ARB Executive Order VR-202-A, preclude the use of this test for determining in-use compliance of certified systems.

3.3 Bagging, or otherwise sealing any nozzle associated with the vacuum pump serving the nozzle being tested, may bias the test results towards compliance. **The V/L test to verify compliance shall be conducted without "bagging" any of the nozzles served by a common vacuum device.**

3.5 If the nozzle being tested introduces liquid into the test equipment, the V/L of that nozzle shall be deemed a failure of the V/L standard.

3.6 Do not drain or remove liquid in either the vapor passage of the hoses or the dispenser vapor piping prior to performing the test. Draining of this liquid gasoline will bias the test toward compliance.

3.7 The O-ring in the V/L adaptor that is not properly lubricated may bias the results toward noncompliance. Refer to the V/L adaptor manufacturer's instructions in the ARB Approved Installation, Operation and Maintenance Manual for the Healy Phase II EVR System Including Veeder-Root ISD System for lubrication requirements.

3.8 Conducting V/L testing with an improperly conditioned portable test tank (not saturated with gasoline vapors) will bias the test results of the as found V/L of the fueling point. Refer to Section 6.6 for proper portable test tank conditioning.

4. SENSITIVITY, RANGE, AND PRECISION

4.1 The maximum rated capacity of the gas volume meter shall be at least 250 CFH and not greater than 3,000 CFH.

4.2 The minimum rated capacity of the gas volume meter shall be 25 CFH.

4.3 The minimum readability of the gas volume meter shall be 0.01 cubic feet.

4.4 Precision is $\pm$ 5 percent of the gas volume meter reading.

5. EQUIPMENT

5.1A Vapor to Liquid Adaptor. Only the Healy Systems, Inc. V/L Test Sleeve, Part No. 8034-1, can be used to conduct V/L testing on the Healy Phase II EVR System Including Veeder-Root ISD. The nominal inside diameter of the flexible tubing shall be between 0.75 and 1.00 inches, and the maximum length of the tubing shall be 6 feet. Figure 1 shows the Healy V/L adaptor assembled on the 900 EVR nozzle.

5.1B Surrogate Spout. Only the Healy Systems, Inc. V/L Surrogate Spout Assembly, Part No. 8175-1, can be used to conduct the pre-test and post-test leak check. Figure 1 shows the Healy Surrogate Spout.

Figure 1 shows the Healy V/L adaptor assembled on the 900 EVR nozzle and the Surrogate Spout.

5.2 Gas Volume Meter. Use a gas volume meter to measure the volumetric flow rate through the V/L adaptor. The meter shall be equipped as shown in Figure 2 and the maximum allowable pressure drop(s) across the meter shall be:

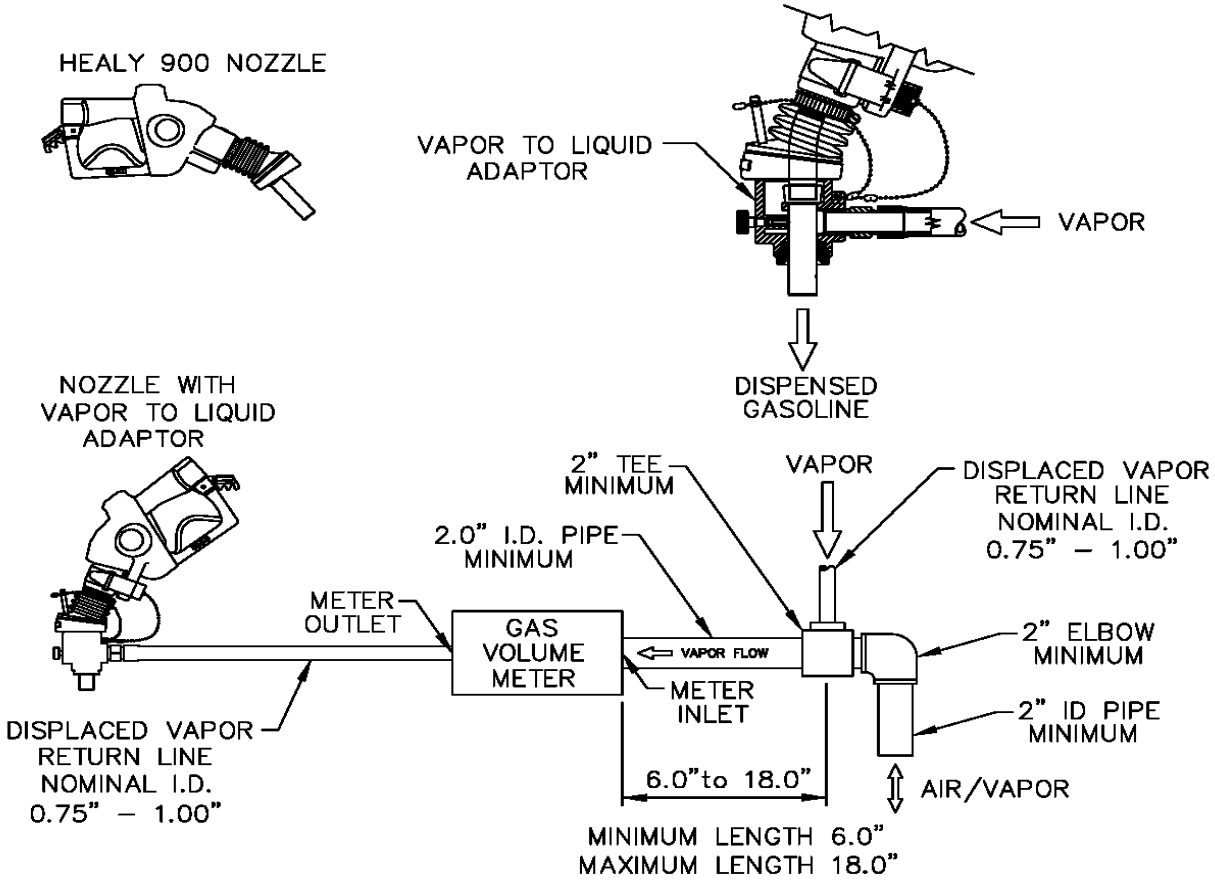
For a meter with a maximum rated capacity of 1000 CFH through 3,000 CFH:
1.10 inches H_2O at a flowrate of 3,000 CFH
0.05 inches H_2O at a flowrate of 30 CFH

