

Source Test Procedure **ST-38**

**GASOLINE DISPENSING FACILITY
STATIC PRESSURE INTEGRITY TEST
ABOVEGROUND VAULTED TANKS**

(Adopted December 21, 1994)

REF: Regulation 8-7-301, 302

L. APPLICABILITY

- 1.1** This test procedure is used to quantify the pressure integrity of any vaulted aboveground storage tanks installed at gasoline dispensing facilities (GDF) equipped with pressure/vacuum (P/V) valves, provided that the designed pressure setting of the valve(s) exceed 2.5 inches of water column (inches H₂O). Excessive leaks in the vapor recovery system will increase the quantity of fugitive hydrocarbon emissions and lower the overall efficiencies of both the Phase I and Phase II vapor recovery systems.
- 1.2** For those systems equipped with a P/V valve(s) allowed to have a designed cracking pressure less than 2.5 inches H₂O, the valve(s) shall be removed and the vent pipe(s) plugged during this test.

2. PRINCIPLE

- 2.1** The entire vapor recovery system is pressurized, with nitrogen, to two (2.0) inches H₂O. The system pressure is then allowed to decay and the pressure after five (5) minutes is compared with an allowable value. This allowable five-minute value is based on the system ullage and pressure decay equations. For the purpose of compliance determination, this test shall be conducted with the Phase I dust cover(s) and containment box cover(s) removed. The test shall be conducted after all Phase I and Phase II components, including P/V valves, have been installed.
- 2.2** For GDF equipped with a coaxial Phase I system, this test shall be conducted at a Phase II riser. For GDF which utilize a two-point Phase I system, this test may be conducted at either a Phase II riser or a Phase I vapor coupler, provided that the criteria set forth in Section 6.9 have been met.

3. RANGE

- 3.1** If mechanical pressure gauges are employed, the full-scale range of the pressure gauges shall be 0-2.0, 0-1.0, and 0-0.50 inches H₂O. Maximum incremental graduations of the pressure gauge shall be 0.05 inches H₂O and the minimum accuracy of the gauge shall be three percent of full scale. The minimum diameter of the pressure gauge face shall be 4 inches.

- 3.2** If an electronic pressure measuring device is used, the full-scale range of the device shall not exceed 0-10 inches H₂O. The minimum accuracy of this device shall be 0.5 percent of full-scale. A 0-20 inches H₂O device may be used, provided the equivalent accuracy is not less than 0.25 percent of full-scale.
- 3.3** The minimum and maximum total ullages shall be 300 and 20,000 gallons, respectively. These values are exclusive of all vapor piping volumes.

4. INTERFERENCES

- 4.1** Introduction of nitrogen into the system at flowrates exceeding five (5) CFM may bias the results toward non-compliance.
- 4.2** For vaulted aboveground tanks equipped with vacuum-assist Phase II systems which utilize an incinerator, power to the collection unit shall be turned off during this test.

