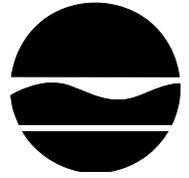


**New York State Department of Environmental Conservation**

**Division of Air Resources, 2<sup>nd</sup> Floor**

625 Broadway, Albany, New York 12233-3250  
**Phone:** (518) 402-8452 \$ **FAX:** (518) 402-9035

**Website:** [www.dec.state.ny.us](http://www.dec.state.ny.us)



# Testing Procedures Guidance Manual

for

## Stage II Vapor Recovery



March 2003

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# Introduction

Attached are test procedures that the New York State Department of Environmental Conservation (NYSDEC) considers acceptable methods for testing Stage II Vapor Recovery Systems at gasoline dispensing sites in New York State. The NYSDEC air pollution regulation that covers vapor collection and testing is 6 NYCRR Part 230, Gasoline Dispensing Sites and Transport Vehicles. Section 230.2(k) (Appendix I), lists specific testing requirements. Included in Appendix II is a coversheet that can be used to report test results to NYSDEC.

As per New York State regulations, vapor integrity test result (pass or fail) of the stage I/II system must be notarized and submitted to DEC within 30 days of test completion at the following address:

Gary McPherson  
DEC Division of Air Resources  
Bureau of Stationary Sources  
625 Broadway  
Albany, NY 12233-3254

NYSDEC requires three tests on vapor collection systems. These include:

- 1.0 **DYNAMIC BACK PRESSURE TEST**. Also referred to as a Dry Test or a Pressure Drop During Flow Test.
  
- 2.0 **LIQUID BLOCKAGE TEST**. Also referred to as a Wet Test. For the purpose of clarity, the liquid blockage test is a dynamic back pressure test that introduces liquid into the vapor piping to check for proper drainage pitch. The result of the liquid blockage test can be no more than .03 inches water column gauge ("wgc) above the "dry" dynamic back pressure test result.
  
- 3.0 **LEAK TEST**. Also referred to as Static Pressure Test. Because of the NY State leak test pressure requirement of 10" wgc (230.2(k)(iii), any nozzles with internal check valves that are not designed to withstand this amount of pressure may be circumvented to accomplish the test. In this situation the leak test should be taken from the end of the hose that would normally thread into the nozzle.

For more information, call NYSDEC Division of Air Resources at (518) 402-8403 and ask to speak with Gary McPherson or Robert Praisner.

For confidential technical assistance, call the Small Business Assistance Program (SBAP) at (800) 780-7227 within NYS or 518-402-7462.

# Dynamic Back Pressure/Liquid Blockage Test

(Taken from San Diego Test Procedure TP-91-2)

## 1.0 INTRODUCTION

This procedure consists of two separate tests which must be conducted sequentially in the order indicated below: Certain prerequisites to testing must be met before a valid test can be performed. These are described in Section 2 below.

**1.1 Dynamic Back Pressure (Dry Test)** This test is used to determine the pressure drop (flow resistance) through balance Stage II vapor recovery systems (including nozzles, vapor hose, swivels, dispenser piping and underground piping) at prescribed flow rates. The test method consists of flowing gaseous nitrogen through a calibrated test panel into the vapor recovery system at various flow rates to simulate the back pressure created during vehicle refueling. The resulting back pressures are measured near the nozzle faceplate using a pressure gauge and compared with NYSDEC certification criteria.

**1.2 Liquid Blockage Test (Wet Test)** This test is used to determine if the piping configuration is correct and to detect low points in the piping where the accumulation of liquid condensate may cause blockages which restrict the flow of vapors and thus decrease the system's vapor collection efficiency. The test method consists of introducing gasoline into the vapor piping at the dispenser. When the gasoline can be heard dropping into the appropriate tank, enough gasoline is deemed to have been added to create a blockage should a low point or other restriction be present. Gaseous nitrogen is introduced into the vapor piping at a rate of 60 standard cubic feet per hour (SCFH). A liquid blockage is indicated either by the needle pegging on the pressure gauge and/or wild pulsing of the needle, or a reading in excess 0.45" wcg back pressure at a flow of 60 SCFH of nitrogen.

## 2.0 PREREQUISITES TO TESTING

The following requirements must be met before a valid test can be performed:

**2.1 Condition of the Vapor Recovery System** - The vapor recovery system must be proven vapor tight with the Leak Test (see page 10), prior to conducting this test. There can be no alteration of the vapor recovery system between the time the pressure decay/leak test is conducted and this pressure drop test is run.

- 2.2 Restriction of Gasoline Dispensing Operations** - During testing of a given product, no dispensing of that product will be allowed. If the vapor spaces of the underground storage tanks are manifolded, dispensing of gasoline from the entire station shall be prohibited during testing.

