

Source Test Procedure **ST-37**

**GASOLINE DISPENSING FACILITY
LIQUID REMOVAL DEVICES**

(Adopted December 21, 1994)

REF: 8-7-302, 317

1. APPLICABILITY

1.1 This procedure is used to quantify the removal of liquid gasoline from the vapor passage of coaxial hoses equipped with a liquid removal device. It is applicable in all cases where a liquid removal system is required in conjunction with a Phase II balance system and in most cases where a vacuum-assist Phase II system requires a liquid removal device. For system designs which preclude the use of this procedure, the methodology referenced in the appropriate California Air Resources Board (CARB) Executive Order shall be employed. Only those criteria specified in the Executive Order shall be quantified.

2. PRINCIPLE

2.1 A dynamic back pressure dry baseline is established pursuant to Source Test Procedure ST-27. Sufficient liquid gasoline is introduced into the vapor passage of the coaxial hose to produce a dynamic back pressure between 2.0 and 6.0 inches of water column (inches H₂O) at a nitrogen flowrate of 60 CFH. After ten gallons of gasoline are dispensed the dynamic back pressure is measured and compared to the baseline value. The total liquid volume removed is also considered.

2.2 If only the removal rate of the liquid removal device is required, Sections 6.3, 6.7, 7.2, 7.3, 7.5 and 7.6 need not be conducted.

3. RANGE

3.1 The minimum and maximum dynamic back pressures that can be measured are dependent upon available pressure gauges. Recommended gauge ranges are 0-.5 and 0-10 inches H₂O.

4. INTERFERENCES

4.1 Any leaks in the nozzle vapor path or hose vapor path will result in erroneously low dynamic back pressure results.

4.2 Alteration of the hose and loop configuration between the pre fueling test and the post refueling test may result in erroneous dynamic back pressure results.

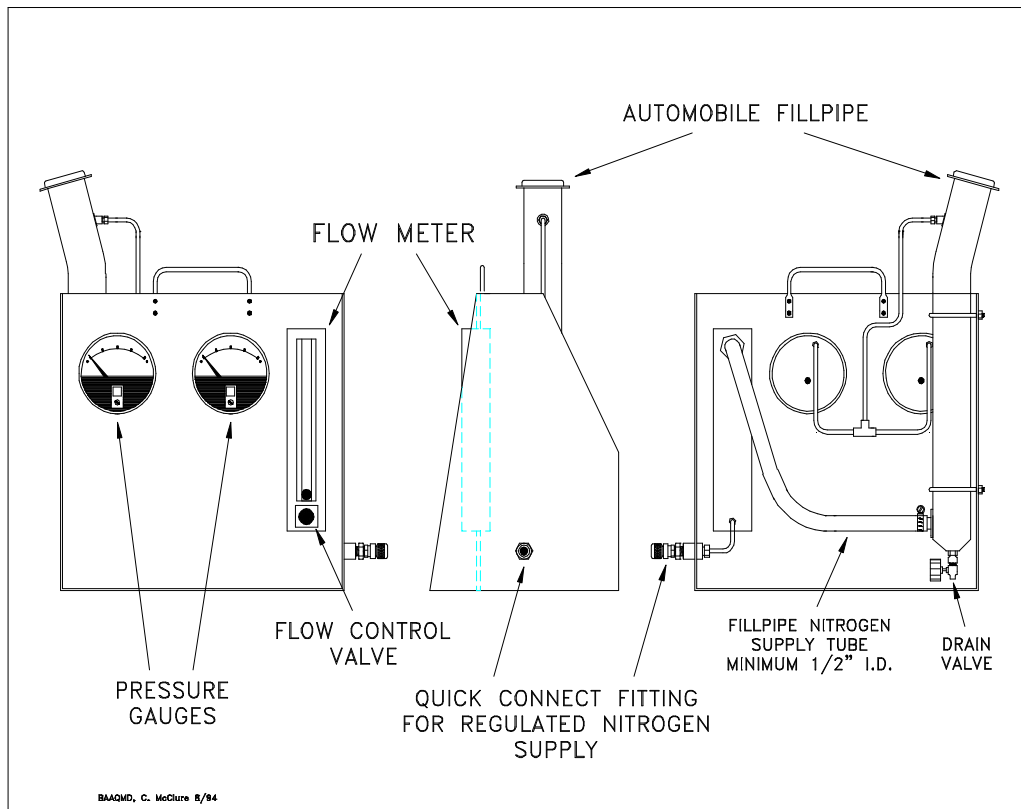
- 4.3** If the hose connection at the dispenser is sufficiently low to allow the 100 CFH nitrogen flow to displace liquid gasoline into the underground Phase II piping, this test procedure shall not be used.
- 4.4** If the Phase II system type precludes conducting a dynamic back pressure test, this test procedure shall be used only to determine the volume of liquid gasoline removed per gallon of gasoline dispensed.

