California Environmental Protection Agency

Air Resources Board

In-Station Diagnostic Evaluation Field Study Report

January 19, 2010

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. EXECUTIVE SUMMARY

The California Air Resources Board (ARB) and the California Air Pollution Control Officer's Association (CAPCOA or Districts) agreed to conduct an 18 month In-Use In-Station Diagnostic (ISD) Evaluation Field Study (ISD Field Study) on the first ISD system certified by ARB. The Healy Phase II Enhanced Vapor Recovery (EVR) including Veeder-Root ISD (Healy including Veeder-Root ISD) was the first system certified.

The ISD Field Study took place from July 2006 through December 2007. The overall objective was to determine whether performance of in-use ISD systems installed in California is similar to the performance of the ISD system tested during certification. Monthly tests were conducted by District staff at five evaluation test sites located throughout the state.

Test results show that the in-use ISD systems tested perform similarly to the ISD system that passed the certification tests in the six objective areas evaluated.

II. INTRODUCTION

The California Air Resources Board (ARB) and the California Air Pollution Control Officer's Association (CAPCOA) agreed to conduct an 18 month In-Use In-Station Diagnostic (ISD) Evaluation Field Study (ISD Field Study) on the first ISD system certified by ARB. The Healy Phase II Enhanced Vapor Recovery (EVR) including Veeder-Root ISD (Healy including Veeder-Root ISD) was the first system certified.

ISD monitors the collection and containment of gasoline vapors by vapor recovery equipment installed at gasoline dispensing facilities (GDFs). Section 9 of the Certification Procedure, CP-201, identifies standards for the ISD system. ISD issues warnings and alarms which indicate a possible problem with the EVR Phase II vapor recovery system. If certain alarms persist, ISD can automatically shut down gasoline dispensing.

The ISD Field Study was conducted to document whether in-use ISD performance is similar to the ISD system certified. The field study took place from July 2006 through December 2007. Five gasoline dispensing facilities were selected by District staff in different parts of the state as test sites.

III. TEST PROGRAM

A. Goals

The overall ISD Field Study objective was to determine whether performance of in-use ISD systems is similar to performance of the Healy including Veeder-Root ISD system tested in certification. In order to meet the overall objective, specific goals and testing methods were defined. These goals were:

- Determine how closely the Healy including Veeder-Root ISD system compares to the Vapor to Liquid (V/L) Exhibit 5 method of Executive Order VR-202-A.

- Determine whether the V/L malfunction criteria for gross and degradation failures can be tightened without compromising the reliability of the ISD assessment.

- Determine if the Healy including Veeder-Root ISD System effectively identifies onboard refueling vapor recovery (ORVR) and non-ORVR vehicles.

- Determine how closely the Healy including Veeder-Root ISD system pressure sensor value compares to the UST pressure value.

- Verify that the Healy including Veeder-Root ISD vapor pressure sensor is operating properly.

- Verify that the Healy including Veeder-Root ISD vapor flow meter is operating properly.

B. Test Sites

Five evaluation test sites were selected by District staff as listed in Table III-1.

Table III-1
ISD Field Study Test Site Information

Test Site	Address	District	District Contact
7-Eleven	9600 Brimhall Road Bakersfield, CA 93312	San Joaquin Valley APCD	Morgan Lambert*
7-Eleven	35015 Fremont Blvd. Fremont, CA 94536	Bay Area AQMD	John Marvin
7-Eleven	7801 Clairemont Mesa Blvd San Diego, CA 92111	San Diego APCD	Randy Smith
ARCO #05913	27727 East Baseline Road Highland, CA 92346	South Coast AQMD	Lou Roberto
Chevron USA	7966 Walerga Road Antelope, CA 95843	Sacramento Metropolitan AQMD	Isam Boulad

*****No Longer with district

C. Testing

The ISD Field Study testing was conducted by District staff. Access to ISD data was obtained in cooperation with Veeder-Root from the TLS console of the Veeder-Root's ISD system. Five different sets of tests (listed below) were conducted at each site, once a month, during the 18 month ISD Field Study. The testing protocol is detailed in the ISD In-Use Evaluation Protocol (Appendix A).

a. V/L Ratio Testing per Exhibit 5 of VR-202-A

b. Identification of ORVR and non-ORVR equipped vehicles

c. Pressure sensor verification per Exhibit 9 of VR-202-A

d. Vapor pressure sensor ambient operability test per Exhibit 9 of VR-202-A

e. Vapor flow meter operability test per Exhibit 9 of VR-202-A

D. Data Submission

District staff recorded necessary information and data onto data sheets/forms. Examples of the data sheets are found in the ISD In-Use Evaluation Protocol (Appendix A). These data forms were submitted to ARB and compiled by ARB staff. The compiled data were made available at http://www.arb.ca.gov/vapor.

Any corresponding readings from the TLS console of the Veeder-Root ISD system were made available by Veeder-Root to ARB staff in order for the compilation of all test data. The compiled data was again made available at http://www.arb.ca.gov/vapor.

IV. FINDINGS

A. V/L Ratio Testing: Exhibit 5 V/L compared to ISD V/L

The ISD Field Study included comparing the V/L values from the Veeder-Root ISD system with those V/L measures in accordance with Exhibit 5 of Executive Order VR-202-A to determine how closely the Healy including Veeder-Root ISD V/L values compared.

Testing times were synchronized to the ISD system time to ensure proper correlation between the same data sets. It was only necessary to determine the V/L accuracy on one side of the dispenser since only one flow meter was installed in each dispenser. The side not being tested was removed from service to prevent dispensing of gasoline during the test.

At least ten Exhibit 5 V/L tests were conducted by District staff at each site per month. V/L tests included using different gasoline grades and different fueling points if available at the time. The test protocol required the nozzle be returned to the dispenser after each test with a time of at least one minute between tests. This ensured the ISD system recognized each test as a separate fueling event. Data was recorded on the Healy V/L Field Data sheet. (Appendix A).

Statistical analysis performed on the data comparisons between the Exhibit 5 V/L and the real time ISD V/L showed that 95 percent of the ISD Data was within 0.12 of the Exhibit 5 VR-202-A data and met the criteria (±0.15) of Exhibit 9 VR-202-A. (Appendix B).

B. V/L Ratio Testing: Malfunction Criteria

Malfunction criteria for gross failure requires the ISD system to assess, on a daily basis, a minimum of 15 non-ORVR fueling events, when the V/L ratio is at least 75 percent below the lower certified V/L ratio threshold or at least 75 percent above the upper certified V/L ratio threshold, shall activate a warning alarm, and shall record the event. When two such consecutive failed assessments occur, the ISD system

shall activate a failure alarm, record that event, and prohibit fuel dispensing from the affected fueling point(s). The ISD system shall have the capability of re-enabling dispensing, and shall record that event.

Malfunction criteria for V/L degradation requires the ISD system to assess, on a weekly basis, a minimum of 30 non-ORVR fueling events, when the V/L ratio is at least 25 percent below the lower certified V/L ratio threshold or at least 25 percent above the upper certified V/L ratio threshold, shall activate a warning alarm, and shall record the event. When two such consecutive failed assessments occur, the ISD system shall activate a failure alarm, record that event, and prohibit fuel dispensing from the affected fueling point(s). The ISD system shall have the capability of re-enabling dispensing, and shall record that event.

The ISD V/L certified range is 0.95 to 1.15. The Malfunction Criteria-Gross Failure and the Malfunction Criteria-Degradation are defined in CP-201, Section 9.2.1 and listed in Table IV-1.

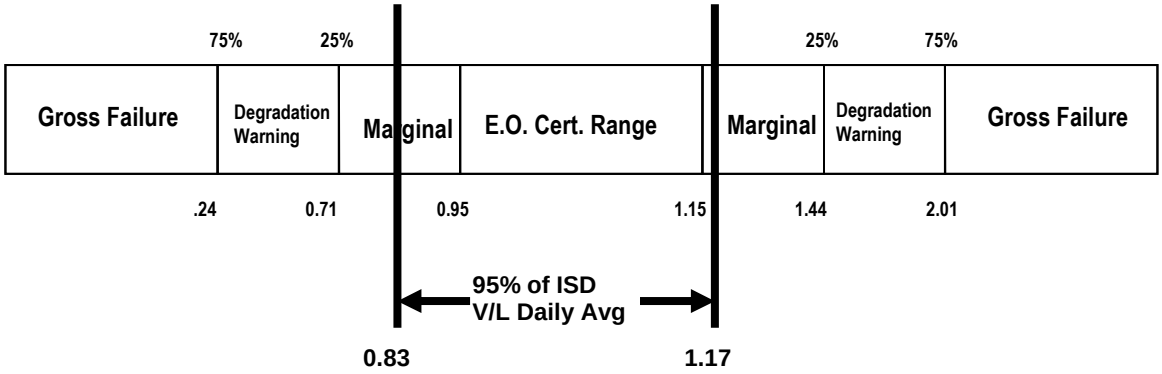
Table IV-1
Gross Failure & Degradation Criteria

Criteria	Gross Failure	Degradation
Assessment Frequency	Daily	Weekly
Minimum number of non-ORVR Vehicles	15	30
V/L Percent Above/Below the Certified Range (Resulting Limits)	75% (0.24 and 2.01)	25% (0.71 and 1.44)
Detecting Warning Alarm Probability	95%	95%
Probability False Alarm	≤1%	≤1%
Warning Alarm	1 Failed Assessment	1 Failed Assessment
Failure Alarm	2 Failed Assessments	2 Failed Assessments

The analysis used the previous day ISD V/L daily average readings to determine whether the V/L malfunction criteria for gross failures and degradation [Section 9.2.1 (b) and (c) of CP-201] could be modified to be more stringent without compromising the reliability of the system.

A statistical analysis indicated 95 percent of the ISD V/L daily averages are within the certification range or marginal range limits, but not in the degradation warning or the gross failure limits as shown in Figure IV-1.

Figure IV-1
V/L Certification Range and ISD Warning and Failure Limits



Since 95 percent of the data is between 0.83 and 1.17 and is within the certified or marginal range, this would suggest the malfunction criteria could be tightened and would not compromise the reliability but may still meet ARB requirements. The thresholds used by Veeder-Root ISD are already more stringent to ensure the system meets the 95 percent probability of detecting failures (Degradation ≤0.81 or ≥1.32, Gross ≤0.33 or ≥1.90). Any changes to the limits would require additional testing and a determination of whether the system is still capable of detecting failure with a 95% probability with no more than a 1 percent probability of false alarms. In addition such change will require a new rulemaking. Details of the analysis are found in Appendix C.

C. Identification of ORVR and non-ORVR Vehicles

District staff collected data that identified vehicles as ORVR or non-ORVR at GDFs while the vehicles refueled. ORVR identification protocol and the Vehicle Determination Data Sheet are detailed in ISD In-Use Evaluation Protocol (Appendix A). The Healy Phase II EVR system identifies ORVR and non-ORVR vehicles by responding to pressure changes at the vehicle fillneck. The Healy system maintains the pressure in the nozzle bellows within specific limits by regulating the vapor flow through the nozzle. When an ORVR vehicle is fueled the vapor flow must be restricted to prevent a vacuum in the nozzle bellows that is outside the desired range.

The Veeder-Root ISD system identifies refueling events as either blocked or unblocked. The ISD system collects V/L data from all fueling events at a GDF including V/L values from ORVR vehicles. V/L values less than 0.51 are classified as blocked events. The ISD system applies statistical algorithms to determine if the blocked events are actually caused by equipment failures or can be attributed to ORVR vehicle refueling events. If the system is not compromised by equipment failures the typical V/L value for non-ORVR vehicles is greater than 0.51. If an equipment failure leads to an actual blockage and V/L values less than 0.51 then significant quantities of gasoline vapors from non-ORVR vehicles will not be

recovered at the nozzle. In this case the non-ORVR fueling events will be classified as blocked events by the Veeder-Root ISD system. If the percentage of blocked events exceeds the expected percentage of ORVR fueling events by a statistically determined level the ISD system will issue an alarm.