For a meter with a maximum rated capacity of 800 to 1,000 CFH:
0.70 inches H_2O at a flowrate of 800 CFH
0.04 inches H_2O at a flowrate of 16 CFH

5.3 Volume Gas Meter Inlet Manifold. This manifold is designed to return the vapors displaced from the portable gasoline tank assembly, at atmospheric pressure, to the inlet of the gas volume meter. This manifold shall be two (2.0) inches minimum inside diameter pipe. The intake passage of the manifold shall be no shorter than 6.0 inches and no longer than 18.0 inches. See Figures 2 and 4.

Figure 1

Healy Vapor To Liquid (V/L) Adaptor and Surrogate Spout Assembly



5.4 Liquid Volume Meter. Use the totalizer on the gasoline dispenser to measure the volume of gasoline dispensed during the test.

5.5 Portable Gasoline Tank Assembly. A portable tank, meeting fire safety requirements for use with gasoline, shall be used to receive the gasoline dispensed during this test. The tank shall have sufficient volume so that at least 4.5 gallons may be dispensed prior to activating the primary shutoff mechanism of the dispensing nozzle. Tank material, likely to provide contact with the nozzle spout, or V/L adaptor, during the entire dispensing event, shall be constructed of aluminum or brass or other materials approved by the local fire codes for such application. The tank and required plumbing configuration is shown in Figure 3 and Figure 4. This configuration permits a portion of the vapors displaced during testing to be returned to the underground storage tank (UST). The minimum and maximum dimensions shown in Figure 2 and Figure 4 shall be adhered to in all cases.

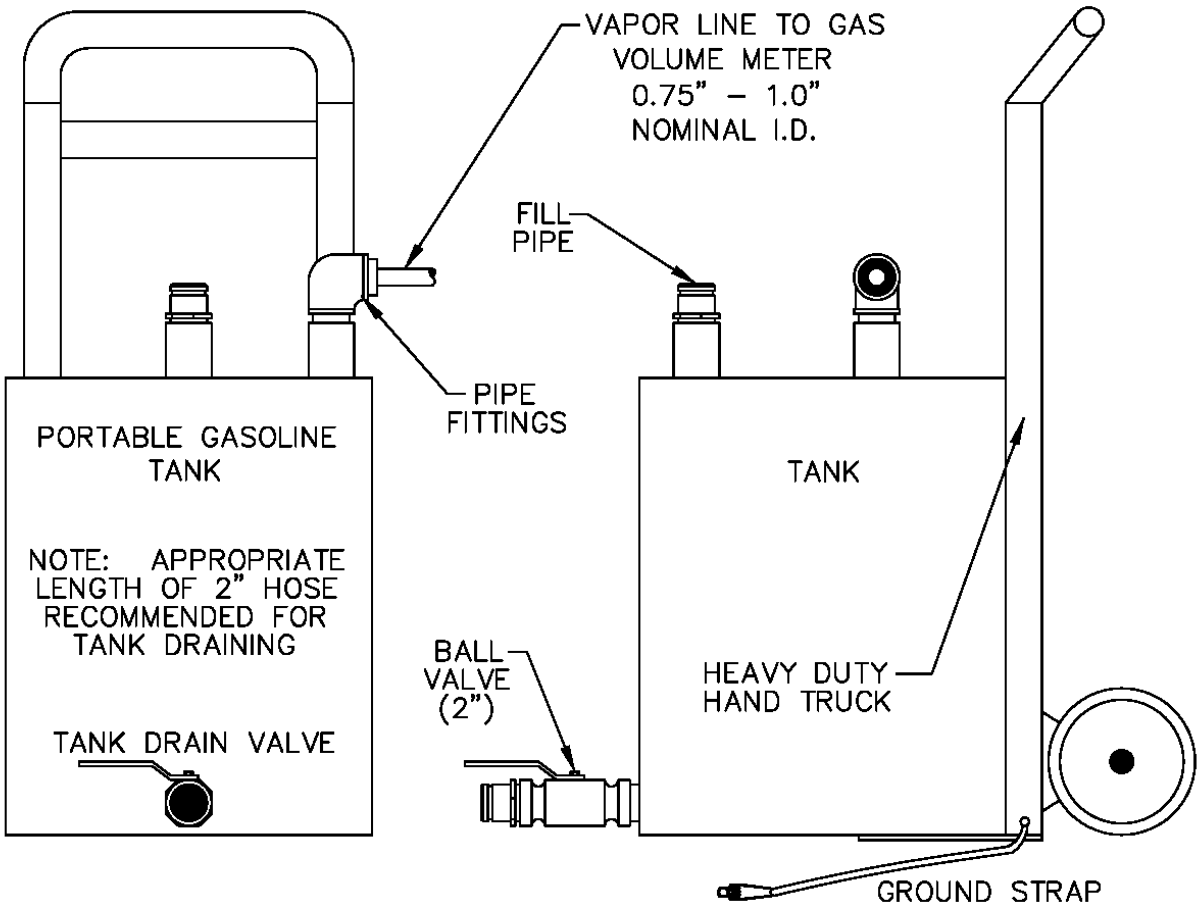
5.6 Stopwatch. Use a stopwatch accurate to within 0.2 seconds.