### **3.0 EQUIPMENT**

The following equipment will be needed to perform the pressure vs. flow and the liquid blockage tests:

- 3.1** A bottle of gaseous nitrogen and pressure regulators capable of regulating final downstream pressure to 5.0 pounds per square inch gauge (psig) are required. Use assorted valves, fittings, and pressure tubing as necessary. A means of providing a grounding path from the bottle of compressed nitrogen must be employed. The bottle shall be grounded for safety. It is recommended that the tubing be flexible metal tubing or non-metallic tubing that incorporates a grounding path throughout its length.

A pressure relief valve must be installed prior to testing. Attach it to the vapor piping or a storage tank vent within the piping system. The pressure relief valve must be adjusted to release at one psig (27.7" wcg.) **(The diaphragms in balance system nozzles are not designed to withstand pressures exceeding one psig and may be accidentally ruptured if this procedure is not followed.)**

**WARNING - The nitrogen bottle must be securely fastened to a large, stationary object at all times. A compressed gas cylinder which falls and is damaged can easily become a lethal projectile.**

- 3.2** A flow regulator is required that is capable of delivering nitrogen at very low pressure and at measured flow rates of 20, 60 and 100 SCFH.
- 3.3** A test panel as shown in Figure 1, Page 7, must be used for testing balance system vapor flow restrictions. The panel consists of a section of vehicle fill pipe, attached pressure gauges, a drain to drain off gasoline liquid that spills into fill pipe from the nozzle fill spout, a plug in the back through which nitrogen enters the fill neck, a flow gauge to adjust nitrogen flow, control valves and attachments to connect the nitrogen bottle. The pressure drop through the Stage II system is determined using a gauge capable of accurately measuring pressures from 0 to 1" wcg and readable in increments of 0.01" wcg. The gauge is used to measure back pressure before and after the gasoline is introduced. Pressure is to be sensed through a port, perpendicular to the direction of flow, located as close as possible to the vapor piping. An additional simultaneous-reading gauge with a 0 to 10" wcg range is desirable to quantify excessive flow resistance.

## 4.0 TEST PROCEDURES

### 4.1 Dynamic Back Pressure (Dry Test)

The farthest dispensing nozzle from the underground tanks for each product grade shall be tested using the following procedure unless otherwise required.

- 4.1.1 Prop open only the Stage I vapor poppet valve at the tank with the same product as the nozzle being tested. (The pressure drop is measured through the nozzle, vapor hoses, dispenser, vapor piping and through the tank to the Stage I vapor poppet. This comes close to duplicating the actual flow resistances that occur during normal operations.) Set up traffic barriers in the vicinity of the vapor poppet valve to preclude the approach of potential ignition sources.
- 4.1.2 For manifolded systems, install the pressure relief safety valve, set at one psig (27.7 inches of water), over the opening of one of the storage tank vents and cap the remaining storage tank vents. (Manifolding the tank vent lines is prohibited.) For non-manifolded systems, test each product vapor recovery system separately with the pressure relief safety valve installed on the vent of the storage tank being tested. (Alternative setups may be used as long as they do not interfere with the objectives of the test and have prior approval.) (Note: The tank vents are closed because it was discovered that wind flowing over open vents 12 feet high can interfere with the pressure measurements, even with the vapor poppets open. Since the pressure decay/leak test must be conducted first, the caps and relief valve are usually already in place.)
- 4.1.3 If there is no remote check valve in the dispenser, proceed to Step 4.1.4. If the Stage II balance system employs a remote vapor check valve that can be disabled by removing the poppet on the fuel side, carefully open the fuel side of the remote vapor check valve and remove the fuel poppet. Replace the threaded plug on the fuel side of the valve.
- 4.1.4 Connect the pressure drop test device to the vapor return piping and the regulated nitrogen source. If the nitrogen is introduced through the vapor recovery nozzle, apply a film of lubricant to the faceplate of the

nozzle to be tested and insert the nozzle into the fill pipe simulator of the test device. The nozzle must fit tightly.

**4.1.5** Zero the pressure gauges.

**4.1.6** Adjust the pressure regulators and the pressure drop panel flow control valve to produce a nitrogen flow rate of 20 SCFH. Record the back pressure (balance system pressure drop) measured immediately upstream of the vapor piping, i.e., at the entrance to the nozzle, in the appropriate space of the data log (attached).

**4.1.7** Repeat steps 4.1.6 above with flow rates of 60 SCFH and 100 SCFH.

**4.1.8** If the system failed to meet the criteria for passage set forth in Section 5.1, make necessary replacements of or adjustment to the nozzles, vapor hoses, swivels, dispenser piping, or underground piping to bring the measured pressure drops within the appropriate standard.