Each test site was evaluated at monthly intervals for 18 months to determine the ISD system responses to blockages, ORVR and non-ORVR vehicles. These responses were compared to the identification by district staff of a vehicle as ORVR or non-ORVR. During vehicle refueling, the opposite side of the dispenser was removed from service to prevent dispensing during the test. Vehicle refuelings that were three gallons or less were excluded. ARB staff matched the vehicle fueling time and the number of gallons dispensed to the corresponding V/L readings from the Veeder-Root TLS. The data was posted at http://www.arb.ca.gov/vapor.

Table IV-2 shows the transition years for installation of ORVR for each vehicle classification. Vehicles manufactured before transition years generally do not have ORVR. Vehicles manufactured after ORVR transition years must have ORVR. The evaporative code on the emissions label, located on the inside of the vehicle's hood or engine compartment specifies if a vehicle is required to have ORVR. However, some manufacturers voluntarily installed ORVR ahead of the federal and state mandated schedule. Thus, some vehicles with a non-ORVR emissions code may have been equipped with ORVR.

If a vehicle was manufactured during the ORVR transition years, the emission label must be checked to determine if ORVR is installed. In particular, the ORVR status of trucks should be verified from the emissions label, because the ORVR transition years vary by gross vehicle weight rating (GVWR).

Table IV-2
ORVR Transition Years

Light Duty Autos	Light Duty Trucks GVWR<5751 Lbs	Medium Duty & Light Heavy Duty GVWR 5751-10,000Lbs
1998, 1999	2001, 2002	2004, 2005

District staff collected data on 1490 vehicles through the ISD Field Study. The non-ORVR vehicles consistently showed V/L values greater than 0.51 and were classified by the Veeder-Root ISD system as non-blocked events. The ISD V/L (≤0.51) determinations were consistent with 78 percent of the vehicles the District identified as ORVR. The ISD V/L (>0.51) determinations were consistent with 96 percent of the vehicles the District staff identified as being non-ORVR. Of the 193 (22 percent) inconsistent ORVR vehicles, 84 were light duty, medium duty and light heavy duty trucks. Approximately 44 percent of those ORVR vehicles were trucks in the transition years.

Some of these trucks may have been incorrectly identified as being ORVR. These trucks had V/L values greater than 0.51 and their model year are part of the transition years. By omitting the questionable trucks from the study, the percentage of vehicles being consistent for ORVR increased from 78 percent to 86 percent.

Table IV-3
ORVR and Non-ORVR Determinations by District Staff

	ORVR	Non-ORVR
ISD V/L Consistent w/ District Staff ID	78%	96%
ISD V/L Inconsistent w/ District Staff ID	22% (V/L >0.51)	4% (V/L ≤0.51)

As part of a separate analysis of the ORVR and non-ORVR vehicles, the light duty vehicles were classified strictly by their model year, and trucks were classified by model year and GVWR, if known, with the transition years omitted for both autos and trucks. This separate analysis did not use the district staff determinations of ORVR and non-ORVR. This analysis resulted in a smaller subset of vehicles. The subset compared 1185 records of V/L values against the ORVR and non-ORVR status with similar results to the original analysis. Of the vehicles identified as ORVR, the ISD V/L confirmed 83 percent as blocked or low V/L values. Of the vehicles identified as non-ORVR, the ISD V/L confirmed 95% of the vehicles unblocked or high V/L values.

Table IV-4
ORVR and Non-ORVR Determinations by MY and GVWR

	ORVR	Non-ORVR
ISD V/L Consistent w/ MY & GVWR	83%	95%
ISD V/L Inconsistent w/ MY & GVWR	17% (V/L >0.51)	5% (V/L ≤0.51)

There are other possible explanations for inconsistencies in the V/L values and ORVR and non-ORVR vehicles. Cool fuel being dispensed into a hot vehicle tank can result in low V/L values on non-ORVR vehicles if there is a good vapor to liquid contact in the vehicle tank and fill neck. Another possible explanation is that mechanical seals were used for on the early ORVR European vehicles. With this design there is no restriction on the amount of air that could be pulled into the nozzle, so a vacuum never forms in the bellows and the vapor flow rate is not restricted. This could cause these ORVR vehicles to appear as non-ORVR with V/L values near 1.0. Other possible explanations for inconsistencies were the possibility of disconnected hoses, or damaged ORVR equipment that would result in V/L values (>0.51) since the nozzle bellows would not be able to be under vacuum as required to activate the restriction of the vapor flow rate, or that the Healy Phase II EVR system may not have responded correctly to pressure changes at the vehicle fillneck resulting in unexpected V/L values. Although the percentages of correctly identified vehicles is relatively high, staff suggests additional testing that correctly identifies vehicles as ORVR and non-ORVR.

D. Pressure Sensor Verification

The ISD Field Study compared pressure sensor values of underground storage tanks between the TLS reading of the Veeder-Root ISD system to actual manometer readings taken by District staff. TLS is limited to pressure readings of ±6.00 IWC. Data was recorded on the Pressure Sensor Verification Data Sheet and followed the test protocol (Appendix A).

The average difference of the ISD reading compared to the manometer reading was 0.12 IWC. A regression analysis identified the best fit line matches closely to the perfect agreement line (slope equal to one). The ISD Field Study data analysis concluded the Veeder-Root ISD system pressure sensor value closely compares to the monitored value (Appendix E).

E. Vapor Pressure Sensor Operability Test

The ISD Field Study also evaluated the vapor pressure sensor's ability to properly record data in accordance with the Veeder-Root ISD specifications. The pressure sensor criteria was ±0.2 IWC. Results were recorded on the Vapor Pressure Sensor Ambient Reference Test data form and followed test protocol detailed in Appendix A. All vapor pressure sensor tests passed (Appendix F).

F. Vapor Flow Meter Operability Test

The Vapor Flow Meter Operability Test, as defined in Exhibit 9 of Executive Order VR-202-A was performed once monthly for 18 consecutive months at each site as detailed in the ISD In-Use Evaluation Protocol (Appendix A). The analysis used the previous day's gross ISD V/L daily average and compared it to the calculated V/L values determined by VR-202-A Exhibit 5. The ISD vapor flow meter operating criteria is ±0.15 of the test value. If the ISD value was not within those limits, further V/L tests were performed.

The vapor flow meter operability test passing rate was 99.1 percent and the results concluded that the flow meters were operating in accordance with the manufacturer's operability test (Appendix G).

V. CONCLUSION

During the ISD Field Study, five different tests were conducted over an 18 month period at five test sites located throughout the state. The objective of the ISD Field Study was to determine whether performance of in-use ISD systems installed in California is similar to the performance of the ISD system tested during certification. The ISD Field Study data demonstrated that the in-use performance of the Veeder-Root ISD system (with Healy EVR system) is similar to the performance standards and specifications the system was certified to meet.

VI. APPENDICES

Appendix A. **ISD In-Use Evaluation Protocol**

Appendix B. **Analysis: V/L Ratio Testing – ISD vs. V/L Method**

Appendix C. **Analysis: V/L Ration Testing – Malfunction Criteria**

Appendix D. **Analysis: ORVR and Non-ORVR Vehicles**

Appendix E. **Analysis: Pressure Sensor Verification**

Appendix F. **Analysis: Vapor Pressure Sensor Operability Test**

Appendix G. **Analysis: Vapor flow Meter Operability Test**

Appendix H. **ISD In-Use Evaluation Test Data: July – September 2006**

Appendix I. **ISD In-Use Evaluation Test Data: October – December 2006**

Appendix J. **ISD In-Use Evaluation Test Data: January – March 2007**

Appendix K. **ISD In-Use Evaluation Test Data: April – June 2007**

Appendix L. **ISD In-Use Evaluation Test Data: July – September 2007**

Appendix M. **ISD In-Use Evaluation Test Data: October – December 2007**

Appendix A
ISD IN-USE EVALUATION PROTOCOL
September 28, 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 Modified 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)

Appendix A

3. ISD Evaluation

CAPCO 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

Although CAPCOA and ARB have no authority to bind individual air districts to specific enforcement actions or enforcement discretion, CAPCOA and ARB have provided recommendations specific to construction and operating permit conditions and the scope of appropriate enforcement actions at evaluation test sites during the 18-month evaluation. These recommendations are contained in the Recommended ISD Enforcement Policy During 18 month Evaluation, June 27, 2006, (See Attachment 3).

5. Vapor Flow Meter Operability Test and Additional V/L (Vapor/Liquid) Testing

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.

In order to insure consistency amongst the data collected by each District, at a given dispenser, the Vapor Flow Meter Operability Test should be performed first, followed by any additional V/L testing as required by the Protocol. The Vapor Flow Meter Operability Test and the V/L test requirements are discussed below.

Appendix A

Vapor Flow Meter Operability Test

The Vapor Flow Meter Operability Test, as defined in Exhibit 9 of Executive Order VR-202-A and described in the steps below, shall be performed once monthly, for 18 consecutive months, minimum. The forms to check-off and record results from these procedures are enclosed.

1. Obtain an ISD Daily Report printout with previous day's gross ISD V/L daily averages from the TLS. See Table 1 for steps to access ISD Daily report from TLS console.

2. Select a dispenser and note the fueling point numbers on the data form (Form 4). Obtain the vapor flow meter serial number from the TLS. See Table 2 for steps to access the vapor flow meter serial numbers from the TLS. Conduct a Healy EVR Phase II system V/L test per Modified 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 Form 4).

   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. Reseat V/L adaptor to nozzle and run two more V/L tests per Modified 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.

Table 1: Accessing ISD Daily Report

Step	Button Pushed	Number of Times Pushed	Readout
1	Mode (M)	Multiple. Push until readout on right is shown.	"MM.DD.YYYY HH:MM:SS XM All Functions Normal"
2	Function (F)	Multiple. Push until readout on right is shown.	"ISD Daily Report Press <step> to cont."
3	Print (P)	Once. Copy of ISD Daily Report will print	"ISD Daily Report Press <step> to cont."
4	Mode (M)	Once. Exit to opening menu.	"MM.DD.YYYY HH:MM:SS XM All Functions Normal"

Appendix A

Table 2: Accessing Vapor Flow Meter Serial Numbers

Step	Button Pushed	Number of Times Pushed	Readout
1	Mode (M)	Multiple. Push until readout on right is shown.	"Diag Mode Press Function to Continue"
2	Function (F). (If system has password, readout on right will show. If not, go to Step 5.)	Once	"Password:******"
3	Type in Password	Once	Example: "Password:003406"
4	Enter (E)	Once	"System Diagnostic Press <Step> to Continue"
5	Function (F)	Multiple. Push until readout on right is shown.	"Smart Sensor Diagnostic" Press <Step> to cont."
6	Step (S)	Once. Information displayed for first flowmeter. " * " represents identification numbers for sensors, dispensers…	"S*: A* Disp. *-* Type: Air Flow Meter
7	Step (S)	Once. Serial Number is displayed.	S*: AX Disp. *-* Serial Number: XXXX
8	Backup (B)	Once.	"S*: AX Disp. *-* Type: Air Flow Meter
9	Tank/Sensor (T)	Once. Information displayed for second flowmeter	S**: A** Disp. **-** Type: Vapor Pressure
10	Repeat Steps 8-9 for each flowmeter.		
11	Mode (M)	Once. Exit to opening menu.	"MM.DD.YYYY HH:MM:SS XM All Functions Normal"

Additional V/L Testing

Throughout the evaluation period, additional V/L testing will be performed monthly for 18 months in accordance with Attachment 1, Modified Exhibit 5 of Executive Order VR-202. For each additional test, testing staff will randomly select the gasoline grade. Staff will perform at least 10 V/L test runs during each site visit. The V/L tests run in accordance with the Vapor Flow Meter Operability Test, described above, can count toward the total of 10. 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.

Return nozzle to dispenser and 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 purposes of recording fuel events, ARB staff recommends District staff use the time of dispenser authorization (when the totalizer zeroes out) as the start time. For each run, record required information on 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.

For vehicles manufactured during the ORVR phase–in periods (identified in the “Evap Family Code” column of Table 3), 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.