5. APPARATUS

- 5.1** Dynamic Back Pressure Test Assembly (ΔP Test Unit). Use a Dynamic Back Pressure Test Assembly, as shown in Figure 37-1 and Source Test Procedure ST-27. This test assembly shall be equipped with two pressure gauges of appropriate ranges, a compatible automobile fillpipe, and a 0-100 CFH flowmeter equipped with a flow control valve. The test unit shall be securely mounted on a stand such that the height, above grade, to the fillpipe opening is 30 inches (± 2 inches).

Figure 37-1

Dynamic Back Pressure Test Assembly



- 5.2** Stopwatch. Use a stopwatch accurate to within 0.2 seconds.
- 5.3** Nitrogen High Pressure Cylinder with Regulator. Use a high pressure supply of commercial grade nitrogen in a cylinder capable of withstanding a pressure

of 2,500 psig. The cylinder shall be equipped with a compatible two-stage regulator and a high pressure delivery hose.

- 5.4 Graduated Cylinder. Use a shatterproof 0-200 milliliter graduated cylinder which is compatible for use with gasoline.
- 5.5 Pressure Gauge. Use a 0-30 psig pressure gauge to measure the gasoline delivery pressure.

6. PRE-TEST PROCEDURES

- 6.1 Use a stopwatch to accurately measure the gasoline dispensing rates at high, medium, and low nozzle hold-open clip settings with no other refueling activity occurring at the facility. Allow at least one gallon to be dispensed before timing the dispensing rate. For those nozzles without hold-open latches, use wedges to simulate the three latch positions. Record this data on Form 37-1.
- 6.2 If feasible, quantify the gasoline delivery pressure using the 0-30 psig pressure gauge. If possible, this pressure shall be measured with no other refueling activity occurring at the facility. Record this pressure on Form 37-1.
- 6.3 Position the ΔP Test Unit 48 inches (± 2 inches) from the face of the dispenser in order to represent a typical refueling configuration. Trace the outline of the base of the ΔP Test Unit.
- 6.4 Completely drain all liquid from the vapor passage of the coaxial hose. Sufficient time shall be allocated for this pre-test procedure, especially if the hose has internal convolutions.
- 6.5 Use the graduated cylinder to pour 150 milliliters of gasoline into the vapor passage of the hose. The quantity of gasoline required may vary according to the volume of the hose vapor volume (inverted coaxial hoses will require less gasoline).
- 6.6 Completely drain the gasoline from the vapor passage back into the graduated cylinder. Subtract this quantity from the original 150 milliliters. This value represents the volume of gasoline lost due to surface adhesion to the hose wall.
- 6.7 With no dispensing activity occurring at the gasoline dispensing facility, conduct the dynamic back pressure test at a nitrogen flowrate of 60 CFH, in accordance with Source Test Procedure ST-27. Record the results on Form 37-1. This establishes the dry baseline value for dynamic back pressure.

7. TESTING

- 7.1 Use the graduated cylinder to pour 150 milliliters of gasoline into the vapor passage of the hose.

- 7.2** With no dispensing activity occurring at the gasoline dispensing facility, conduct the dynamic back pressure test in accordance with Source Test Procedure ST-27 at a nitrogen flowrate of 60 CFH. Record this data on Form 37-1. This establishes the wet baseline value for dynamic back pressure. Ensure that the dynamic back pressure at 60 CFH does not exceed six (6) inches H₂O. This should preclude the possibility of premature nozzle shutoff while dispensing fuel. If the wet baseline value is less than (2) inches H₂O, use the graduated cylinder to add sufficient gasoline to raise the dynamic back pressure to a minimum of two (2) inches H₂O.
- 7.3** Move the Δ P Test Unit and position a vehicle such that the fillpipe inlet is in approximately (± six inches) the same location previously occupied by the Δ P Test Unit fillpipe.
- 7.4** Using the medium hold-open clip setting, dispense 10.0 gallons into the vehicle gas tank with no other refueling activity occurring at the facility. A gas can may be used provided the minimum capacity of the gas can exceeds twelve (12) gallons. Record the exact gallonage on Form 37-1.
- 7.5** Move the vehicle and return the Δ P Test Unit to its original position, using the traced outline of the base to verify its position.
- 7.6** Conduct the dynamic back pressure test in accordance with Source Test Procedure ST-27 at a nitrogen flowrate of 60 CFH. Record this data on Form 37-1. This value represents the post-refueling dynamic back pressure.
- 7.7** Carefully drain any gasoline present in the vapor passage of the hose into the graduated cylinder. Record this quantity on Form 37-1.
- 7.8** Repeat Sections 6.3 through 6.7 and Sections 7.1 and 7.7 with the hold-open clip in the high positions. Record this data on Form 37-1.