**4.1.9** After completion of the pressure vs flow test, close and cap the underground storage tank vapor poppet valves and remove the closures from the tank vent pipes.

**4.1.10** For Stage II balance systems with remote vapor check valves, carefully reassemble the remote vapor check valve by removing the plug on the fuel side and reinserting the fuel poppet. Replace the threaded fuel plug.

## **4.2 Liquid Blockage Test (Wet Test)**

Each dispensing nozzle/vapor return piping inlet shall be tested using the following procedure unless otherwise stated. Testing shall be done starting with the farthest dispensing nozzle from the underground storage tanks for each product.

**4.2.1** Prop open only the vapor poppet valve at the tank with the same product as the nozzle being tested. Set up traffic barriers in the vicinity of the vapor poppet valve to preclude the approach of potential ignition sources.

- 4.2.2** Install a pressure relief safety valve set at a maximum cracking pressure of one pound per square inch gauge (27.7" wcg) at the vent of one of the storage tanks. If the system has manifolded vapor piping, cap the vents of the other storage tanks. If the system has non-manifolded piping, be sure the pressure relief valve is on the tank that has the same product as that which is dispensed at the location where liquid is introduced to the vapor piping.
- 4.2.3** For each nozzle, introduce gasoline into the vapor piping inlet located at or in each dispenser. (Don't introduce gasoline through the vapor return nozzle and vapor hose.) Have someone listening at the open Stage I vapor poppet to identify the tank where liquid splashing is heard. For systems with manifolded underground vapor piping, the liquid must drop into the leaded product tank, or the lowest octane unleaded tank if there is no leaded product. For non-manifolded systems with separate underground vapor piping, the liquid shall return to the tank that has the same product as is dispensed at the nozzle where the liquid was introduced into the vapor piping. If the product at the nozzle does not match the product in the tank, the underground piping is crossed and the system fails the test.
- 4.2.4** Restore the dispensing/vapor return system to its normal balance system configuration.
- 4.2.5** If there is no remote check valve in the dispenser, proceed to Step 4.2.6. If the Stage II balance system employs a remote vapor check valve, that can be disabled by removing the poppet on the fuel side, carefully open the fuel side of the remote vapor check valve and remove the fuel poppet. Replace the threaded plug on the fuel side of the valve.
- 4.2.6** Connect the pressure drop test device to the vapor return piping and the regulated nitrogen source. If the nitrogen is introduced through the vapor recovery nozzle, apply a film of lubricant to the faceplate of the nozzle to be tested and insert the nozzle into the fillpipe simulator of the test device. The nozzle must fit tightly.
- 4.2.7** Zero the pressure gauges.
- 4.2.8** Adjust the pressure regulators and the pressure drop panel flow control valve to produce a nitrogen flow rate of 60 SCFH. Note the

response and reading of the pressure gauge immediately upstream of the vapor piping, i.e., at the entrance to the nozzle. Record the back pressure reading on the attached data log under “wet test”.

**4.2.9** If during the “wet test” the back pressure gauge pegs at full scale or continuously fluctuates, note this in the “Comments” section for the nozzle being tested.

**4.2.10** If the system failed to meet the criteria for passage set forth in Section 5.2, make necessary repairs or adjustments to the tested piping to eliminate the blockage.

**4.2.11** For Stage II balance systems with remote vapor check valves, carefully reassemble the remote vapor check valve by removing the plug on the fuel side and reinserting the fuel poppet. Replace the threaded fuel plug.

**4.2.12** Repeat steps 4.2.1 through 4.2.11 for each nozzle/vapor return piping inlet associated with the vapor return line being tested.

**4.2.13** After completion of the liquid blockage test for all nozzles connected to the vapor return line, close and cap the underground storage tank vapor poppet valves and remove the closures from the tank vent pipes.

## **5.0 TEST STANDARDS**

### **5.1 Dynamic Back Pressure (Dry Test)**

Back pressure during dynamic back pressure tests must not exceed 0.45” wcg at a flow rate of 60 cubic feet per hour or 0.95” wcg at a flow rate of 100 cubic feet per hour.

### **5.2 Liquid Blockage Test (Wet Test)**

The system fails if the back pressure gauge pegs at full scale, continuously fluctuates during the “wet test”, or if the back pressure during liquid blockage tests exceeds 0.03” wcg above the dynamic back pressure test results for the system for flow rates of 60 and 100 cubic feet per hour.