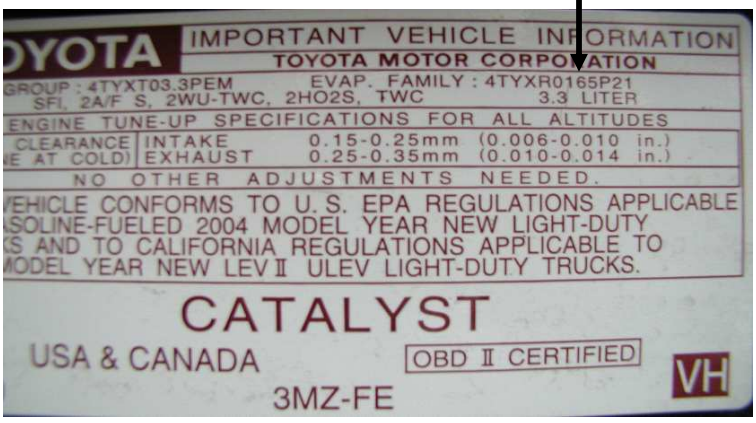
Appendix A

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 and record the fifth digit on Form 1. If the emissions label is missing or unreadable, enter “NV” (Not Verified) in the appropriate column of Form 1 and do not count that vehicle as a recorded vehicle fueling.

Appendix A

Table 3: 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 Car	< 1996	1997, 1998, 1999	> 2000
Light Duty Trucks (0 - 6000 GVWR*)	< 2000	2001, 2002	> 2003
Light Duty Trucks/ Medium duty Vehicles (6001 – 8500 GVWR)	< 2003	2004, 2005	>2006

* "GVWR" stands for Gross Vehicle Weight Rating and can be found printed on label affixed to driver's side door jamb.

After recording 20 vehicle fuelings, 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 pressure sensor verification testing once monthly, for 18 consecutive months, minimum. This test should be conducted prior to performing any V/L testing. The Pressure Sensor Verification test should only be done after the completion of the Vapor Pressure Sensor Ambient Reference Test and only if the Vapor Pressure Sensor is reading properly (See Section 8.) 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. Two test personnel are required, minimum, one to monitor and record ambient temperature and UST pressure at manometer, and one to monitor corresponding pressure reading from the pressure sensor via the TLS console readout. For a more detailed description, which includes recommended pre-test procedures, equipment descriptions, and calibration procedures; see Attachment 2, Pressure Sensor Verification.

A. Access pressure sensor readout via TLS console in accordance with Table 3.

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

Appendix A

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

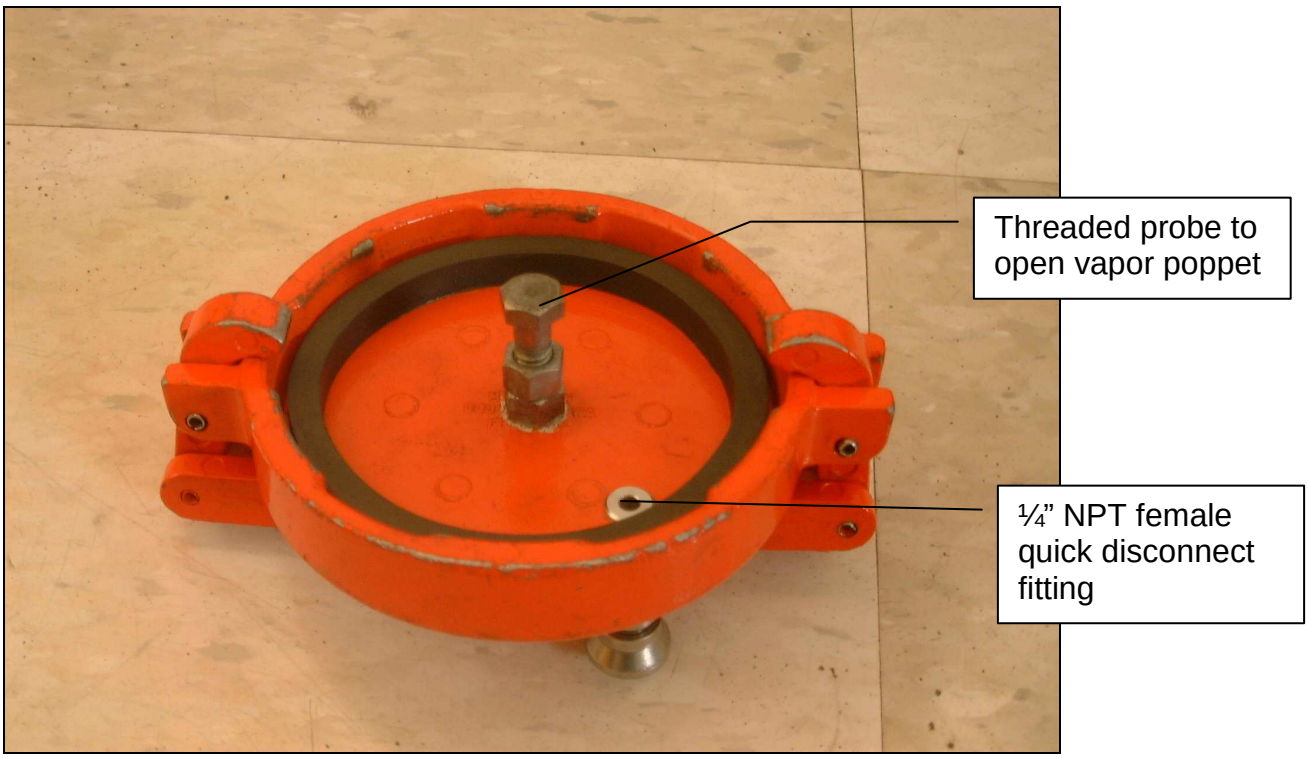
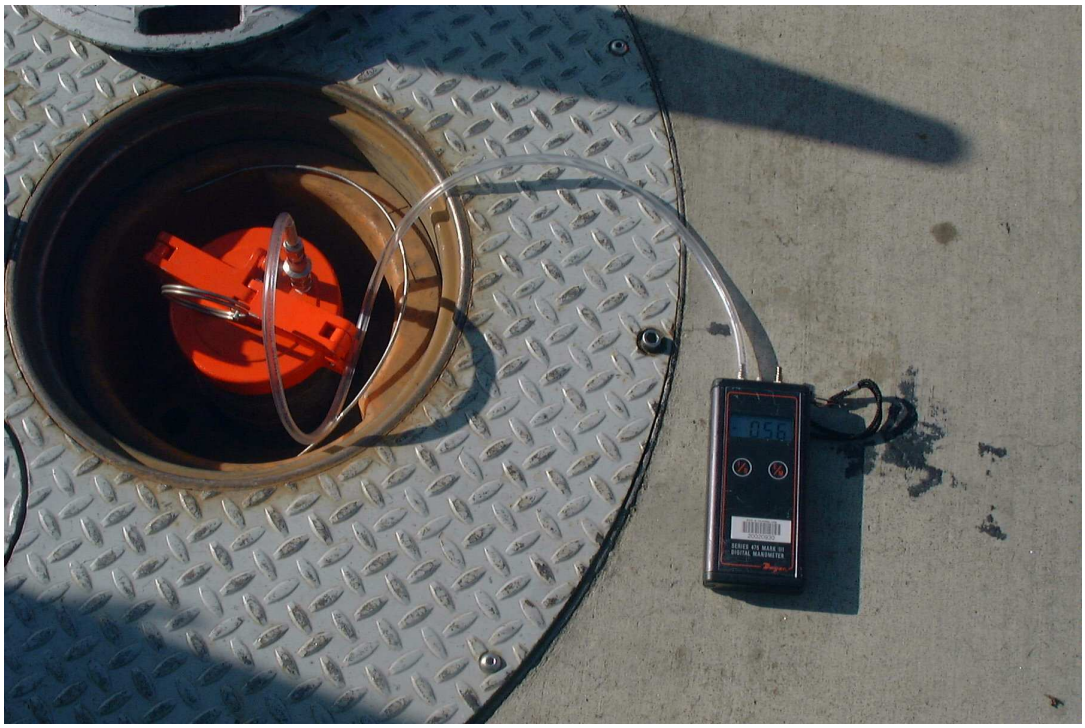


Figure 2: Typical Field Installation of UST Pressure Measurement Assembly



C. Proceed with monitoring pressure for ten minutes and record the simultaneous readings from the manometer and the TLS on Form 2. Record pressure at beginning and end of test period. Note: The negative pressure reading limit of the TLS is -6.00 inches of water column (WC). The positive pressure reading limit of the TLS is +6.00 inches of WC.

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

E. If manometer pressure reading at the end of the test period differs by 1.5" from the manometer pressure reading measured at the beginning of the test period, a UST Pressure Measurement Assembly pressure leak may exist. This test will be invalid. The UST Pressure Measurement Assembly should be leak tested as follows.

F. If the manometer pressure reading is positive, apply soap solution to the dust cap and vapor adaptor and visually check for leaks (formation of bubbles). If the manometer pressure reading is negative, seal the UST Pressure Measurement Assembly in a bag with rubber band or tape secured around vapor adaptor below dust cap/vapor adaptor interface and visually check for leaks (bag deflation). See Figure 3. Correct leak and repeat Steps A through E.

Figure 3: Leaking UST Pressure Measurement Assembly in Secured Bag

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. Vapor Pressure Sensor Ambient Reference Test

The Vapor Sensor Ambient Reference Test, as defined in Exhibit 9 of Executive Order VR-202-A and described below, shall be performed once monthly, for 18 consecutive months, minimum. The forms to check-off and record results from these procedures are enclosed.

Appendix A

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. As procedure is being executed, check boxes/record data as specified on Form 3.

1. Access the Vapor Pressure Sensor in the dispenser. Record which dispenser contains the pressure sensor on the 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 4).

3. Start at the “DIAG MODE” menu at the TLS Console front panel to enter the ‘Smartsensor Diagnostic” as shown in Table 4 to view pressure sensor serial number. Record on Form 3.

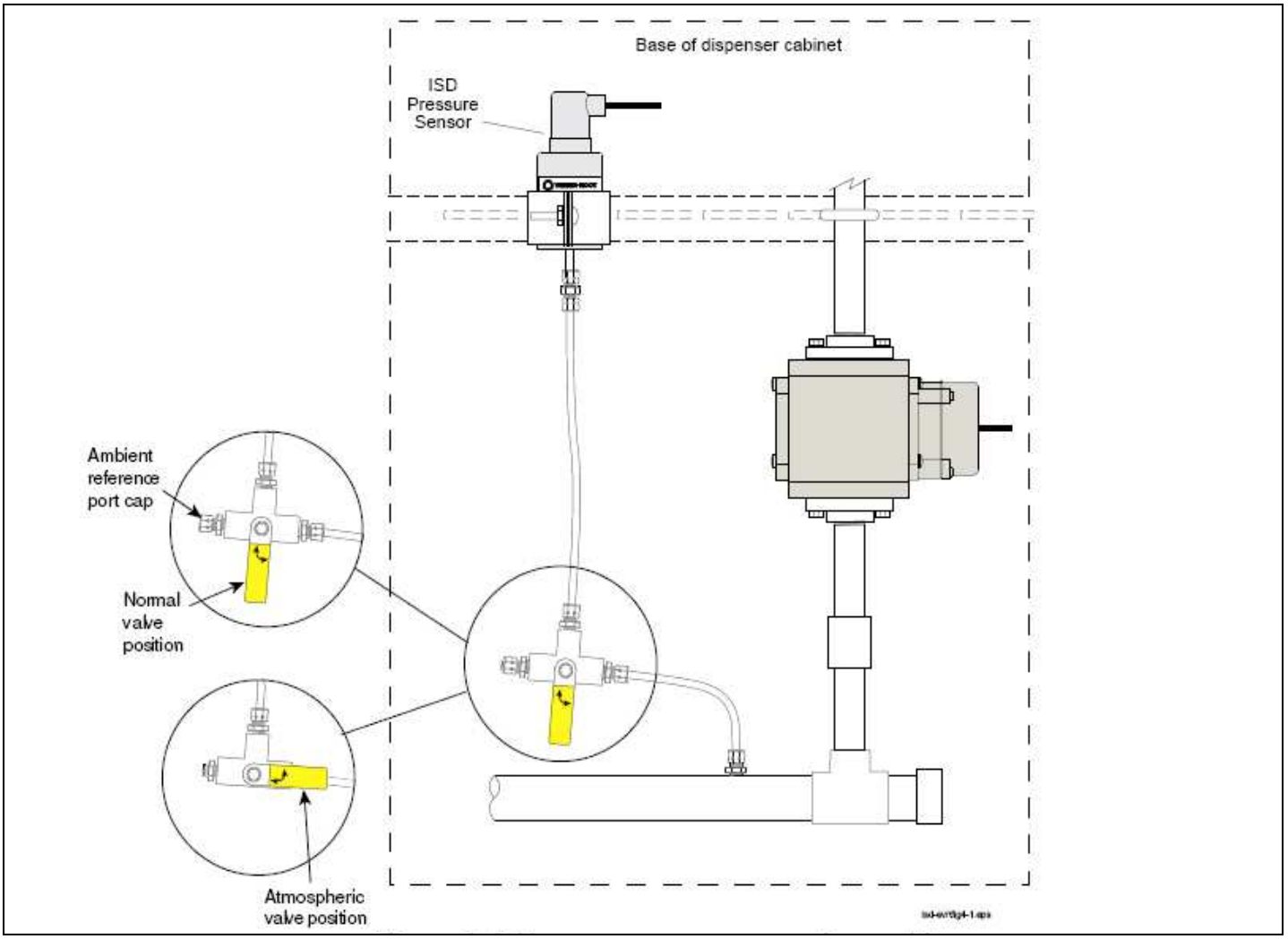
4. Start at the “DIAG MODE” menu at the TLS Console front panel to enter the ‘Calibrate SmartSensor’ menu as shown in Table 5 to view the non-calibrated pressure value.