5.7 Lubricant. Appropriate lubricant shall be used to ensure a leak-tight seal between the O-ring in the V/L adaptor and the nozzle spout.

5.8 Leak Detection Solution. Any liquid solution designed to detect gaseous leaks may be used to verify the pressure integrity of test equipment during this test.

Figure 3

Portable Tank Assembly



6. PRE-TEST PROCEDURES

6.1 Assemble the portable tank assembly and gas volume meter as shown in Figure 4. The minimum and maximum dimensions shown in Figure 4 shall be adhered to in all cases. **Ensure that the ground strap is properly connected to an acceptable ground**.

Note: A one-time test to verify proper design of the tee connection at the gas volume meter shall be conducted. Disconnect the V/L adaptor from the nozzle. Insert the nozzle into the portable test tank so that there is no visible gap between the nozzle boot/portable test tank fill pipe interface. Dispense between four and one-half and five (4.5 - 5.0) gallons into the portable test tank. The tee connection design passes the test if the displacement on the gas volume meter is less than 0.01 cubic feet. The result of this test shall be kept with the test equipment.

6.2 The gas volume meter shall be calibrated, within 180 days prior to conducting this procedure. In addition, calibration shall be conducted after any repairs or alterations to the meter. Calibrations, at a minimum, shall be conducted at flowrates of 30, 60, and 90 CFH (3.7, 7.5, and 11.2 gallons/minute) in accordance with one of the following:

(a) ARB Air Monitoring Quality Assurance, Volume VI, Standard Operating Procedures for Stationary Source Emission Monitoring, January 1979, or