5. APPARATUS

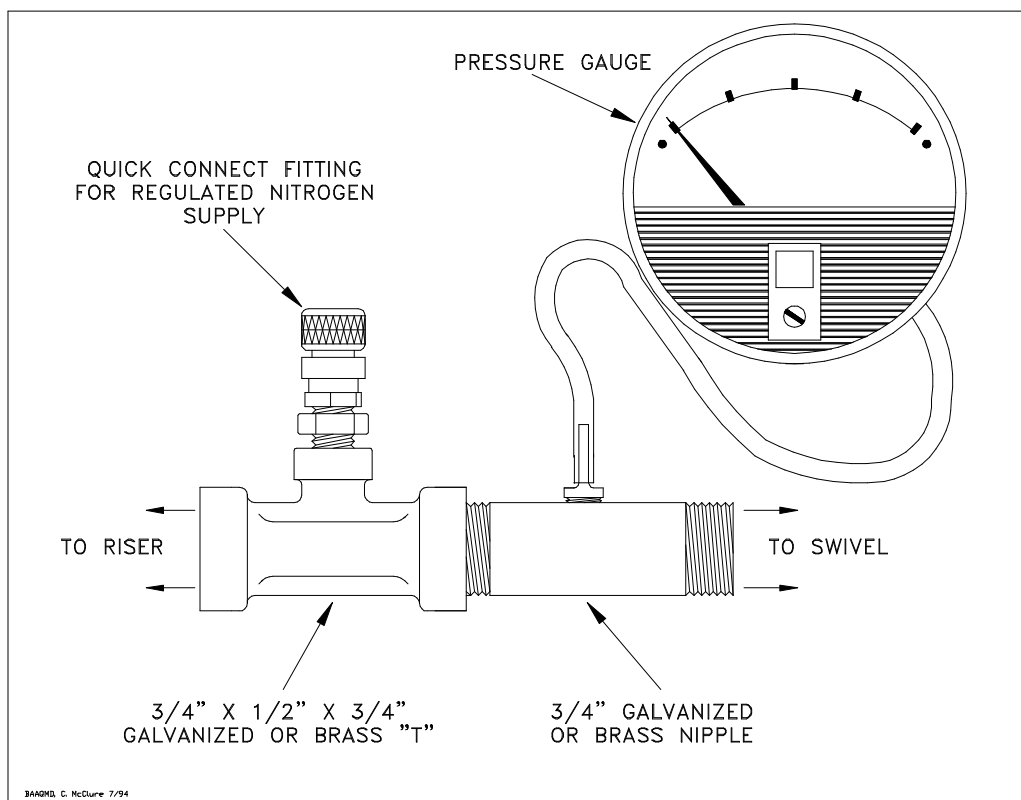
- 5.1** Nitrogen. Use commercial grade nitrogen in a high pressure cylinder, equipped with a two-stage pressure regulator and a one psig pressure relief valve.
- 5.2** Pressure Measuring Device. Use a 0-2.0, 0-1.0, and 0-0.50 inches H₂O pressure gauges connected in parallel, a 0-2.0 inches H₂O manometer, or an electronic pressure measuring device to monitor the pressure decay in the vapor recovery system. The pressure measuring device, at a minimum, shall be readable to the nearest 0.05 inches H₂O.
- 5.3** "T" Connector Assembly. See Figure 38-1 for example.
- 5.4** Vapor Coupler Integrity Assembly. Assemble OPW 633-A, 633-B, and 634-A adapters, or equivalent, as shown in Figure 38-2. If the test is to be conducted at the storage tank Phase I vapor coupler, this assembly shall be used prior to conducting the static leak test in order to verify the pressure integrity of the Phase I vapor poppet. The internal volume of this assembly shall not exceed 0.1 cubic feet.
- 5.5** Vapor Coupler Test Assembly. Use a compatible OPW 634-B cap, or equivalent, equipped with a center probe to open the Phase I poppet, a pressure measuring device to monitor the pressure decay, and a connection for the introduction of nitrogen into the system. See Figure 38-3 for an example.
- 5.6** Stopwatch. Use a stopwatch accurate to within 0.2 seconds.
- 5.7** Flowmeter. Use a Dwyer flowmeter, model RMC-104, or equivalent, to determine the required pressure setting of the delivery pressure gauge on the

nitrogen supply pressure regulator. This pressure shall be set such that the nitrogen flowrate is between 1.0 and 5.0 CFM.

- 5.8** Combustible Gas Detector. A Bacharach Instrument Company, model 0023-7356, or equivalent, may be used to verify the pressure integrity of the system components during this test.
- 5.9** Leak Detection Solution. Any liquid solution designed to detect vapor leaks may be used to verify the pressure integrity of system components during this test.

Figure 38-1

"T" Connector Assembly



6. PRE-TEST PROCEDURES

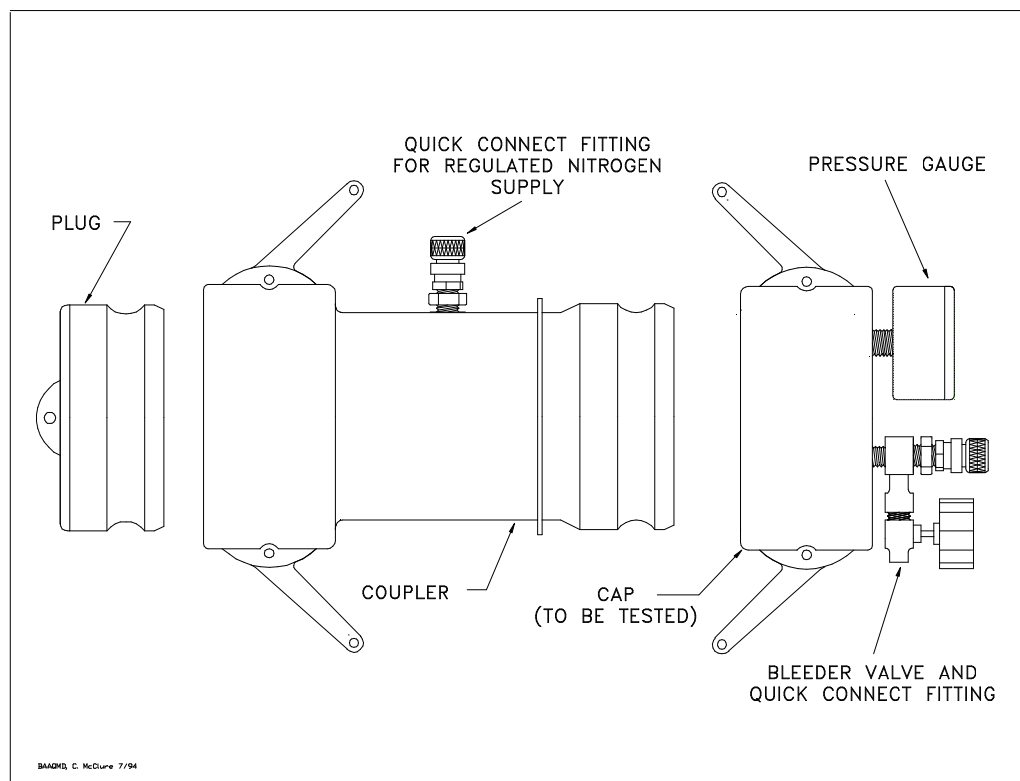
- 6.1** The following safety precautions shall be followed:
- 6.1.1** Only nitrogen shall be used to pressurize the system.
- 6.1.2** A one psig relief valve shall be installed to prevent the possible over-pressurizing of the vapor recovery equipment.
- 6.2** Product dispensing shall not occur during the test. There shall have been no bulk drops into, or out of, the storage tanks within the three hours prior to the