5. Verify that the pressure value is between +0.2 and -0.2 inches water column (IWC). Record on Form 3. 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 4). Notify Station Owner that testing indicates Vapor Pressure Sensor should be replaced.

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

Appendix A

Figure 4: Vapor Pressure Sensor Valve position



Appendix A

Table 4: Accessing Pressure Sensor Serial Number

Step	Button Pushed	Number of Times Pushed	Readout
1	Mode (M)	Multiple. Push until readout on right is shown.	"Diag Mode Press Function to Continue"
2	Function (F). (If system has password, readout on right will show. If not, go to Step 5.)	Once	"Password:******"
3	Type in Password	Once	Example: "Password:003406"
4	Enter (E)	Once	"System Diagnostic Press <Step> to Continue"
5	Function (F)	Multiple. Push until readout on right is shown.	"Smart Sensor Diagnostic" Press <Step> to cont."
6	Step (S)	Once.	
7	Tank/Sensor (T)	Multiple. Push until "Type" indicates vapor pressure sensor. " * " represent identification numbers for sensors, dispensers…	S*: P* Disp. *-* Type: Vapor Pressure
8	Step (S)	Once. Serial Number is displayed.	S*: P* Disp. *-* Serial Number: XXXX
9	Mode (M)	Once. Exit to opening menu.	"MM.DD.YYYY HH:MM:SS XM All Functions Normal"

Appendix A

Table 5: Accessing Non-calibrated Pressure Reading

Step	Button Pushed	Number of Times Pushed	Readout
1	Mode (M)	Multiple. Push until readout on right is shown.	"Diag Mode Press Function to Continue"
2	Function (F). (If system has password, readout on right will show. If not, go to Step 5.)	Once	"Password:******" .
3	Type in Password	Once	Example: "Password:003406"
4	Enter (E)	Once	"Diag Mode Press Function to Continue"
5	Function (F)	Multiple. Push until readout on right is shown.	"Smart Sensor Diagnostic" Press <step> to cont."
6	Step (S)	Once. "*" represents identification numbers for sensors, dispensers…	"S*: A* Disp. *-* Type: Air Flow Meter
7	Tank Sensor (T)	Multiple. Push until readout on right is shown.	"S*: P* Disp *-* Type: Vapor Pressure"
8	Step (S)	Multiple. Push until readout on right is shown.	"Calibrate Smartsensor Press Enter"
9	Enter (E)	Once. Real time pressure sensor measurement is shown in inches of W.C. Updates automatically.	"S*:VRPS No. 1 Pressure: X.XXXX"
10	Mode (M)	Once. Exit to opening menu.	"MM.DD.YYYY HH:MM:SS XM All Functions Normal"

Appendix A

9. Summary of Testing Requirements

The testing requirements and recommended frequency of each test are summarized in Table 6.

Table 6: Summary of Required Tests

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

* V/L Tests run in accordance with the Vapor Flow Meter Operability Test can count towards the total of 10.

** Minimum 100 ORVR and 100 non-ORVR

Required Testing Sequence:

1) Vapor pressure sensor ambient reference test
2) Pressure sensor verification per attachment 2
3) Vapor flow meter operational test
4) Additional V/L testing per modified exhibit 5
5) ORVR and Non-ORVR identification can be conducted throughout the testing period

Appendix A

Attachment 1

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

Modified Exhibit 5 of Executive Order VR-202-A

Appendix A

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 For purposes of evaluating In-Station Diagnostic Systems (ISDs) in accordance with the requirements of the ISD In-Use Evaluation Protocol, 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 In-Station Diagnostics (ISD) installed at gasoline dispensing facilities (GDF).

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.

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

2.4 The test procedure will be conducted on a fueling point on one side of the dispenser with the other side of the dispenser not dispensing fuel. 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 (see Equation 9-2) 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 V/L adaptor, gas vapor meter or the adaptor supply hose, 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. See Section 5.7 for lubrication requirements. Motor oil (any weight) is acceptable for lubricating the O-ring. Contact Healy Technical Services with any questions about other lubricants that may be used in conducting this test.

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 ACCURACY

4.1 The maximum rated capacity of the gas volume meter shall be at least 800 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 Accuracy, determined during calibration, must be $\pm$ 5 percent of the gas volume meter reading.

Appendix A

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 length of the tubing shall be between 3.0 and 6.0 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, 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) (determined by the manufacturer) 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

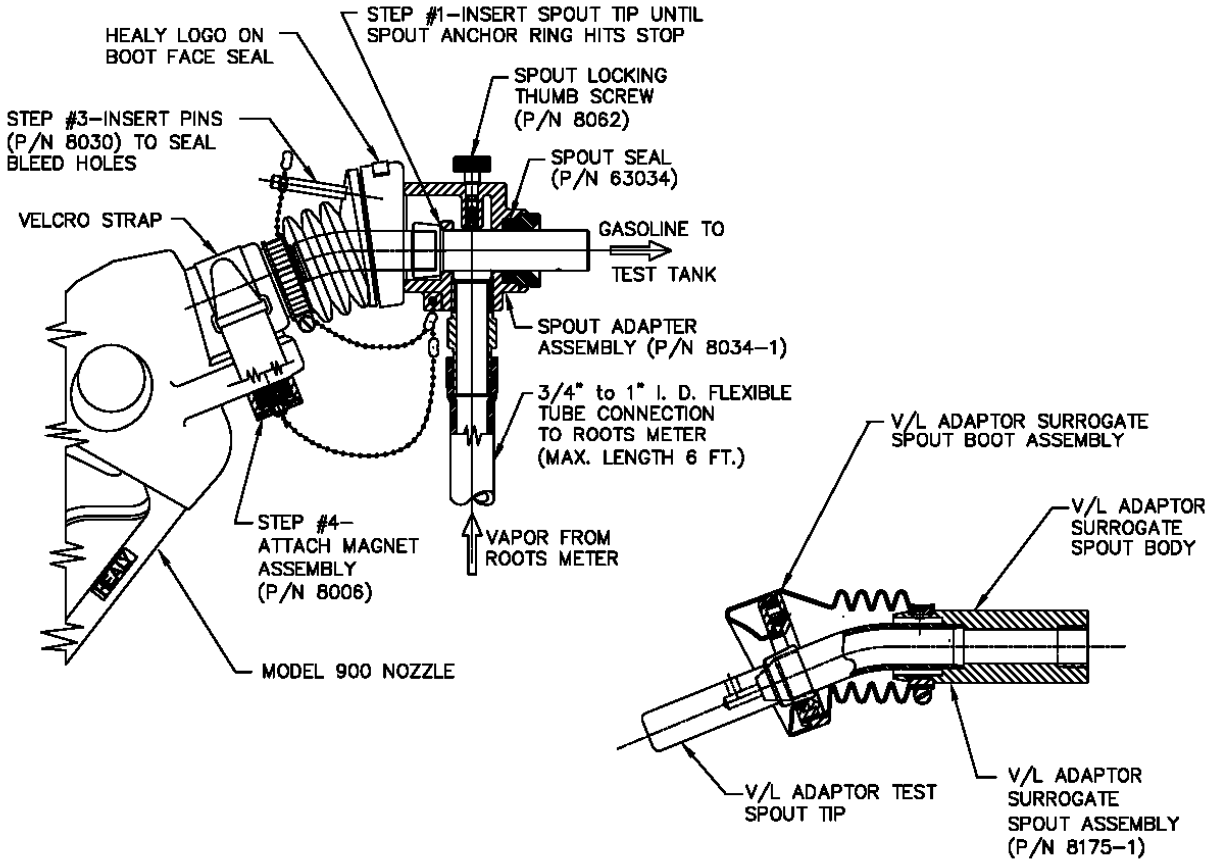
For a meter with a maximum rated capacity of 800 to 1,000 CFH:
0.70 inches H_2O at a flowrate of 800 CFH
0.04 inches H_2O at a flowrate of 16 CFH

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.

Appendix A

Figure 1

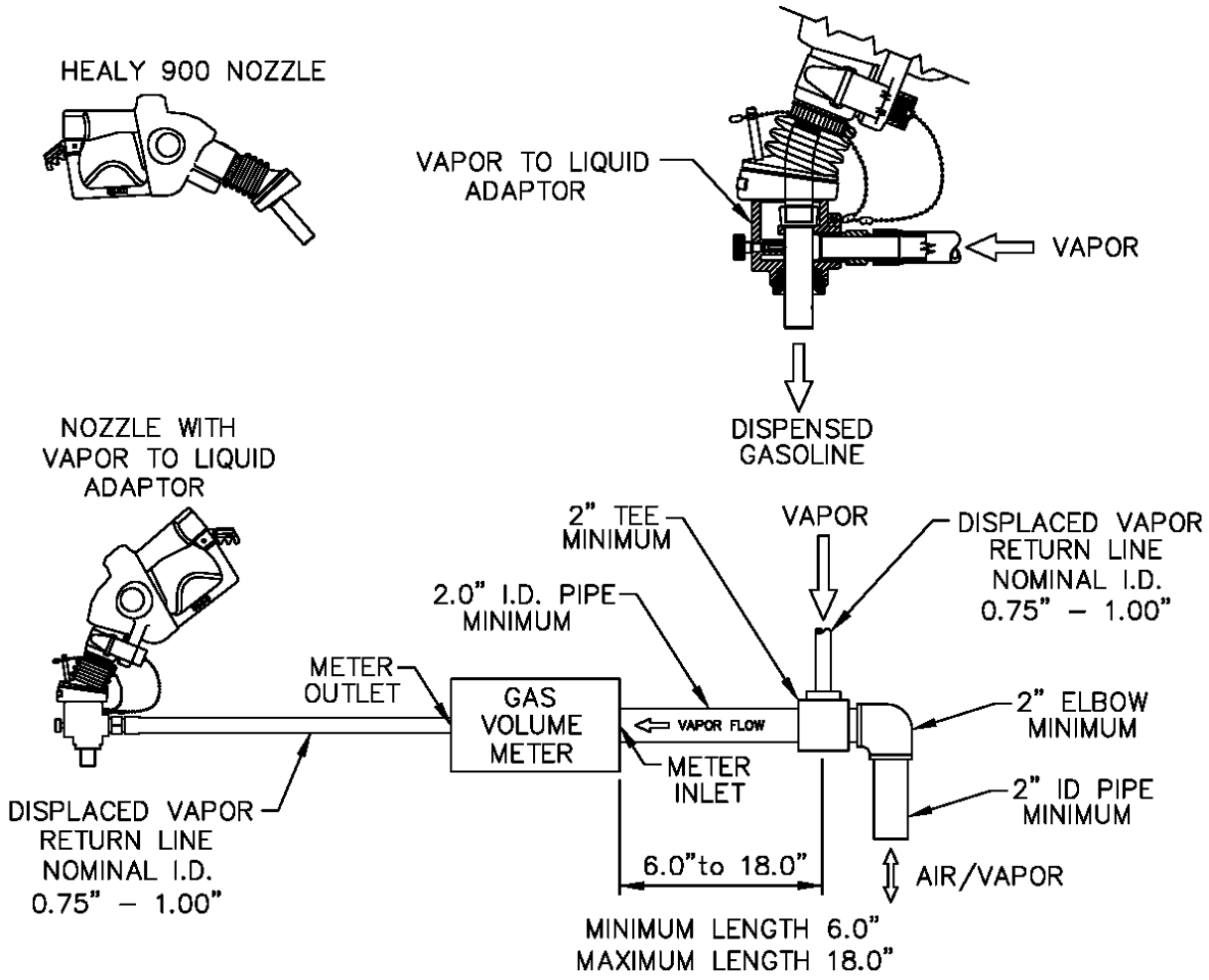
Healy Vapor To Liquid (V/L) Adaptor and Surrogate Spout Assembly



Appendix A

Figure 2

Gas Volume Meter and Vapor To Liquid Adaptor



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. Portable tanks shall have a permanent label or mark indicating the total fuel capacity in gallons. 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. Motor oil (any weight) is acceptable for lubricating the O-ring. Contact Healy Technical Services with any questions about other lubricants that may be used in conducting this test.