TEST PANEL

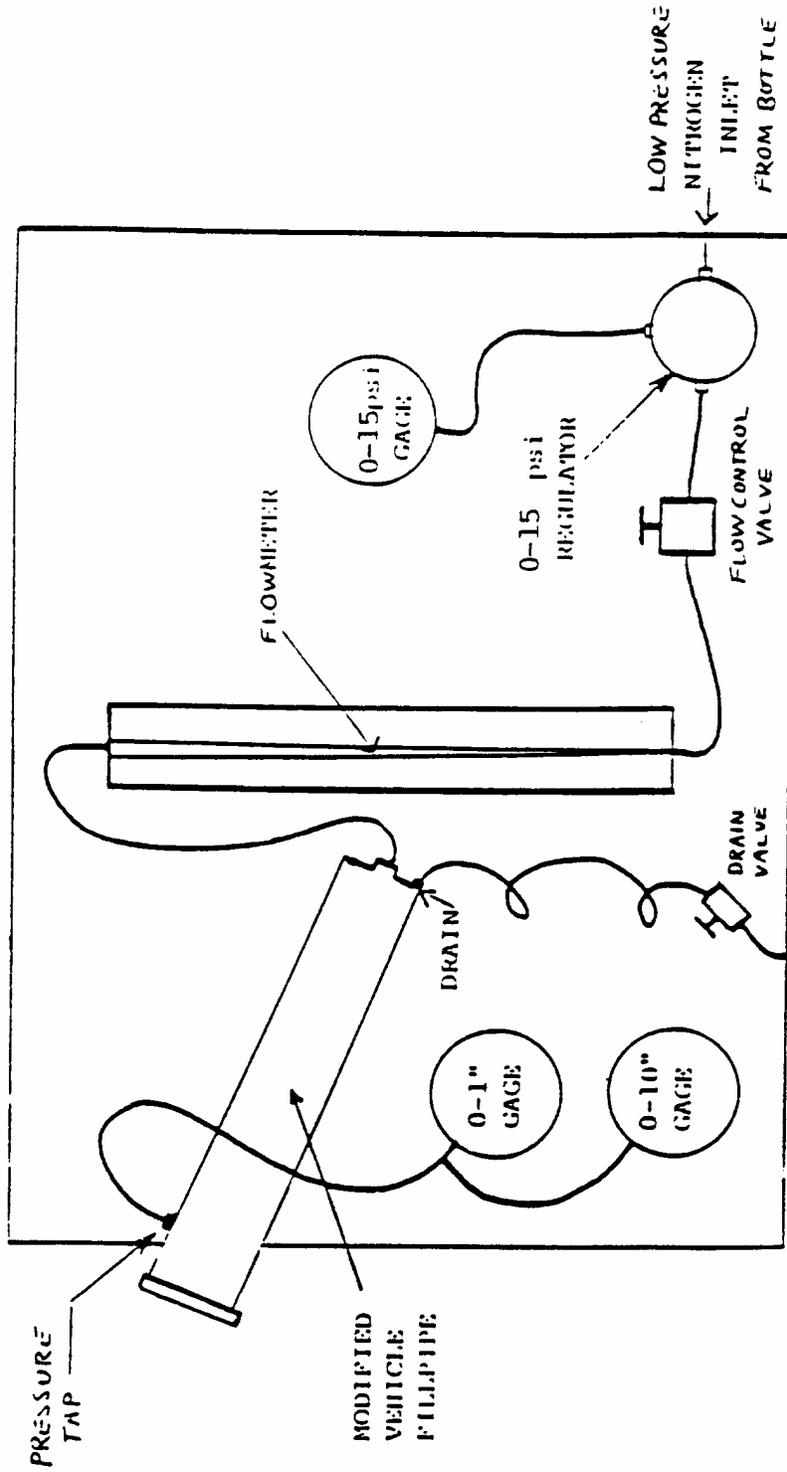


Figure 1



# Leak Test

(taken from Bay Area Air Quality Management District test procedure ST-30)

## 1.0 APPLICABILITY

1.1 This test procedure is used to quantify the vapor tightness of any vapor recovery system installed at a gasoline dispensing facility (GDF). Leaks in a balance system may cause excessive vapor emissions. Leaks in a vacuum assist system may decrease the efficiency of the vapor collection or processing system.

## 2.0 PRINCIPLE

2.1 The entire vapor recovery system is pressurized with nitrogen to ten (10)" wcg and then allowed to decay for five (5) minutes. The acceptability of the final pressure is based upon the vapor system volume or ullage space.

## 3.0 RANGE

3.1 The minimum and maximum full-scale range of the pressure gauges are 0-10 and 0-20" wcg, respectively. Maximum incremental graduations of the pressure gauge shall be in 0.1" wcg.

## 4.0 INTERFERENCES

4.1 On vacuum assist systems the processor must be isolated and the vapor system capped. On balance systems the vent pipes must be capped or plugged. Any leakage at these points will show up as a system component leak.