test. For vacuum-assist Phase II systems, product dispensing shall not occur during the thirty minutes immediately prior to the test.

- 6.3** Measure the gallons of gasoline present in each aboveground storage tank compartment and determine the actual capacity of each storage tank compartment. Calculate the ullage space for each tank compartment by subtracting the gasoline gallonage present from the actual capacity. The minimum ullage during the test shall be 25 percent of the tank capacity or 300 gallons, whichever is greater. The total ullage shall not exceed 20,000 gallons.

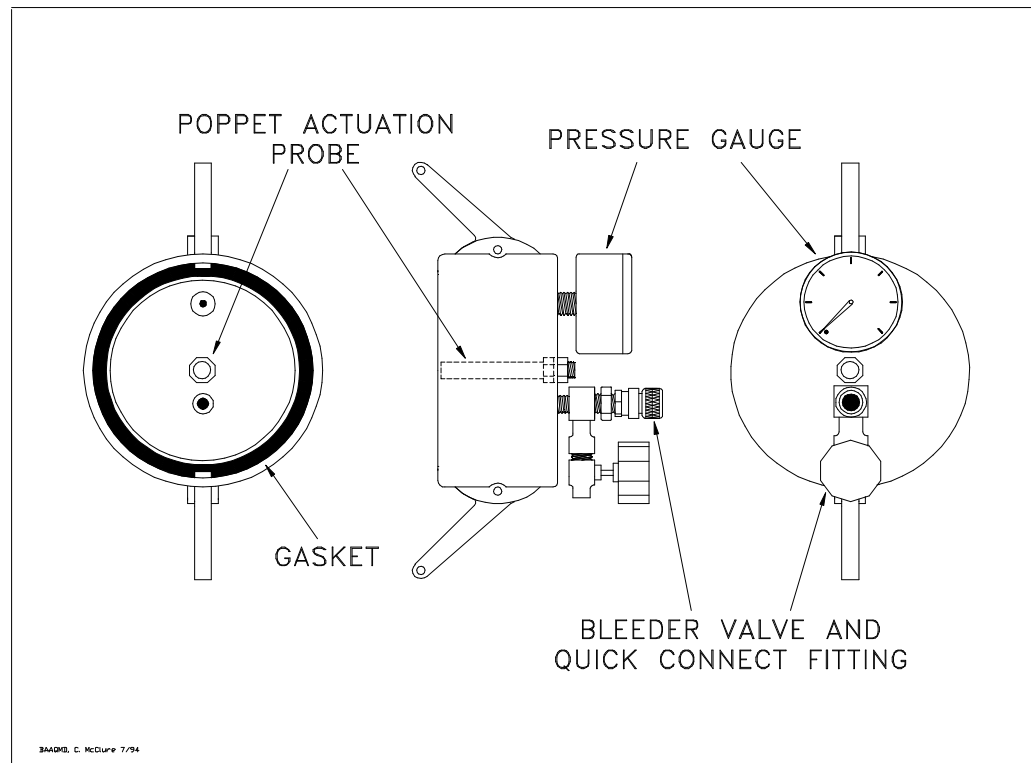
Figure 38-2

Vapor Coupler Integrity Assembly



- 6.4** For two-point Phase I systems, this test shall be conducted with the dust cap removed from the vapor coupler. This is necessary to insure the vapor tightness of the vapor poppet. See Section 6.9 if this test is to be conducted at the Phase I vapor coupler.
- 6.5** For coaxial Phase I systems, this test shall be conducted with the dust cap removed from the Phase I coupler. This is necessary to insure the vapor tightness of the vapor poppet.
- 6.6** Verify that the liquid level in the storage tank is at least four (4) inches above the highest opening at the bottom of the submerged drop tube.