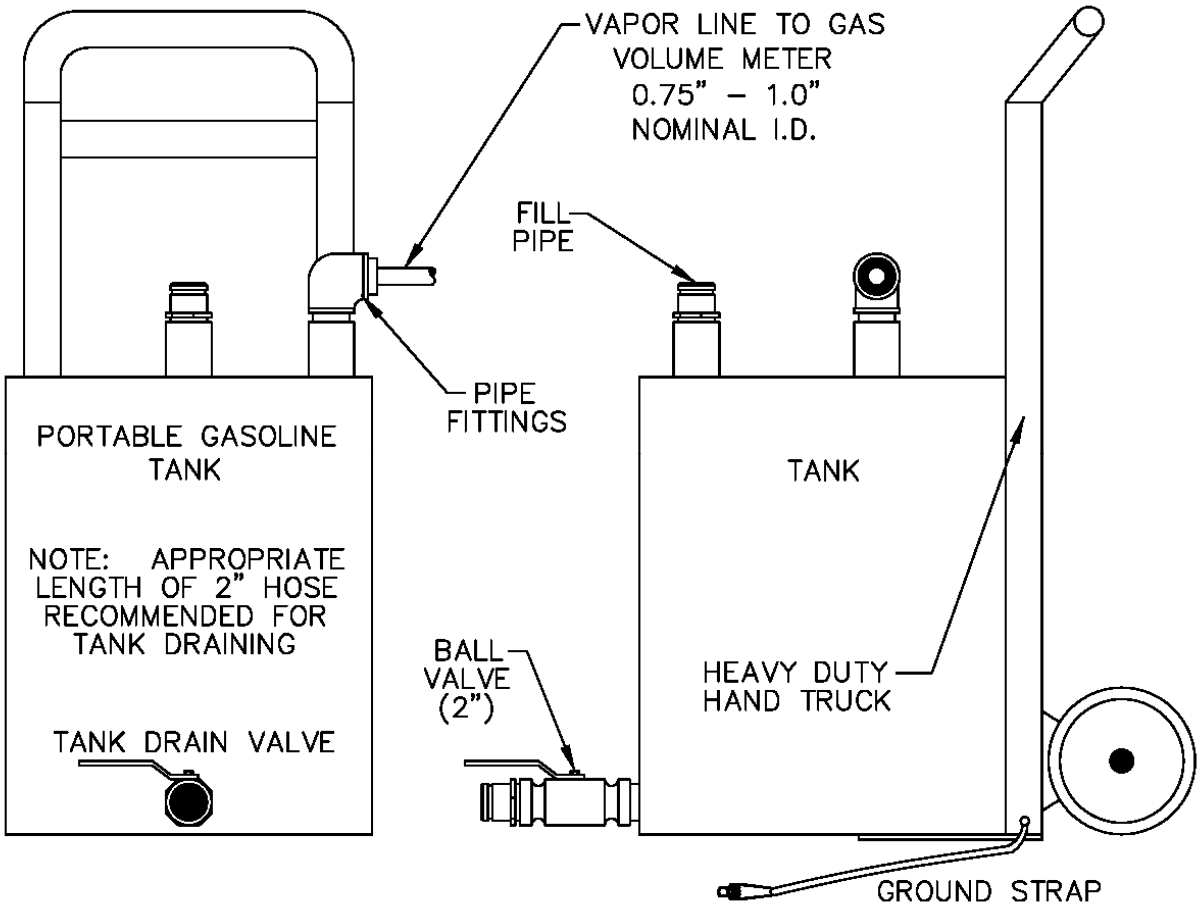
5.8 Leak Detection Solution. Any liquid solution designed to detect gaseous leaks may be used to verify the pressure integrity of test equipment during this test.

5.9 Pressure Measuring Device. An electronic pressure measuring device with a full scale range that shall not exceed 0-10 inches WC with a minimum accuracy of $\pm$0.5 percent of full scale. A 0-20 inch WC device may be used provided the minimum accuracy is $\pm$0.25 percent of full scale.

Appendix A

Figure 3

Portable Tank Assembly



Appendix A

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. If the tee connection is altered or changed, the above test must be repeated to ensure proper design.

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 (changes to the operation or configuration of the meter) 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

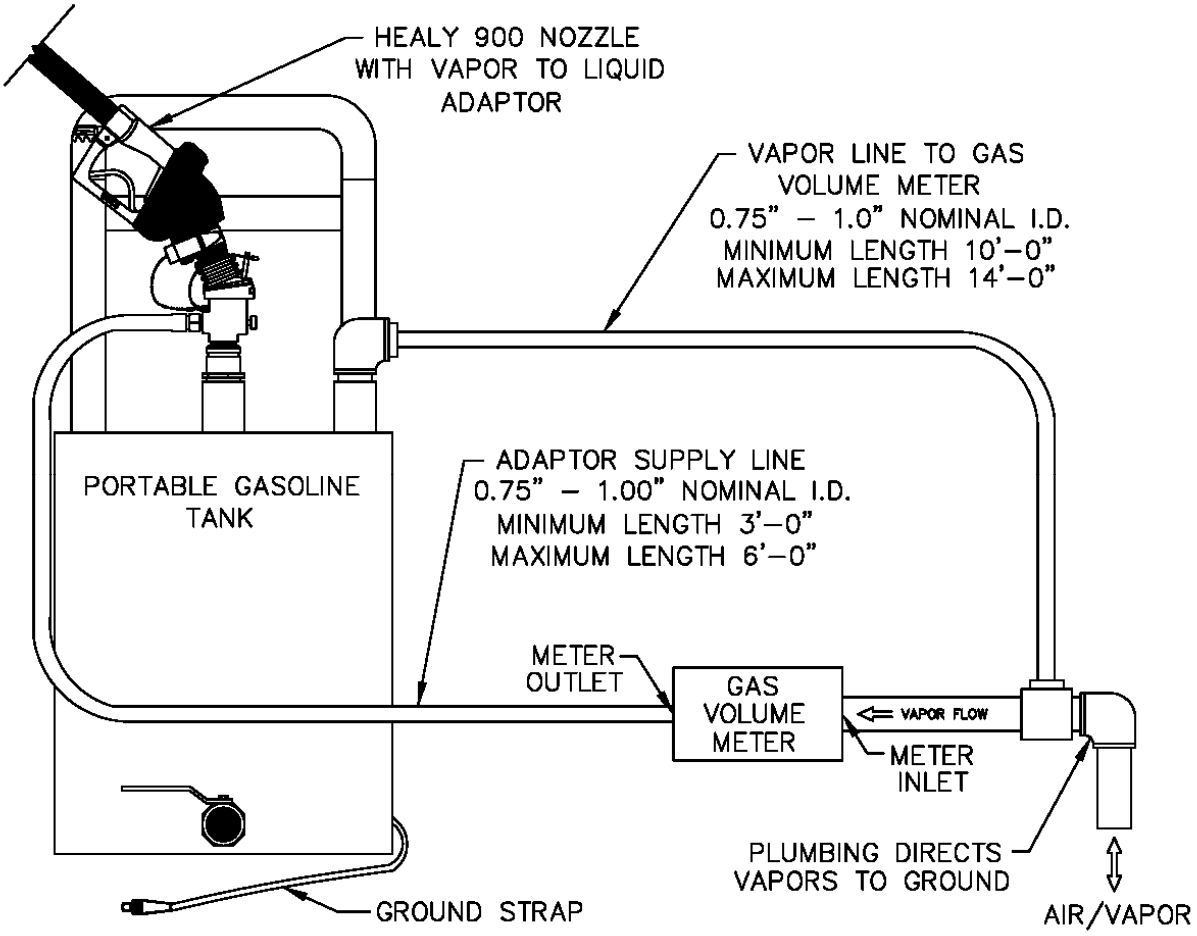
(d) Appropriate calibration procedures in accordance with California Department of Food and Agriculture, Division of Measurement Standards and County Department of Weights and Measures (title 4, CCR, section 3.33).

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

Appendix A

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 (see Section 5.7) to ensure a vapor tight connection.

6.4 Conduct a pre-test leak check of the V/L adaptor, the gas volume meter and adaptor supply hose by connecting the V/L adaptor to a surrogate spout as shown in Figure 5. and described in Section 5.1B. Raise the test pressure to 5.00" ±0.50 WC. There shall not be a pressure drop of more than 1.00" WC from the above starting pressure for 30 seconds from the start of the test. If the leak test passes, proceed with the V/L testing. If the leak test fails, proceed to isolate the source of the leak by pressurizing the test equipment again. Squirt liquid leak detector solution on interfaces and other potential leak sources and watch for the formation of bubbles. Once leak(s) are repaired, repeat the test procedure.

Note: Leak checks shall be conducted in a shaded area away from direct sunlight. 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 with the adaptor dust cap(s) installed.