## 5.0 APPARATUS

5.1 Nitrogen. Use commercial grade nitrogen in a high pressure cylinder, equipped with a two-stage pressure regulator and a one psig pressure relief valve.

5.2 Pressure Gauge or Water Manometer. Use a 0-10" wcg pressure gauge or water manometer to measure the pressure decay in the vapor recovery system. The pressure gauge shall, at a minimum, be readable to the nearest 0.1" wcg.

5.3 Vent Cap Assembly. See Figure 30-1 for example.

**5.4** "T" Connector Assembly. See Figure 30-2 for example.

**5.5** Stopwatch. Use a stopwatch accurate to within 0.2 seconds.

## **6.0 PRE-TEST PROCEDURES**

**6.1** Dispensing shall not take place during the test. There shall have been no bulk drops into the storage tanks within the three hours prior to the test.

**6.2** Measure the gallons of gasoline present in each underground storage tank and determine the actual capacity of each storage tank from facility records. Calculate the ullage space for each tank by subtracting the gasoline gallonage present from the actual tank capacity. The minimum ullage during the test shall be 30 percent of the tank capacity or 500 gallons, whichever is greater. The vent pipes may be manifolded during the test to achieve the required ullage.

**6.3** Insure that all Stage I couplers are equipped with a locking dust cap. Replace the manhole covers as a safety precaution.

**6.4** Disconnect the dispenser end of one vapor recovery hose and install the "T" connector assembly (see Figure 30-2). Connect the nitrogen gas supply (do not use air) and the pressure measuring device to the "T" connector.

**6.4.1** For those Stage II systems utilizing a remote vapor check valve, the "T" connector assembly shall be installed on the vapor riser side of the check valve unless the remote check valve is disabled by removing the poppet on the fuel side.

**6.5** Install the vent cap assembly(s) (see Figure 30-1). For manifolded systems all storage tank vent pipes shall be capped during the test.

**6.6** If the storage tank vent pipe is open, and easily accessible, a modified version of the "T" connector may be installed at the vent pipe (see Figure 30-3). This will allow the test to be conducted without any dispenser modifications. This is advantageous at certain facilities using coaxial Stage II systems.

## **7.0 TESTING**

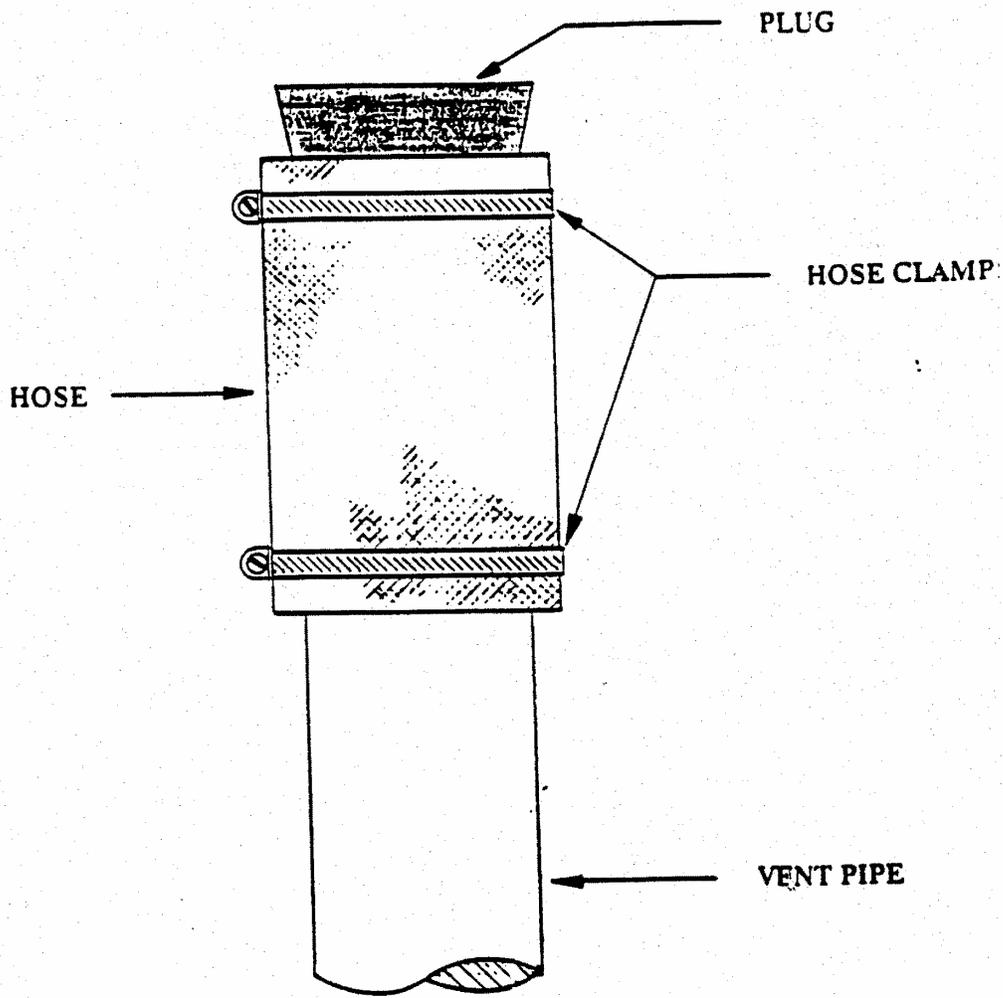
- 7.1** Open the nitrogen gas supply valve and set the regulator delivery pressure to 5 psig. Pressurize the vapor system (or subsystem for individual vapor return line systems) to or slightly above 10" wcg initial pressure. It is critical to maintain the nitrogen flow until both flow and pressure stabilize, indicating temperature and vapor pressure stabilization in the tanks. Check the vent cap assembly and the "T" connector assembly using leak detecting solution to verify that the test equipment is leak tight.
- 7.2** Close the nitrogen supply valve and start the stopwatch when the pressure has decreased to the initial starting pressure of 10" wcg.
- 7.3** At one-minute intervals during the test, record the system pressure. After five minutes, record the final system pressure. See Tables I to determine the acceptability of the final system pressure results.
- 7.4** If the system failed to meet the criteria set forth in Table I repressurize the system and check all accessible vapor connections using leak detector solution or a combustible gas detector. If vapor leaks in the system are encountered, repair or replace the defective component and repeat the test.
- 7.5** Carefully remove the vent cap assembly(s). Allow any remaining pressure to be relieved through vent pipe(s). Keep all potential ignition sources away from the vent pipe(s).
- 7.6** After the remaining system pressure has been relieved, remove the "T" connector assembly and reconnect the vapor recovery hose. If the fuel poppet was removed from a remote vapor check valve to conduct this test, carefully replace the poppet and reconnect the vapor hose.
- 7.7** If the vapor recovery system utilizes individual vapor return lines, repeat the leak test for each of the other gasoline grades. Avoid leaving any vapor return line open longer than is necessary to install or remove the "T" connector assembly.