(b) US EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, or

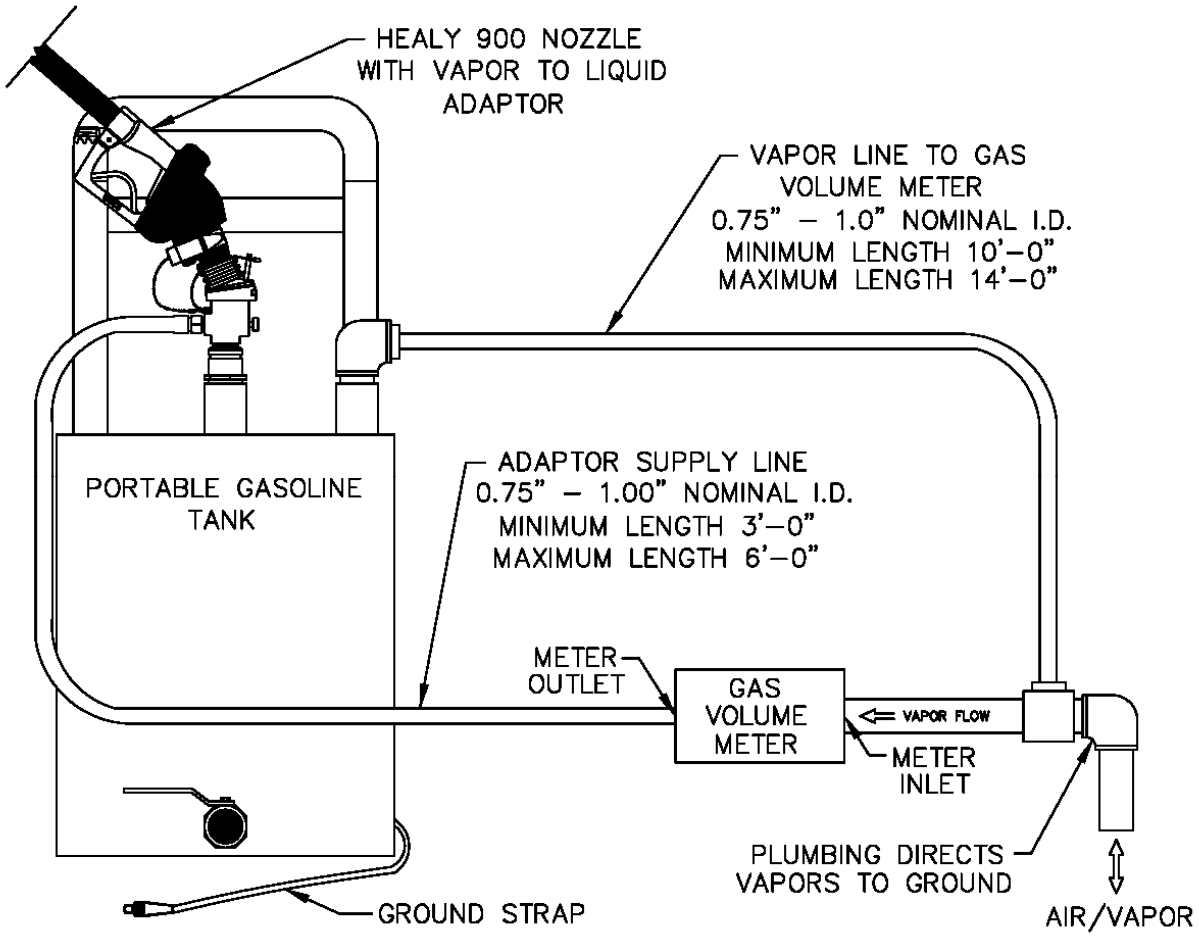
(c) EPA Method 2A, Measurement of Gas Volume Through Pipes and Small Ducts (40 CFR Part 60, Appendix A), or

(d) Appropriate calibration procedures in accordance with California Department of Food and Agriculture, Division of Measurement Standards and County Department of Weights and Measures (title 4, CCR, section 3.33).

A copy of the most current calibration shall be kept with the meter.

Figure 4

Assembled Vapor to Liquid Volume Ratio Test Equipment



6.3 Verify that the O-ring in the V/L adaptor is present and in good condition. An O-ring with nicks, tears, or other deformations shall be replaced prior to the test. The O-ring shall be properly lubricated to ensure a vapor tight connection. Refer to the V/L adaptor manufacturer's instructions in the ARB Approved Installation, Operation and Maintenance Manual for the Healy Phase II EVR System Including Veeder-Root ISD System for lubrication requirements.

6.4 Conduct a pre-test leak check of the V/L adaptor by connecting the V/L adaptor to a surrogate spout as shown in Figure 5. Raise the test pressure to five inches WC (5.00" WC). Squirt liquid leak detector solution on interfaces and other potential leak sources while watching for the formation of bubbles. There shall be no formation of bubbles or a drop in pressure below 4.00" WC for thirty seconds from the start of the test.