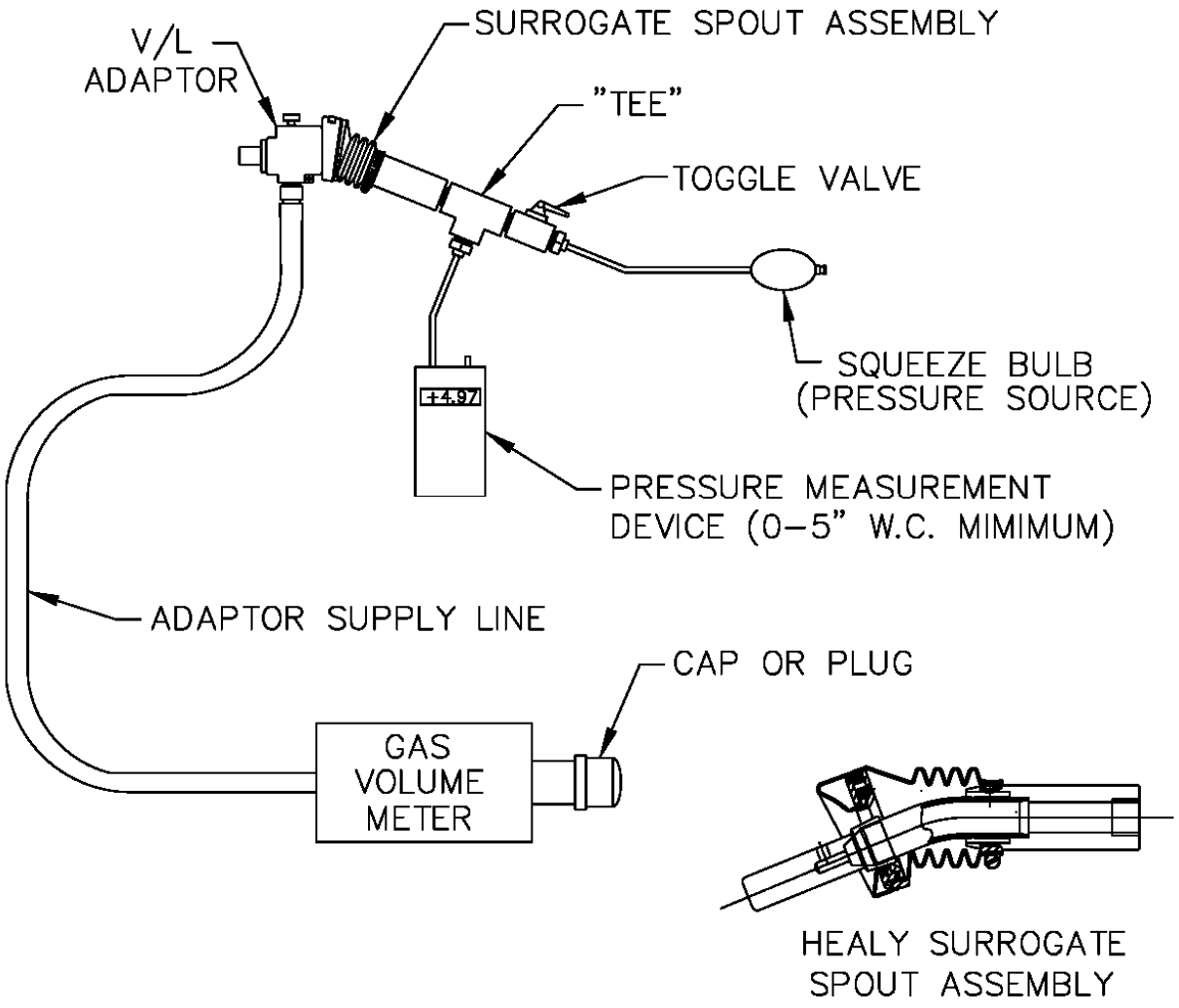
6.6 With the portable tank and V/L test equipment assembled, dispense gasoline into the portable test tank until at least 10% of the tanks total capacity has been reached. This will condition the portable tank with gasoline vapors. This conditioning shall be conducted each time the test tank is emptied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

6.7 All pressure measuring device(s) shall be bench calibrated using a reference gauge, inclined manometer or NIST traceable standard at least once every six (6) months in accordance with manufacturer's recommended calibration procedures. Calibration must be performed at minimum of three calibration points (e.g. 25, 50, and 75% of full scale). Accuracy shall be within ± 0.05 inches WC.

Appendix A

Figure 5

Vapor To Liquid Adaptor and Gas Volume Meter Leak Test Assembly



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 Holding the nozzle lever in the maximum hand-held position in order to dispense at the highest possible flow rate 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 V/L adaptor, the gas volume meter or the adaptor supply hose, 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.

Appendix A

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 gas volume meter and adaptor supply hose by connecting the V/L adaptor to a surrogate spout as shown in Figure 5. and described in Section 5.1B. Raise the test pressure to 5.00" ±0.50 WC. There shall not be a pressure drop of more than 1.00" WC from the above starting pressure for 30 seconds 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.

Note: Leak checks shall be conducted in a shaded area away from direct sunlight.

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 (determined during gas volume meter calibration) 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

Appendix A

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-202-A Allowable V/L Range 0.95 – 1.15

Pump #	Fuel Grade	Nozzle Serial #	For ISD Evaluation: Starting Time of Run	Initial Dispenser Totalizer, Gallons	Final Dispenser Totalizer, Gallons	Total Gas Pumped, Gallons	Time, Seconds	Dispensing Rate, gpm	Initial Meter Reading, ft3	Final Meter Reading, ft3	V/L

Appendix A

Attachment 2

Pressure Sensor Verification

1. Range and Accuracy

1.1 The minimum full scale range for digital manometer shall be 0.00 to 10.00 inches WC. The minimum accuracy shall be ±0.05 inches of WC.

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 0.2 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 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 A dust cap or vapor coupler test assembly can be used provided a tight seal is achieved.

3.2 The dust cap shall be modified in the following manner:

3.2.1 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.

3.2.2 Tap, thread and install an ¼ inch NPT female quick connect fitting on the top of the dust cap, offset from the center probe.

3.2.3 Use approximately 24 inches of clear “Tygon tubing” or equivalent, sized to fit digital manometer pressure connection, to connect the manometer to the dust cap. Connect one end of the “Tygon tubing” to a ¼ inch NPT male quick connect fitting and connect the other end to the digital manometer.

3.3 Digital Manometer (Electronic Pressure Measuring Device)

An electronic pressure measuring device with a full scale range that shall not exceed 0-10 inches WC with a minimum accuracy of ± 0.5 percent of full scale. A 0-20 inch WC device may be used provided the minimum accuracy is ± 0.25 percent of full scale.

3.4 Vacuum Grease or Petroleum Jelly

Use commercially available vacuum grease or petroleum jelly to apply to the dust cap 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.

3.8 Portable pressure test assembly (as depicted in figure 1, 2 of page 9).

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 All pressure measuring device(s) shall be bench calibrated using a reference gauge, inclined manometer or NIST traceable standard at least once every six (6) months in accordance with manufacturer’s recommended calibration procedures. Calibration must be performed at minimum of three calibration points (e.g. 25, 50, and 75% of full scale). Accuracy shall be within ± 0.05 inches of WC.

4.2 The temperature measurement device shall be checked against an NIST traceable temperature measuring device at an interval not to exceed 12 months.

5. Pre Test Procedures

5.1 During the duration of the test, the digital manometer and temperature measurement device shall remain in a shaded area away from direct sunlight.

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

5.3 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.

5.4 Apply thin layer of vacuum grease or petroleum jelly to gasket located under the dust cap.

5.5 Attach male quick connect fitting attached to Tygon tubing to female quick connect fitting of dust cap.

5.6 Attach digital manometer to open end of Tygon tubing.

6. Test Procedure

6.1 Attach the dust cap to the vapor adaptor.

6.2 Record simultaneous pressure readings from the manometer and the TLS on Form 2. At a minimum, record pressure at beginning and end of test period.

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

6.4 If the manometer pressure reading at the end of the test period differs by 1.5” from the manometer pressure reading from the beginning of the test period, a pressure leak may exist. This test will be invalid. Proceed with trouble shooting of leak of UST Pressure Measurement Assembly.

6.5 Troubleshoot UST Pressure Measurement Assembly as follows:

6.5.1 If the manometer pressure reading is positive, apply soap solution to the dust cap and vapor adaptor and check for visual leaks. Correct all detected leaks and repeat steps 6.1 through 6.4.

6.5.2 If the manometer pressure reading is negative, bag UST Pressure Measurement Assembly and check for visual leaks. Correct all detected leaks and repeat steps 6.1 through 6.4.

Appendix A

Attachment 3

ISD Enforcement Policy

Appendix A

California Air Resources Board
PO Box 2815
Sacramento, CA 95812
www.arb.ca.gov

CAPCOA
980 9th Street, 16th Floor
Sacramento, CA 95814
916-449-9603

June 27, 2006

Mr. Jay McKeeman
Executive Vice President/Government Relations Director
California Independent Oil Marketers Association
3831 North Freeway Boulevard, Suite 130
Sacramento, California 95834-1933

Dear Mr. McKeeman:

RECOMMENDED ISD ENFORCEMENT POLICY DURING 18-MONTH EVALUATION

The California Air Resources Board (ARB) will implement an 18-month program to evaluate the in-use performance of In-Station Diagnostics (ISD) systems at selected gasoline dispensing facilities (GDF) equipped with vapor recovery. This evaluation is being supported by the California Air Pollution Control Officers Association (CAPCOA) and its air district membership. This evaluation period will commence on July 1, 2006, and may be extended by written agreement between ARB and CAPCOA. Although CAPCOA and ARB have no authority to bind individual air districts to specific enforcement action or enforcement discretion, CAPCOA and ARB are providing recommendations specific to construction and operating permit (permit) conditions and scope of appropriate enforcement actions. Nothing herein shall be deemed or construed as a recommendation that any air district refrain from enforcing against any violations. During this evaluation period, CAPCOA and ARB recommend that local air districts not take enforcement action based solely on data recorded by and retrieved from the ISD system except as specified below.

Background:

ISD systems are designed to provide continuous real time monitoring of critical gasoline vapor recovery system parameters and components and to alert the owner/operator when a failure mode as defined in ARB regulations (title 17, California Code of Regulations, section 94011) is detected so that corrective action can be taken. ISD systems record two types of gasoline vapor recovery system failure alarms. The first failure alarm will notify the GDF owner/operator of a potential vapor recovery system problem that requires maintenance. If the required corrective action is not taken within the specified time, the ISD system will trigger a second failure alarm and will terminate all fuel dispensing. If an owner/operator ignores the alarm and resets the system to resume fuel dispensing without the required repairs, the ISD system will record and store these events for a 12-month period.

During this ISD evaluation period, ARB and CAPCOA will gather in-use data from the ISD systems, including accuracy, precision and data reliability. The information collected will be used to develop long-term recommendations concerning the use of data recorded and retrieved from ISD systems. It may also be used to develop a recommendation to revise the applicable certification procedure to change the levels at which the ISD system alarms activate. ARB and CAPCOA will meet periodically with representatives of the gasoline dispensing industry and interested stakeholders to share data and discuss ISD system performance.

Construction and Operating Permit Conditions

When air districts issue permits for gasoline vapor recovery systems equipped with ISD they will specify conditions under which the GDF owner/operator can reset the system to allow for fuel dispensing.

If the GDF is equipped with ISD and is located in a county having a projected population for 2005 of less than 132,000 people (see attached Table 1), it is recommended that such permits incorporate the following requirements:

(1) Within two (2) hours of detecting that the first ISD failure alarm has activated, the facility attendant shall notify (e.g., direct contact, voice mail, e-mail, fax) the responsible company official or their designee and request service as soon as is reasonably possible to correct the problem. All information relating to the alarm event and reporting shall be promptly recorded on an air district-approved form, maintained at the GDF, and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request. Only persons authorized by the applicable ARB Certification Executive Orders shall be allowed to make vapor recovery or ISD system repairs.

(2) If a second ISD failure alarm sounds indicating that the same problem still exists and gasoline dispensing is terminated, the ISD system may be reset to allow vehicle fueling to resume only if:

(a) All required repairs are made as soon as is reasonably possible but not later than seven (7) calendar days of the first ISD system alarm notification and all information associated with the repairs is recorded on an air district-approved form that shall be maintained at the GDF and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request. The Executive Officer/Air Pollution Control Officer or their designee may also for good cause (e.g., the unavailability of a certified repair technician or required parts) on a case-by-case basis and at their sole discretion, allow the ISD system to be reset to allow gasoline dispensing to continue for a specified time beyond this seven (7)

day period if the required notification (see 1 above) was made within two (2) hours of detection of the first ISD failure alarm. In such case, the granting of the additional extension of time shall be in writing and shall include the reason the additional time was granted and the maximum time period gasoline dispensing may continue while necessary repairs are made. This written extension shall be kept with the ISD system records at the GDF and shall be made available to the Executive Officer/Air Pollution Control Officer or their designee upon request, or

(b) The dispenser(s) associated with the problem that triggered the failure alarm is isolated, removed from service and not operated until the required repairs are completed and, when completed, all information associated with the repairs is recorded on an air district-approved form that shall be maintained at the GDF and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request.

Notwithstanding the above, the Executive Officer/Air Pollution Control Officer of an air district in which a county having a projected population for 2005 of less than 132,000 people (see attached Table 1) is located may elect at their sole discretion, to condition permits for GDFs in such county as if the county had a projected population for 2005 of greater than 132,000 people (i.e., subject to II. below).