## **8.0 REPORTING**

- 8.1** The calculated ullage and system pressures for each five minute vapor recovery system test shall be reported as shown in Figure 30-4.

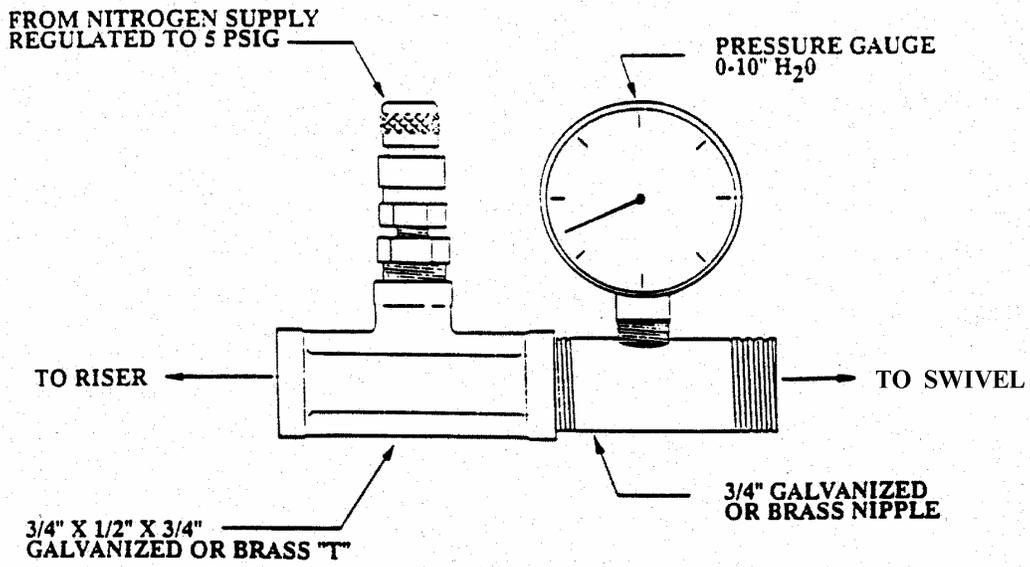
**FIGURE 30 - 1**

**VENT CAP ASSEMBLY**



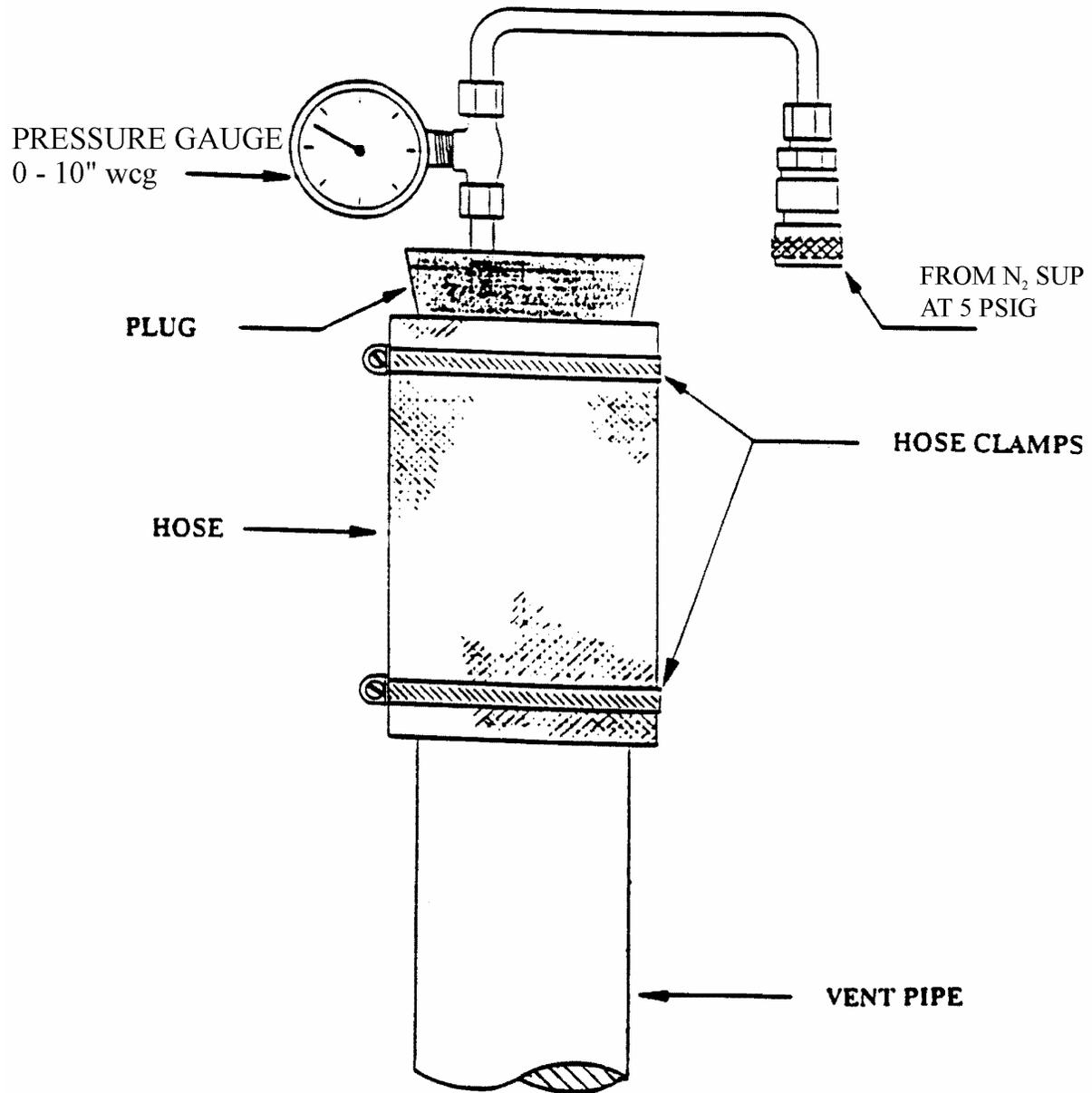
**FIGURE 30 - 2**

**"T" CONNECTOR  
ASSEMBLY**



**FIGURE 30 - 3**

**ALTERNATE VENT CAP ASSEMBLY**



<p>FIGURE 30 - 4</p> <p><b>SUMMARY OF SOURCE TEST RESULTS</b></p>	<p>REPORT NO. _____</p> <p>TEST DATE: _____</p> <p><u>TEST TIMES:</u></p> <p>RUN A: _____</p> <p>RUN B: _____</p> <p>RUN C: _____</p>
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SOURCE INFORMATION		FACILITY PARAMETERS
<p>Firm Name And Address</p>   <p>Permit Conditions</p>	<p>Firm Representative and Title</p>  <p>Phone No. _____</p> <p>Source: Vapor Recovery System</p> <p>Plant No. _____ Permit No. _____</p> <p>Operates _____ hr/day &amp; 365 days/yr</p>	<p>STAGE II SYSTEM TYPE (Check One)</p> <p>Balance _____</p> <p>Hirt _____</p> <p>Red Jacket _____</p> <p>Hasstech _____</p> <p>Healy _____</p> <p>Manifolded? (Y or N) _____</p>