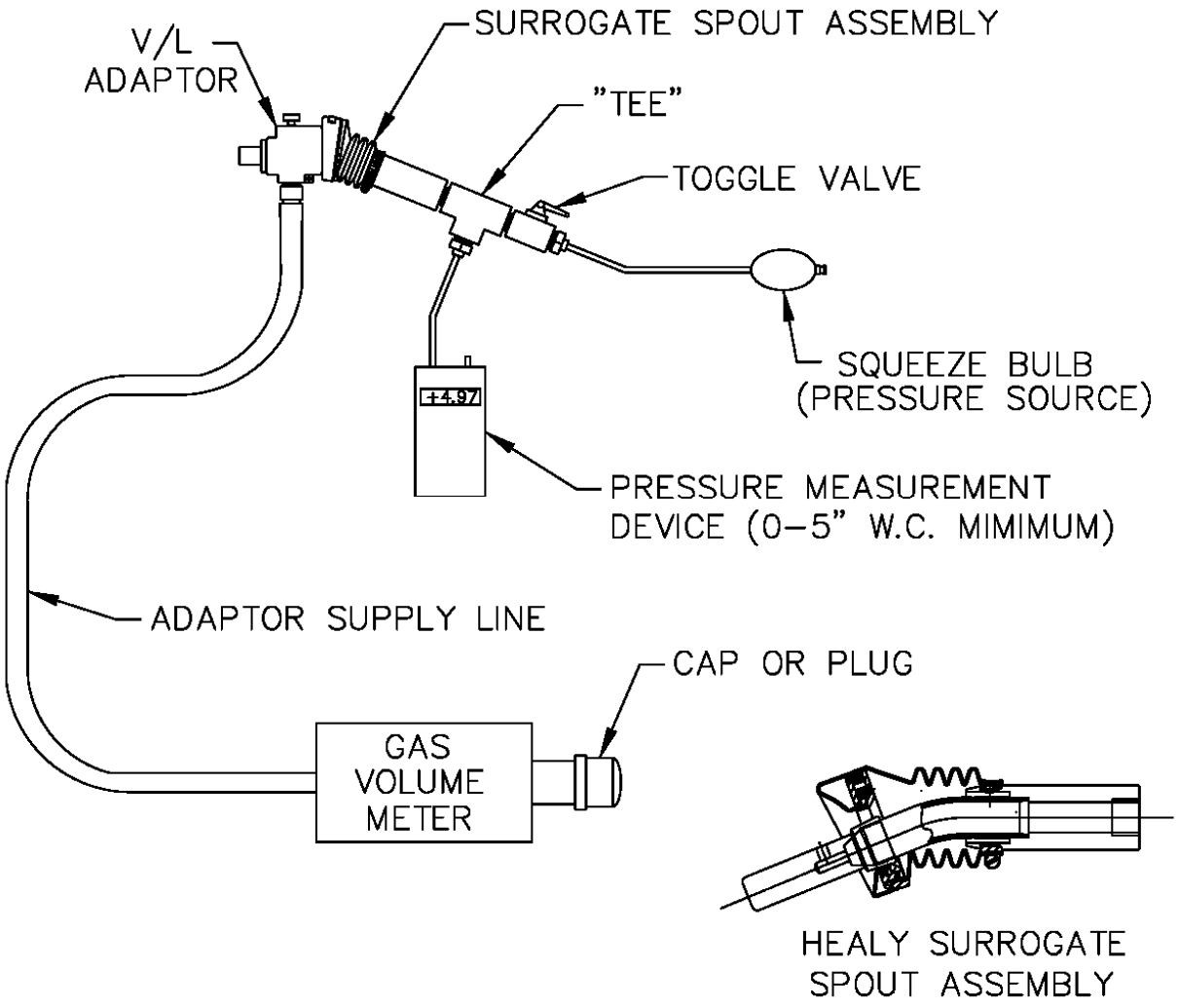
Note: Leak checks may be conducted during V/L testing to ensure leak integrity of test equipment.

6.5 This test procedure shall be conducted with the storage tank pressure/vacuum (P/V) valve(s) installed and the Phase I vapor coupler(s) poppet(s) in the closed position.

6.6 With the portable tank and V/L test equipment assembled, dispense gasoline into the portable test tank until at least 10% of the tanks total capacity has been reached. This will condition the portable tank with gasoline vapors. This conditioning shall be conducted each time the test tank is emptied prior to conducting testing at each facility.

Figure 5

Vapor To Liquid Adaptor and Gas Volume Meter Leak Test Assembly



7. TEST PROCEDURES

7.1 Carefully connect the V/L adaptor to the nozzle spout as shown in Figure 1, isolating the vapor path of the nozzle and ensuring a tight connection.

7.2 Record the initial reading from the index of the gas volume meter on the Healy V/L Field Data Sheet at the end of this document. This initial reading shall be taken before each test. Do not use the final reading from the preceding test as the initial reading for the current test, unless it has been verified. This is necessary since the meter index may have moved due to the low pressure drop through the meter.

7.3 Reset the stopwatch and, if appropriate, reset the totalizer on the dispenser.

7.4 Fully engage the nozzle trigger and begin dispensing into the portable gasoline tank. **Ensure that the nozzle spout is in contact with the grounded tank assembly during dispensing**. Start the stopwatch when the totalizer indicates dispensing has started.

7.5 Dispense between four and one-half (4.5) and five (5.0) gallons of gasoline.

If the nozzle being tested introduces liquid into the test equipment, the V/L of that nozzle shall be deemed a failure.

7.6 Simultaneously stop both the stopwatch and gasoline dispensing.

7.7 The following data for each test shall be recorded on the Healy V/L Field Data Sheet:

7.7.1 Dispenser (pump) number

7.7.2 Fuel grade

7.7.3 Nozzle model and serial number

7.7.4 Initial gas volume meter reading, in cubic feet

7.7.5 Initial totalizer reading from the dispenser, in gallons

7.7.6 Final gas volume meter reading, in cubic feet

7.7.7 Final totalizer reading from the dispenser, in gallons

7.7.8 Elapsed time during dispensing, in seconds

Note: Units other than cubic feet, gallons, and seconds may be used, provided that Equation 9-1 is appropriately modified.

7.8 If the V/L Volumetric Ratio, as determined by Equation 9-1 is between 0.95 –1.15, the grade point complies with the specifications.

7.9 If the V/L Volumetric Ratio is between 0.76 – 0.94, or greater than or equal to 1.16, conduct the test two additional times. Do not make adjustments to the gasoline dispensing or vapor recovery lines until all three test runs have been completed. Adjustments of the V/L test equipment, including the V/L adaptor and nozzle, are allowed as may be necessary to ensure measurement accuracy. If the V/L test equipment is adjusted, then the prior test run results for that grade point tested should not be used. Calculate the numerical average of the three test runs. If the average V/L value of these three test runs is within the allowable limits, compliance has been verified. If the resulting average is outside of the specified limits, the grade point tested does not comply with the specifications of the EO.