- 6.7** If the Phase I containment box is equipped with a drain valve, the valve assembly may be cleaned and lubricated prior to the test. This test shall, however, be conducted with the drain valve assembly installed. See subsection 7.4.1 for further details regarding containment box drain valves.
- 6.8** If the test is to be conducted at a Phase II riser, disconnect the dispenser end of the vapor recovery hose and install the "T" connector assembly (see Figure 38-1). Connect the nitrogen gas supply (do not use air) and the pressuring measuring device to the "T" connector.

Figure 38-3**Vapor Coupler Test Assembly**

- 6.8.1** For those Phase II systems utilizing a dispenser mounted remote vapor check valve, the "T" connector assembly shall be installed on the vapor riser side of the check valve.
- 6.9** If this test is to be conducted at the Phase I vapor coupler on a two-point Phase I system, the procedures set for in subsections 6.9.1 and 6.9.2 shall be successfully completed prior to the testing. The static pressure integrity test shall not be conducted at the Phase I coupler at facilities equipped with coaxial Phase I systems.
- 6.9.1** Connect the Vapor Coupler Integrity Assembly to the Phase I vapor coupler. Connect the Vapor Coupler Test Assembly. Connect the nitrogen supply to the assembly and carefully pressurize the internal

volume of the assembly to two (2.0) inches H₂O. Start the stopwatch. Record the final pressure after one minute.

- 6.9.2** If the pressure after one minute is less than 0.25 inches H₂O, the leakrate through the Phase I vapor poppet precludes conducting the static leak test at this location. If the pressure after one minute is greater than or equal to 0.25 inches H₂O, the static leak test may be conducted at this location. This criteria assures a maximum leakrate through the Phase I vapor poppet of less than 0.0002 cubic feet per minute.
- 6.9.3** Disconnect the Vapor Coupler Integrity Assembly from the Phase I vapor coupler. If the requirements of subsection 6.9.2 were met, install the Vapor Coupler Test Assembly to the Phase I vapor coupler.
- 6.10** All pressure measuring devices shall be calibrated using either a reference gauge or incline manometer. Calibration shall be performed at 20, 50, and 80 percent of full scale. Accuracy shall be within two percent at each of these calibration points.
- 6.11** Use the flowmeter to determine the nitrogen regulator delivery pressures which correspond to nitrogen flowrates of 1.0 and 5.0 CFM. These pressures define the allowable range of delivery pressures acceptable for this test procedure. Also record which regulator delivery pressure setting, and the corresponding nitrogen flowrate, will be used during the test.
- 6.12** Use Equation 9.2 to calculate the minimum time required to pressurize the system ullage to two inches H₂O. This will allow the tester to minimize the quantity of nitrogen introduced into those systems which cannot meet the static leak standards.
- 6.13** Attach the Vapor Coupler Test assembly to the Phase I poppet or the "T" connector assembly to the Phase II vapor riser. Read the initial pressure of the storage tank and piping. If the initial pressure is greater than 0.5 inches H₂O, carefully bleed off the pressure, in accordance with all applicable safety procedures, in the storage tank and piping to less than 0.5 inches H₂O.

7. TESTING

- 7.1** Open the nitrogen gas supply valve and regulate the delivery pressure to within the allowable range determined in Section 6.11, and start the stopwatch. Pressurize the vapor system (or subsystem for individual vapor return line systems) to **at least 2.2 inches H₂O** 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. Close the nitrogen supply valve and disconnect the nitrogen supply hose.