**Operating Parameters:**

Tank #	Capacity	Gallons Present
1	_____	_____
2	_____	_____
3	_____	_____

Applicable Regulations:

VN Recommended:

Source Test Results and Comments:

Tank #:	1	2	3
---------	---	---	---

Product Grade:

Actual Tank Capacity, gallons	_____	_____	_____
Ullage, gallons	_____	_____	_____
Initial Pressure, " wcg	_____	_____	_____
Pressure After 1 Minute, " wcg	_____	_____	_____
Pressure After 2 Minute, " wcg	_____	_____	_____
Pressure After 3 Minute, " wcg	_____	_____	_____
Pressure After 4 Minute, " wcg	_____	_____	_____
Final Pressure After 5 Minute, " wcg	_____	_____	_____

NO COMMERCIAL USE OF THESE RESULTS IS AUTHORIZED		
Test Conducted by:	Test Company:	Date of Test:

Taken from Bay Area Air Quality Management District Test Procedure ST-30

## Appendix I – 6NYCRR Part 230.2 (k) Testing Requirements

### (k) TESTING REQUIREMENTS

(1) (i) Owners and/or operators of Stage II systems installed or modified after July 20, 1994 must perform dynamic back pressure, liquid blockage, and leak tests before commencing operation.

(ii) Owners and/or operators of Stage II systems must perform dynamic back pressure, liquid blockage, and leak tests at five year intervals after commencing operation.

(2) (i) Back pressure during dynamic back pressure tests must not exceed 0.45" wcg at a flow rate of 60 cubic feet per hour or 0.95" wcg at a flow rate of 100 cubic feet per hour.

(ii) Back pressure during liquid blockage tests must not exceed 0.03" wcg above the dynamic back pressure test results for the system for flow rates of 60 and 100 cubic feet per hour.

(iii) Pressure in gasoline storage tanks must not fall below the values in Table 1 after five minutes from an initial pressure of 10.0" wcg during the leak test.

Table 1

Leak Test Criteria  
for Gasoline Dispensing Sites  
with Stage II Vapor Recovery

Ullage Space (Gallons)	Minimum Pressure After 5 Minutes (Inches of Water)
500	3.7
600	4.5
700	5.2
800	5.8
900	6.2
1,000	6.5
1,500	7.6
2,000	8.2
2,500	8.5
3,000	8.7
3,500	8.9
4,000	9.1
4,500	9.2
5,000	9.3
7,500	9.5
10,000	9.6
15,000	9.7
30,000	9.8

Use linear interpolation for intermediate values.

# Appendix II - Cover Sheet for New York State Stage II System Testing Report

Facility Name:
Address:
Facility PBS Number:
Phone Number:
Contact Person:
Number of Pumps:
Number of Tanks:

**\* Boxes must be checked, sheet must be signed and notarized in order for this document to be valid.**

**Dynamic Back Pressure Test Results**

For all pumps at this facility,

- Water column gauge at a flow rate of 60 ft<sup>3</sup>/hr does not exceed 0.45 inches (passes) AND
- Water column gauge at a flow rate of 100 ft<sup>3</sup>/hr does not exceed 0.95 inches (passes)

**Liquid Blockage Test Results**

For all pumps at this facility,

- Pressure does not exceed 0.03 inches above the dynamic back pressure test results (passes)

**Leak Detection Test Results**

For all tanks at this facility,

- After 5 minutes, from an initial pressure of 10.0" wcg, pressure in all gasoline storage tanks did not fall below the values in Table I of Part 230

Testing Company:	
Address:	
Phone Number:	
Date of test:	
Tests completed by:  _____ <div style="text-align: center;">name</div>  _____ <div style="text-align: center;">signature</div>  _____ <div style="text-align: center;">date</div>	<p style="text-align: center;"><b>ACKNOWLEDGEMENT TO BE COMPLETED BY A NOTARY PUBLIC</b></p> State of _____ County of _____ ss: On this _____ day of _____, 20____ before me personally appeared _____ to me known and known to me to be the same person described in and who executed the foregoing instrument, and _____ he duly acknowledged to me that _____ he executed the same.  _____ <div style="text-align: center;">Notary Public (please sign and affix stamp)</div>

Attach test results to this cover sheet and submit to:

Gary McPherson  
DEC Division of Air Resources  
Bureau of Stationary Sources  
625 Broadway  
Albany, NY 12233-3254

\* Keep copies of test results and this cover sheet at facility for 5 years.