7.10 If the initial V/L Volumetric Ratio is less than or equal to 0.75, this indicates a V/L failure of the grade point tested.

7.11 To avoid a build-up of gasoline, drain any condensed gasoline, periodically or after each test run, from the hoses between:
(a) the gas volume meter and portable tank assembly, and
(b) the V/L adaptor and gas volume meter.

8. POST-TEST PROCEDURES

8.1 Remove the V/L adaptor from the nozzle.

8.2 Drain the dispensed product into the appropriate gasoline storage tank at the facility. **Ground the portable tank assembly to the storage tank before draining**. Do not mix product grades in the portable tank assembly without approval of the facility owner and use caution to drain the portable tank into the correct facility storage tank. If blending valves are utilized to produce product grades that do not have a dedicated storage tank, product from the blended grade shall be returned to the lower octane tank.

8.3 After concluding testing at the facility, perform a post-test leak check of the V/L adaptor by connecting the V/L adaptor to a surrogate spout as shown in Figure 5. Raise the test pressure to five inches WC (5.00" WC). Squirt liquid leak detector solution on interfaces and other potential leak sources while watching for the formation of bubbles. There shall be no formation of bubbles, or a drop in pressure below 4.95" WC for three minutes from the start of the test. The data collected during the V/L testing between the last valid test equipment leak check (see Section 6.4) and the post-test leak check is invalid if the test equipment fails this post-test leak check.

8.4 Prior to transportation, the inlet and outlet of the gas volume meter shall be carefully sealed to prevent foreign matter from entering the meter.

8.5 The Authority Having Jurisdiction (AHJ) may be contacted on the requirements for storage and transportation of the portable test tank. This would typically be the local fire department.

9. CALCULATING RESULTS

9.1 The V/L Volumetric Ratio shall be calculated as shown in Equation 9-1.

$$V/L = \left[\frac{y(Vf - Vi)}{G_f - G_i} \right] \times 7.481 \quad \textbf{[Equation 9-1]}$$

Where:

V/L	=	Vapor to Liquid Volumetric Ratio, dimensionless
y	=	Correction factor for gas volume meter. See Equation 9-3
V_i	=	Initial gas volume meter reading, cubic feet
V_f	=	Final gas volume meter reading, cubic feet
G_i	=	Initial totalizer reading from the dispenser, gallons
G_f	=	Final totalizer reading from the dispenser, gallons
7.481	=	Conversion factor from gallons to cubic feet, gallons per cubic foot

9.2 The gasoline dispensing rate during the V/L test shall be calculated as shown in Equation 9-2.

$$Q_g = \left[\frac{G_f - G_i}{t} \right] \times 60 \qquad \textbf{[Equation 9-2]}$$

Where:

Q_g = Gasoline dispensing rate, gallons per minute
G_I = Initial totalizer reading from the dispenser, gallons
G_f = Final totalizer reading from the dispenser, gallons
t = Elapsed time during dispensing event, seconds
60 = Conversion factor, seconds per minute

9.3 The correction factor for correcting observed values of the gas volume meter shall be calculated as shown in Equation 9-3.

$$y = \left[\frac{V_r}{V_m} \right] \qquad \textbf{[Equation 9-3]}$$

Where:

y = Correction factor for the gas volume meter's observed reading, dimensionless
V_r = True volume from current calibration of gas volume meter, cubic feet
V_m = Corresponding observed reading from gas volume meter, cubic feet

10. REPORTING RESULTS

10.1 Report V/L test data and other information as required in the Healy V/L Field Data Sheet at the end of this document. Districts may require the use of alternate forms, provided they include the same minimum parameters as identified in the Healy V/L Field Data Sheet.

11. ALTERNATE PROCEDURES

11.1 This procedure shall be conducted as specified. Modifications to this test procedure shall not be used to determine compliance unless prior written approval has been obtained from the ARB Executive Officer, pursuant to Section 14 of Certification Procedure CP-201.

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GDF Name and Address _____ _ _____ _____ _____ _____	**Healy V/L Field Data Sheet** Tee Connection Test Result (See Section 6.1)_____ ft^3 Date of Last Gas Volume Meter Calibration _____ Correction Factor for Gas Volume Meter _____ Pressure Measurement Device Calibration Date _____	Testing Firm Name and Address: _____ _____ _____ Phone No. ( )
Test Date/Time:		Test Performed by:
Pre-Test Leak Check: Initial/Final Pressures, in. H_2O _____ / _____ **Post-Test Leak Check:** Initial/Final Pressures, in. H_2O ___ _ / _____	**A/C #** _____ **P/O #** _____	District Test Witness _____ Applicable ARB EO # VR-201-A Allowable V/L Range 0.95 – 1.15