8. CALCULATIONS

- 8.1** The volume of liquid gasoline removed from the hose vapor passage per gallon of gasoline dispensed shall be calculated as follows:

$$V_R = \frac{(V_I - V_W) - V_F}{G} \quad \text{[Equation 8-1]}$$

where:

- V_R = Gasoline removed per gallon dispensed, milliliters per gallon
 V_I = Total initial volume in hose vapor passage, from Section 7.1, milliliters
 V_W = Liquid lost due to wall adhesion, from Section 6.6, milliliters
 V_F = Liquid remaining after dispensing, from Section 7.7, milliliters
 G = Total gallons dispensed, from Section 7.4, gallons

- 8.2** The percent increase in dynamic back pressure, from dry baseline to post refueling conditions, shall be calculated as follows:

$$P_I = \frac{(P_{PR} - P_{DB})100}{P_{DB}} \quad \text{[Equation 8-2]}$$

where:

- P_I = Percent increase in dynamic back pressure from dry baseline to post refueling conditions, percent
- P_{PR} = Post refueling dynamic back pressure, inches H₂O
- P_{DB} = Dry baseline dynamic back pressure, inches H₂O
- 100 = Conversion factor from decimal fraction to percent

9. REPORTING

- 9.1** The results shall be reported as shown in Form 37-1.

FORM 37-1

<p>Distribution:</p> <p>Firm Permit Services Enforcement Services Technical Services Planning Requester DAPCO</p>	<p>BAY AREA AIR QUALITY MANAGEMENT DISTRICT</p> <p><i>939 Ellis Street San Francisco, California 94109 (415) 771-6000</i></p> <p>Summary of Source Test Results</p>	<p>Report No.: _____</p> <p>Test Date: _____</p> <p>Test Times:</p> <p>Run A: _____</p> <p>Run B: _____</p> <p>Run C: _____</p>
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Source Information		Facility Parameters
<p>GDF Name and Address</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>LIQUID REMOVAL DEVICE REQUIREMENTS:</p>	<p>GDF Representative and Title</p> <p>_____</p> <p>_____</p> <p>GDF Phone No. ()</p> <p>Source: GDF Vapor Recovery System</p> <p>BAAQMD GDF # _____</p> <p>BAAQMD A/C # _____</p>	<p>CARB Executive Order Data</p> <p>CARB EXECUTIVE ORDER # _____</p> <p>CARB EXHIBIT NUMBER _____</p> <p>PHASE II SYSTEM TYPE _____</p> <p>FOR OFFICE USE ONLY :</p>
<p>Operating Parameters:</p> <p>Make and Model of Nozzle _____ Make and Model of Liquid Removal Device _____</p> <p>Make and Model of Hose _____ Make and Model of Dispenser _____</p>		<p>Applicable Regulations: BAAQMD REGULATION 8, RULE 7</p> <p>FOR OFFICE USE ONLY</p>

Source Test Results and Comments:

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| <ol style="list-style-type: none"> 1. Product Grade 2. Nozzle Make & Model 3. Hold -Open Latch Position, medium or high 4. Dry Baseline Δ P at 60 CFH, inches H₂O 5. Gasoline added to Hose, mls (150) 6. Gallons Dispensed (10.0) 7. Dispensing Rate, gpm 8. Gasoline in Hose after Dispensing, mls 9. Post-Refueling Δ P at 60 CFH, inches H₂O 10. Total Gasoline Removed, mls 11. Liquid Removal Rate, mls/gallon 12. Increase Δ P, percent 13. Test Status [Pass or Fail] | <table style="width:100%; border-collapse: collapse;"> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td><td>_____</td></tr> </table> | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
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<p>Test Conducted by:</p>	<p>Test Company</p> <p>Name _____</p> <p>Address _____</p> <p>City _____</p>	<p>Date and Time of Test:</p>
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