II. If the GDF is equipped with ISD and is located in a county having a projected population for 2005 of greater than 132,000 people (see Table 1), it is recommended that such permits incorporate the following requirements:

(1) Within two (2) hours of detecting that the first ISD failure alarm has activated, the facility attendant shall notify (e.g., direct contact, voice mail, e-mail, fax) the responsible company official or their designee and request service as soon as is reasonably possible to correct the problem. All information relating to the alarm event and reporting shall be promptly recorded on an air district-approved form, maintained at the GDF, and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request. Only persons authorized by the applicable ARB Certification Executive Orders shall be allowed to make vapor recovery or ISD system repairs.

(2) If a second ISD failure alarm sounds indicating that the same problem still exists and gasoline dispensing is terminated, the ISD system may be reset to allow vehicle fueling to resume only if:

(a) All required repairs have been made and all information associated with the repairs is recorded on an air district-approved form that is maintained at the GDF and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request, or

(b) The dispenser(s) associated with the problem that triggered the failure alarm is isolated, removed from service and not operated until the required repairs are completed and, when completed, all information associated with the repairs is recorded on an air district-approved form that is maintained at the GDF and made available to the Executive Officer/Air Pollution Control Officer or their designee upon request.

The Executive Officer/Air Pollution Control Officer of an air district may also designate in writing a portion of a county as "rural" (i.e., allowing operators to correct the problems identified by the ISD system within seven (7) calendar days of the first ISD failure alarm pursuant to the provisions in section I. above and condition permits for gasoline dispensing facilities in such areas accordingly) where that portion has a projected population for 2005 of less than 132,000 people and is in a separate air basin. The Executive Officer/Air Pollution Control Officer of a local air district may further designate in writing additional "rural" areas (i.e., make them subject to the provision in section I. above) and condition permits for gasoline dispensing facilities in such areas accordingly even though such areas may be within a county having a projected population for 2005 of more than 132,000 people (see attached Table 1).

Please be advised that in the event that timely compliance cannot be achieved, the Hearing Board of the affected air district may grant an Order of Abatement or other administrative relief if the findings required by statute can be made, allowing gasoline dispensing to resume before the requisite repairs are completed.

Recommended Enforcement Action:

For the duration of the 18-month in-use performance evaluation period starting on July 1, 2006, it is recommended that air districts take enforcement action if the GDF owner/operator resets the ISD system without adhering to the permit conditions. It is also recommended that air districts take enforcement action if a GDF owner/operator dispenses gasoline while the ISD system is shut off, tampered with, disconnected or otherwise disabled. Air districts will continue to take appropriate enforcement action for violations of gasoline vapor recovery requirements determined by using current enforcement methods including, but not limited to, visual inspections, testing, and records (non-ISD) review. Enforcement action will also be taken for failure to maintain gasoline vapor control equipment in accordance with maintenance requirements specified by the applicable ARB Certification Executive Orders and California Health and Safety Code/Title 17 defects (title 17, California Code of Regulations, section 94006).

CAPCOA has surveyed the California air districts and CAPCOA believes that all districts concur with the recommended enforcement action.

If you have any questions, please call Dick Smith, CAPCOA Vapor Recovery sub Committee Liaison at 858-586-2700 or William V. Loscutoff, Chief, Monitoring and Laboratory Division, at 916-445-3742.

Sincerely,

Catherine Witherspoon
Executive Officer, ARB

Barbara A. Lee, President
CAPCOA

Attachment: Table 1 - "Projected 2005 Population by Counties"

cc: CAPCOA Board
Dick Smith, CAPCOA Vapor Recovery sub Committee Liaison
Kathleen Tschogl, ARB
William V. Loscutoff, ARB
Steve Arita, WSPA

Appendix A

Table 1
Projected 2005 Population By Counties

County	Projected 2005 population	County	Projected 2005 population
Alpine	1,304	Monterey	430,150
Sierra	3,529	Sonoma	483,859
Modoc	9,855	Stanislaus	509,985
Trinity	13,684	San Joaquin	662,864
Mono	13,758	San Mateo	725,098
Mariposa	17,981	Kern	755,072
Inyo	18,596	San Francisco	798,688
Colusa	20,935	Ventura	819,698
Plumas	21,143	Fresno	889,029
Glenn	28,163	Contra Costa	1,032,968
Del Norte	29,014	Sacramento	1,392,930
Lassen	35,751	Alameda	1,526,821
Amador	37,771	Santa Clara	1,765,162
Calaveras	45,204	Riverside	1,899,271
Siskiyou	45,469	San Bernardino	1,964,243
Tuolumne	57,461	San Diego	3,073,469
San Benito	58,216	Orange	3,080,710
Tehama	60,261	Los Angeles	10,226,598
Lake	64,135	**GRAND TOTAL**	**37,033,473**
Yuba	67,102		
Sutter	88,905		
Mendocino	90,468		
Nevada	100,199		
Humboldt	131,317		
Napa	134,129		
Madera	141,218		
Kings	145,952		
Imperial	162,599		
El Dorado	174,949		
Shasta	180,246		
Yolo	192,508		
Butte	215,558		
Merced	243,915		
Marin	251,607		
Santa Cruz	261,862		
San Luis Obispo	262,843		
Placer	310,698		
Tulare	412,418		
Santa Barbara	420,577		
Solano	425,565		

Interpolated from projections by Vivian Lerch, ARB, 3/22/05, from 2004 population data prepared by the California Demographic Research Unit, Department of Finance

Appendix A

Form 1

GDF Name and Address	**ORVR VEHICLE DETERMINATION DATA SHEET**	Person(s) Conducting Test :
Test Date/Time:	Source: **GDF Phase II Vapor Recovery** **GDF # _____** **Permit # _____**	Time of day

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

Appendix A

Form 2

Data Sheet for Pressure Sensor Verification					
GDFName:		Test Time:		Test Date:	
Address:		Persons Conducting Test:			
City:		Permit Number:			
Initial Ambient Temperature [ºF]:		Final Ambient Temperature [ºF]:			

Observed Underground Storage Tank Pressure

TLS Reading		Manometer Reading	
Time	Pressure (In H_2O)	Time	Pressure (In H_2O)

Appendix A

Form 3

Vapor Pressure Sensor Ambient Reference Test

PERSONS CONDUCTING TEST:	**DATE OF TEST**
	TIME OF TEST
	DISTRICT PERMIT #
GDF 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, NOTIFY STATION OWNER** ☐	
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?** ☐	

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

PERSON'S CONDUCTING TEST		**DATE OF TEST**	
GDF 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.**		

Appendix B
Analysis: Vapor to Liquid (V/L) Ratio Testing: ISD vs. V/L Method

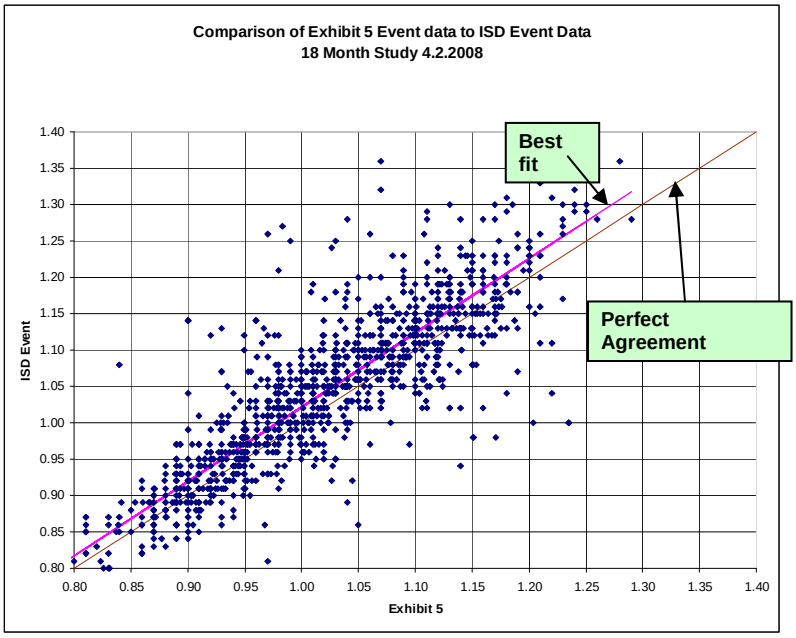
The ISD Field Study included the vapor to liquid (V/L) testing per modified Exhibit 5 of Executive Order VR-202-A to determine how closely the Healy including Veeder-Root ISD system compares to the Exhibit 5 V/L method.

Test data time was synchronized to the ISD system time to ensure proper correlation between data sets. It was only necessary to test the V/L accuracy on one side of the dispenser since there was only one flow meter in each dispenser. The opposite side of the dispenser being tested was removed from service to prevent dispensing of gasoline during the test.

The analysis used 1171 V/L data sets comparing Exhibit 5 V/L to the ISD V/L values. V/L tests included using different gasoline grades, and different fueling points if available at the time. Test protocol required the nozzle be returned to the dispenser after each test with a time of at least one minute between tests to ensure the ISD system recognized each test as a separate fueling event.

Statistical analysis was performed on the ISD and Exhibit 5 V/L values. The best fit line matched closely to the perfect agreement line (slope equal to 1). The average difference in values was 0.04 while the standard deviation was 0.06. Analysis showed that at the 95 percent confidence level (twice the standard deviation), the ISD V/L values were within 0.12 of Exhibit 5 V/L data and met the criteria (0.15) of the Exhibit 9 of VR-202-A.

Figure VI-B-1
Vapor/Liquid (V/L) Ratio Testing-Graph



Appendix C
Analysis: Vapor to Liquid (V/L) Ratio Testing: Malfunction Criteria

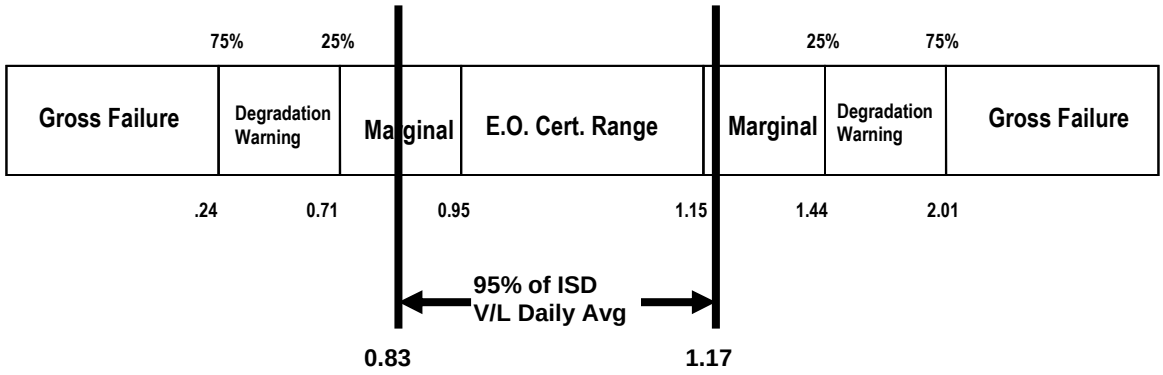
The V/L ratio testing was used to determine whether the V/L malfunction criteria for gross and degradation failures (Section 10.2.1 (b) and (c) of CP-201) could be modified to be more stringent without compromising the reliability of the system.

The certified range limits of V/L for ISD are 0.95 to 1.15. ISD malfunction criteria for gross failure includes a daily assessment that limits V/L to 75 percent above or below the certified range resulting in limits of 0.24 and 2.01. One assessment outside of these limits will result in a warning alarm. Two failed assessments will result in a failure alarm.

ISD malfunction criteria for degradation warnings includes a weekly assessment that limits V/L to 25 percent above or below the certified range (0.95 to 1.15) resulting in limits of 0.71 and 1.44. One assessment outside of these limits will result in a warning alarm. Two failed assessments will result in a failure alarm.

Marginal limits are limits between the certified range and degradation warnings as shown in Figure VI-C-1.