7.7.1 Pump #	7.7.2 Fuel Grade	7.7.3 Nozzle Model & Serial #	Starting Time of Run	7.7.5 Initial Dispenser Totalizer, Gallons	7.7.7 Final Dispenser Totalizer, Gallons	Total Gas Pumped, Gallons	7.7.8 Time, Seconds	Dispensing Rate, gpm	7.7.4 Initial Meter Reading, ft3	7.7.6 Final Meter Reading, ft3	7.8 V/L	7.9 V/L Average (if necessary)	7.8, 7.9 or 7.10 Pass or Fail

Attachment 2

Determination of Pressure in Underground Gasoline Storage Tanks

1. Range and Accuracy

1.1 The minimum full scale range for digital manometer shall be 0.00 to 4.00 inches WC. The minimum accuracy shall be ±0.5% full scale at 60 to 78 ºF, and ±1.5% full scale at 32 to 60 ºF and 78 to 104 ºF.

1.2 The temperature measuring device shall have a maximum range of 0 to 150 ºF and shall be accurate to within 2 ºF.

1.3 The stop watch shall have an accuracy of 0.1 seconds.

2. Biases and Interference's

2.1 Leaking vapor adaptors will not allow test assembly to achieve a leak tight seal.

2.2 Improper connection of dust cap or vapor coupler test assembly can result in accidental discharge of vapor due to positive pressure in UST's. Wait ten (10) minutes before retesting.

2.3 Temperature fluctuations during test period can result in erroneous values. All testing must be avoided when temperature differences exceeds 5° F.

3. Equipment

3.1 The dust cap test assembly shall be modified in the following manner:

3.1.1 Tap, thread, and install a ¾ inch NPT threaded probe in the center of the dust cap. The probe shall be of sufficient length to open approximately ½ inch of the dry break while allowing the cap to maintain a leak tight seal on the adaptor.

3.1.2 Tap, thread and install a ¼ inch NPT female quick connect fitting on the top of the dust cap, offset from the center probe. A Swagelok, part number SS-QC4-B-4-PM, quick connects fitting or equivalent is required.

3.1.3 Use approximately 24 inches of ¼ inch (internal diameter) clear “Tygon tubing” or equivalent to connect the manometer to the dust cap. Install a ¼ inch male quick connect fitting, Swagelok part number SS-QC4-5-400 or equivalent, on one end of a ferrule stainless steel tube (1/8 inch internal diameter) of approximately 1.5 inches. Connect one end of the “Tygon tubing” to the stainless steel tube and connect the other end to the digital manometer.

3.2 Alternatively, the vapor coupler test assembly, Figures 2 and 3 of TP-201.3 may be used in lieu of the dust cap test assembly.

3.3 Digital Manometer (Electronic Pressure Measuring Device)

Use a 0 - 4.00 inches WC digital manometer to monitor the UST pressure with a minimum sensitivity of 0.01 inches of WC. Dwyer Series 475 Mark III model 475-00-FM (0-4.00 inches WC) Digital manometer or equivalent is required. A copy of the manufacturer’s operating instruction shall be kept with the equipment.

3.4 Vacuum Grease or Petroleum Jelly

Use commercially available vacuum grease or petroleum jelly to apply to the dust cap or vapor coupler test assembly gasket to maintain good seal.

3.5 Soap Solution mixture with spray bottle or “Snoop.”

3.6 Temperature gauge or thermometer capable of measuring ambient temperature with a resolution of 2° F.

3.7 Stop watch with accuracy of 0.1 seconds.

4. Calibration Requirements

A copy of the most current calibration shall be kept with the equipment to verify that the calibrations have been done appropriately.

4.1 Digital manometer shall be bench calibrated using a reference pressure measuring device or incline manometer. Calibration shall be performed at 20, 50, and 80 percent of full scale. Accuracy shall be within two percent at each of these calibration points. Calibration shall be conducted on a frequency not to exceed 180 days.

4.2 The temperature measurement device shall be checked at an interval not to exceed 180 days using an ice bath, ambient air, and boiling water. The accuracy of the temperature measuring device shall be checked against an NIST traceable temperature measuring device.

5. Pre Test Procedures

5.1 Turn on digital manometer and allow instrument to warm up for five minutes.

5.2 Zero out digital manometer using adjustment pod on top of instrument in accordance with manufactures instructions. Drift may be minimized by re-zeroing immediately after use by venting both pressure port to atmosphere and adjusting the knob until the display reads exactly zero.

5.3 Apply thin layer of vacuum grease or petroleum jelly to gasket located under the dust cap or vapor coupler test assembly.

5.4 Attach male quick connect fitting of pressure line to cap.

5.5 Attach digital manometer to open end of Tygon tubing.

6. Test Procedure

6.1 Attach the dust cap or vapor coupler test assembly to the vapor adaptor.

6.2 Apply soap solution to the dust cap or vapor coupler test assembly and vapor adaptor and check for visual leaks.

6.3 If no leaks are detected within two minutes after applying soap solution, proceed with monitoring pressure for ten minutes and record on Form 2 the time, pressure, and whether the processor is on.

6.4 Record temperature at the beginning and end of test period on Form 2. This test will be invalid if temperature differential exceeds 5° F.

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Form 1

GDF Name and Address _____ _____ _____	**ORVR VEHICLE DETERMINATION DATA SHEET**	Testing Firm Name and Address: _____ _____ _____ Phone No. ( )
Test Date/Time:		Test Performed by:
	Source: **GDF Phase II Vapor Recovery** **GDF #** _____ **Permit #** _____	Vapor pressure _____ Time of day _____

Year	Make	Model	Evap Family Code R, E, V or NV (Not Verified)	Fueling Point	Starting Dispensing Time	Dispensing Time, Seconds	Gallons Dispensed	V/L from TLS

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Form 2

Data Sheet for Determination of Pressure In Underground Gasoline Storage Tanks			
Facility Name:		Test Time:	Test Date:
Address:			
City:			
Testing Company :		Testing Company Address	
Person Conducting Test:		Testing Company Phone Number	
Initial Ambient Temperature [ºF]:		Final Ambient Temperature [ºF]:	

Observed Underground Storage Tank Pressure

Time	Pressure (In H_2O)	Time	Pressure (In H_2O)

Comments:	

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Form 3

Vapor Pressure Sensor Ambient Reference Test

DATE OF TEST _____

SERVICE COMPANY NAME	SERVICE COMPANY'S TELEPHONE
SERVICE TECHNICIAN	VEEDER-ROOT TECH CERTIFICATION #
STATION NAME	DISTRICT PERMIT #
STATION ADDRESS	CITY STATE ZIP

STEP 1.	PRESSURE SENSOR LOCATION: DISPENSER FUELING POINT NUMBERS FP___ /FP___	PRESSURE SENSOR SERIAL NUMBER _____
STEP 2.	REFERENCE PORT CAP REMOVED? ☐ VALVE SET TO REFERENCE PORT (PER FIG. 3)? ☐	
STEP 3.	NON-CALIBRATED SENSOR VALUE _____ INCHES OF WATER COLUMN (OBTAIN VALUE USING TLS CONSOLE KEYPAD SEQUENCE SHOWN IN FIG. 4, STEP 7)	
STEP 4.	PRESSURE BETWEEN +0.20 & -0.20 (Y/N)? ☐ IF NO: REPLACE PRESSURE SENSOR: NEW SENSOR SERIAL NUMBER _____ NEW SENSOR VALUE _____ INCHES OF WATER COLUMN NEW SENSOR PRESSURE BETWEEN +0.20 & -0.20 (Y/N)? ☐	
STEP 5.	REFERENCE PORT CAP REPLACED? ☐ VALVE SET TO VAPOR SPACE PORT (PER FIG 3)? ☐	
STEP 6.	MODE KEY PRESSED TO EXIT CALIBRATE SMARTSENSOR MENU? ☐	

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Form 4
Veeder-Root In-Station Diagnostics (ISD) Vapor Flow Meter Operability Test Procedure

DATE OF TEST _____

SERVICE COMPANY NAME		**SERVICE COMPANY'S TELEPHONE**	
SERVICE TECHNICIAN		**VEEDER-ROOT TECH CERTIFICATION #**	
STATION NAME		**DISTRICT PERMIT #**	
STATION ADDRESS	**CITY**	**STATE**	**ZIP**
	VAPOR FLOW METER SERIAL NUMBER _____		
	DISPENSER FUELING POINT NUMBERS FP _____	FP _____	
STEP 1.	**ISD DAILY REPORT GROSS V/L VALUES**		
STEP 2.	**LOW GRADE FUEL HOSE *V/L RESULT #1 (ONE FP ONLY)**		
STEP 3.	**STEP 1. VALUE MINUS STEP 2. VALUE**	**DIFF.**	**DIFF.**
	PASS IF DIFFERENCE IS WITHIN +/-0.15, IF LARGER DIFFERENCE, THEN CONTINUE TO STEP 4 (CIRCLE ONE)	**PASS CONTINUE TO STEP 4**	**PASS CONTINUE TO STEP 4**
STEP 4.	**LOW GRADE FUEL HOSE V/L RESULT #2**		
	LOW GRADE FUEL HOSE V/L RESULT #3		
	AVERAGE OF 3 V/L RESULTS	**AVG.**	**AVG.**
STEP 5.	**STEP 1. VALUE MINUS STEP 4. AVG.**	**DIFF.**	**DIFF.**
	PASS IF DIFFERENCE IS WITHIN +/-0.15, IF LARGER DIFFERENCE, THEN CONTINUE TO STEP 6 OR 7 (CIRCLE ONE)	**PASS CONTINUE TO STEP 6**	**PASS NOTIFY STATION OWNER**
STEP 6.	**IF CONTINUE, REPEAT AT STEP 2. FOR 2ND FP USING 2ND FP COLUMN, ABOVE.**		