Figure VI-C-1
V/L Certification Range and ISD Warning and Failure Limits

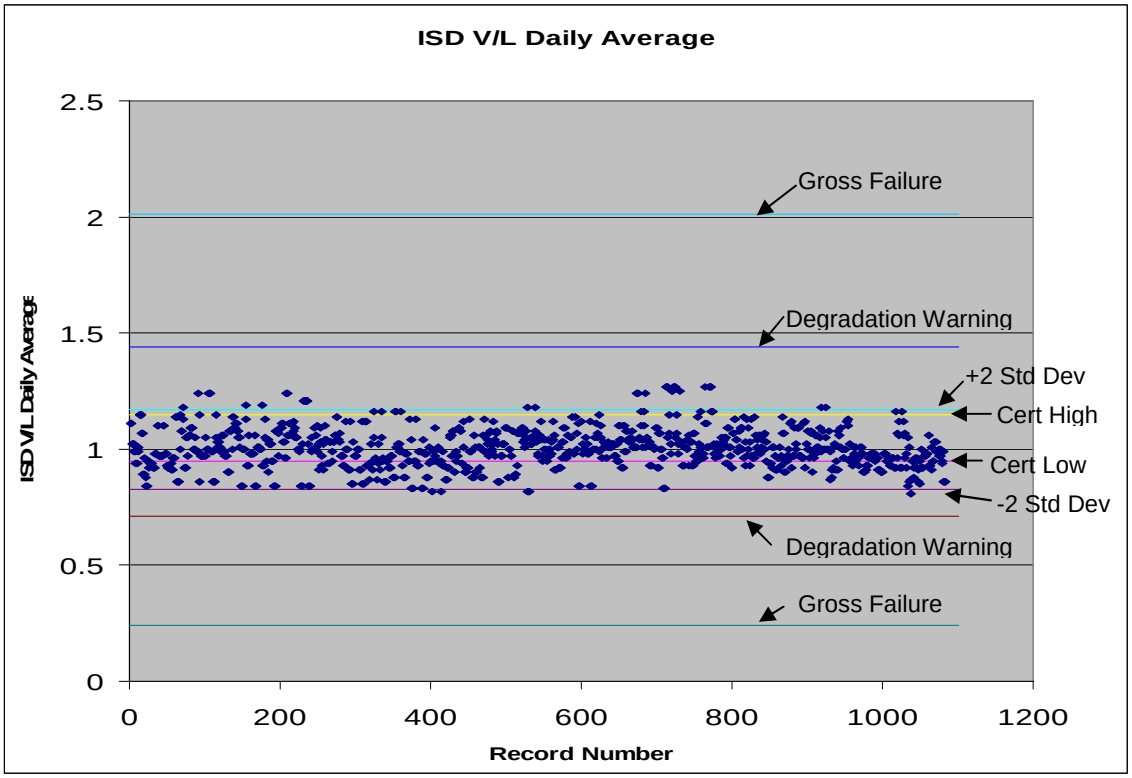


There were 1084 V/L data sets. The maximum ISD V/L daily average was 1.27 and the minimum was 0.81. These values were outside the E.O. certification range, but not within the degradation warning or the gross failure limits. Statistical analysis resulted in a mean of 1.000 while the standard deviation was 0.086. Analysis showed that at the 95 percent confidence level (twice the standard deviation), the ISD V/L values were within the certification range and marginal range limits, but not in the degradation warning or the gross failure limits.

Appendix C
Analysis: V/L Ratio Testing: Malfunction Criteria

The test site data indicated that the malfunction criteria could be tightened without compromising the reliability of the assessment. Quantification of this is beyond the scope of the ISD Field Study. Any changes to the limits would require additional testing and evaluation as well as require regulatory development.

Figure VI-C-2
ISD V/L Daily Averages



Appendix D
Analysis: ORVR & Non-ORVR Vehicles

District staff collected data that identified vehicles as ORVR vehicles or non-ORVR vehicles at GDFs while the vehicles refueled. During vehicle refueling, the opposite side of the dispenser was removed from service to prevent dispensing during the test. Vehicle refuelings that were three gallons or less were invalid. ARB Staff matched the vehicle fueling time and the number of gallons dispensed to the corresponding V/L readings from the Veeder-Root TLS.

For vehicles manufactured during the ORVR transition years, district staff determined if the vehicle was equipped with ORVR. This determination was made by checking the emission label attached to the vehicle's hood or engine compartment.

Vehicles that require ORVR must have an identifying code in the emission label. However, some vehicles that had voluntary early implementation of ORVR may not have the code on the emission label since there is no legal requirement to identify the vehicle until the vehicle is required to have ORVR. Trucks were difficult to determine because the possible transition years were dependent on model year and gross vehicle weight rating (GVWR). Transition years are listed in Table VI-D-1.

Table VI-D-1
ORVR Transition Years

Light Duty Autos	Light Duty Trucks GVWR<5751 Lbs	Medium Duty & Light Heavy Duty GVWR 5751-10,000Lbs
1998, 1999	2001, 2002	2004, 2005

District staff collected data on 1490 vehicles (888 ORVR and 602 non-ORVR) through the ISD Field Study. The ISD blocked fueling events (V/L ≤0.51) were consistent with 78 percent (695) of the vehicles the district identified as ORVR. The ISD non-blocked fueling events (V/L >0.51) determinations were consistent with 96 percent (575) of the vehicles the district staff identified as being ORVR. Of the 22 percent (193) misidentified ORVR vehicles, 84 were light duty, medium duty, and light heavy duty trucks. Some of these trucks may have been incorrectly identified as being ORVR. These trucks had V/L >0.51 and their model year are part of the transition years. With the questionable trucks omitted from the study, the percentage of vehicles being consistent for ORVR increased from 78 percent to 86 percent.

Appendix D
Analysis: ORVR & Non-ORVR Vehicles

Table VI-D-2
ORVR and Non-ORVR Determinations by District Staff

	ORVR (888)	Non-ORVR (602)
ISD V/L Consistent w/ District Staff ID	78% (695)	96% (575)
ISD V/L Inconsistent w/ District Staff ID	22% (193) (V/L >0.51)	4% (27) (V/L ≤0.51)

As part of a separate analysis of the ORVR and non-ORVR vehicles, the light duty autos were classified strictly by their model year, and trucks were classified by model year and GVWR, if known, with the transition years omitted. This analysis resulted in a smaller subset of vehicles. The subset compared 1185 records of V/L values against the ORVR and non-ORVR status with similar results to the original analysis. Of the vehicles identified as ORVR, the ISD V/L confirmed 83 percent as ORVR. Of the vehicles identified as non-ORVR, the ISD V/L confirmed 95 percent of the vehicles as non-ORVR.

Table VI-D-3
ORVR and Non-ORVR Determinations by MY and GVWR

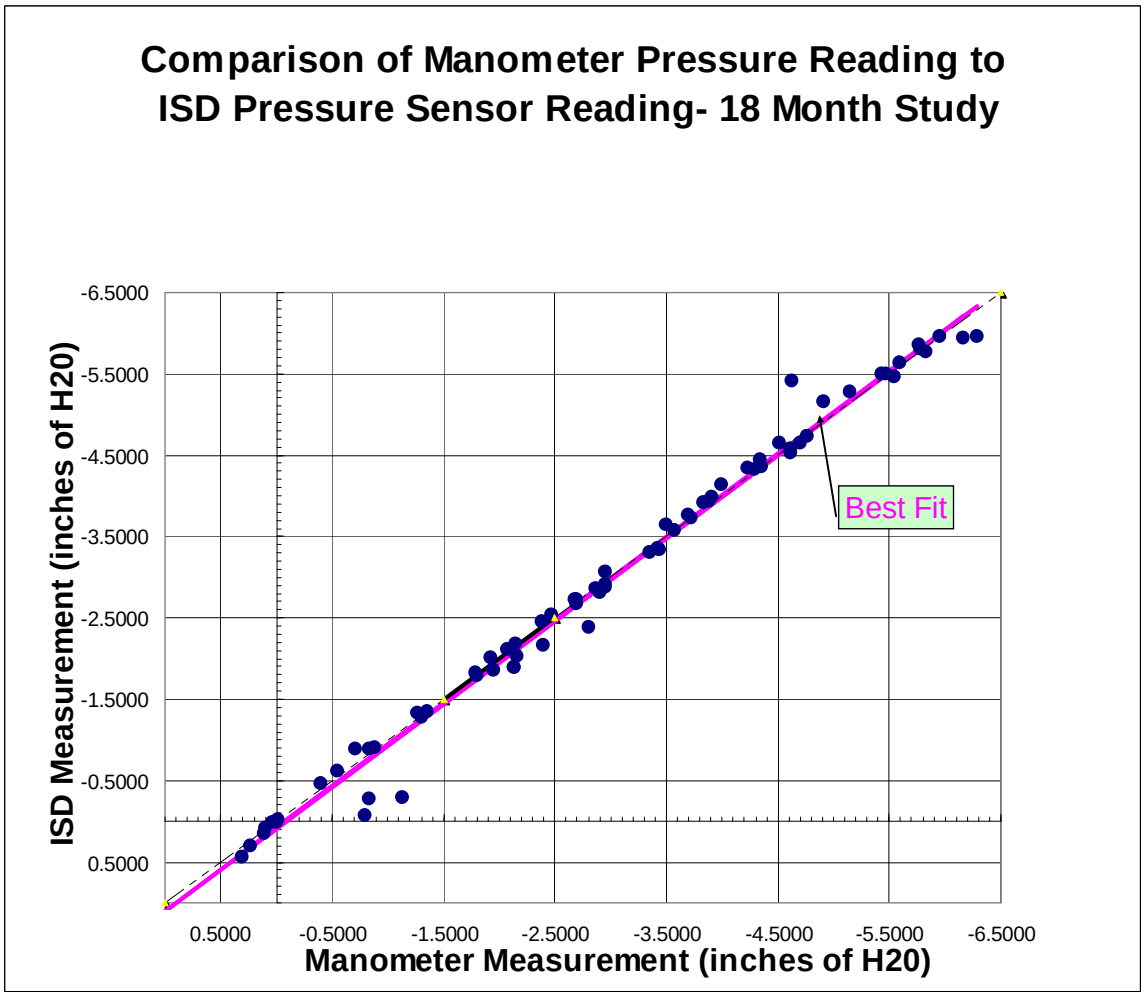
	ORVR (547)	Non-ORVR (638)
ISD V/L Consistent w/ MY & GVWR	83% (455)	95% (605)
ISD V/L Inconsistent w/ MY & GVWR	17% (92) (V/L >0.51)	5% (33) (V/L ≤0.51)

Appendix E
Analysis: Pressure Sensor Verification

The ISD Field Study compared pressure sensor values of underground storage tanks between the TLS reading of the Healy including Veeder-Root ISD system to actual manometer readings taken by ARB staff. The TLS is limited to a negative pressure reading of ±6.00 IWC.

A linear regression analysis identified the best fit line matches closely to the perfect agreement line (slope equal to one). The average difference of the ISD reading compared to the manometer reading was 0.12 IWC while the standard deviation was 0.20. The coefficient of determination R^2 for a linear regression is equal to the square of a correlation coefficient. Analysis calculated R^2 as 0.99. The ISD Field Study data analysis concluded the Healy including Veeder-Root ISD system pressure sensor value closely compares to the monitored value.

Figure VI-E-1
Pressure Sensor Verification-Graph



Appendix F
Analysis: Vapor Pressure Sensor Operability Test

The ISD Field Study also evaluated the vapor pressure sensor's ability to properly record data in accordance with the Healy including Veeder-Root ISD specifications. The pressure sensor criteria was ±0.2 IWC. There were 89 tests conducted. Results were recorded on the Vapor Pressure Sensor Ambient Reference Test data form and followed test protocol detailed in Appendix A. All vapor pressure sensor tests passed.

Appendix G
Analysis: Vapor flow Meter Operability Test

The test is defined in Exhibit 9 of Executive order VR-202-A. The analysis used the previous day's gross ISD V/L daily average and compares it to the calculated V/L values determined by VR-202-A Exhibit 5. The ISD vapor flow meter operating criteria is ±0.15 of the test value. If the ISD was not within those limits, further V/L tests were performed. The analysis included 585 tests of which 580 tests passed and only one failed. Four tests were inconclusive. The passing rate was 99.1 percent and the results verify that the flow meter was operating properly.