- 7.1.1** If the time required to achieve a pressure of two (2.0) inches H₂O exceeds twice the time derived from Equation 9.2, stop the test and use liquid leak detector, or a combustible gas detector, to find the leak(s) in the system. Repair or replace the faulty component(s) and restart the test pursuant to Section 7.1.
- 7.2** Start the stopwatch when the pressure has decreased to the initial starting pressure of two (2.0) inches H₂O.
- 7.3** At one-minute intervals during the test, record the system pressure. After five minutes, record the final system pressure. See Equation 9-1 or Table 38-I to determine the acceptability of the final system static pressure results. For intermediate values of ullage in Table 38-1, linear interpolation may be employed.
- 7.4** If the system failed to meet the criteria set forth in Table 38-I (or Equation 9.1), 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(s) and repeat the test. Potential sources of leaks include nozzle check valves, pressure/vacuum relief valves, containment box drain valve assemblies, plumbing connections at the risers, and emergency vents.
- 7.4.1** If the facility fails to comply with the static leak test standards and the Phase I system utilizes a non-CARB-certified drain valve equipped containment box, which was installed prior to July 1, 1992, for which a CARB-certified replacement drain valve assembly is not marketed, the following two subsections shall apply:
- 7.4.1.1** The drain valve may be removed and the port plugged. Retest the system. If the facility complies with the static leak test standards under these conditions, the facility shall be considered complying with the requirements, provided that the manufacturer and model number of the containment box and the date of installation are submitted with the test results.
- 7.4.1.2** The criteria set forth in subsection 7.4.1.1 shall not apply after July 1, 1996.
- 7.6** If the compartments in the vaulted tanks are not manifolded, repeat the test for each of the gasoline compartments. Avoid leaving any vapor return line open longer than is necessary to install or remove the "T" connector assembly.
- 7.7** After the remaining system pressure has been relieved, remove the "T" connector assembly and reconnect the vapor recovery hose, if applicable.

8. POST TEST PROCEDURES

- 8.1** Use Equation 9-1 or Table 38-I to determine the compliance status of the facility by comparing the final five-minute pressure with the minimum allowable pressure. Linear interpolation may be used for intermediate values of ullage in Table 38-I.

9. CALCULATIONS

- 9.1** The minimum allowable pressure after five (5) minutes, with an initial pressure of 2.0 inches H₂O, shall be calculated as shown below, or obtained from Table 38-I:

$$P_5 = 2e^{\left(\frac{-760.49}{V_u}\right)} \quad \text{[Equation 9-1]}$$

where:

- P_5 = The minimum allowable five-minute final pressure, inches H₂O
 V_u = The total ullage affected by the test, gallons
 e = A dimensionless constant approximately equal to 2.718
 2 = The initial starting pressure, inches H₂O
 -760.49 = The decay constant for a 5 minute test

- 9.2** The minimum time required to pressurize the system ullage to one inch H₂O shall be calculated as follows:

$$t_1 = \frac{V}{(1522)F} \quad \text{[Equation 9-2]}$$

where:

- t_1 = The minimum time to pressurize the ullage to two inches H₂O, minutes
 V = The total ullage affected by the test, gallons
 F = The nitrogen flowrate into the system, cubic feet per minute
 1522 = Conversion factor for pressure and gallons

- 9.3** If the policy of the local district requires an allowable tolerance for testing error, the minimum allowable five-minute final pressure, including testing error, shall be calculated as follows:

$$P_{f-E} = 2 - \left[1 + \left(\frac{E}{100} \right) \right] [408.9 - (P_f + 406.9)] \quad \text{[Equation 9-3]}$$

where:

- P_{f-E} = The minimum allowable five-minute final pressure including allowable testing error, inches H₂O
 E = The allowable testing error, percent

- P_f = The minimum allowable five-minute final pressure calculated in Equation 9-1, inches H₂O
- 2 = The initial starting pressure, inches H₂O
- 408.9 = Atmospheric pressure plus the initial starting pressure, inches H₂O
- 406.9 = Atmospheric pressure, inches of H₂O

10. REPORTING

- 10.1** The calculated ullage and system pressures for each five minute vapor recovery system test shall be reported as shown in Form 38-1. Be sure to include the Phase I system type (two-point or coaxial), the Phase II system type, whether the Phase II system is manifolded, and the one-minute pressures during the test.

TABLE 38-I
LEAK RATE CRITERIA
ABOVEGROUND VAULTED TANKS
INITIAL PRESSURE OF 2.0 INCHES OF H₂O

<u>ULLAGE,</u> <u>GALLONS</u>	<u>MINIMUM PRESSURE</u> <u>AFTER 5 MINUTES, INCHES OF H₂O</u>
300	0.16
350	0.23
400	0.30
450	0.37
500	0.44
550	0.50
600	0.56
650	0.62
700	0.67
750	0.73
800	0.77
850	0.82
900	0.86
950	0.90
1,000	0.93
1,100	1.00
1,200	1.06
1,300	1.11
1,400	1.16
1,500	1.20
1,600	1.24
1,700	1.28
1,800	1.31
1,900	1.34
2,000	1.37
2,200	1.42
2,400	1.46
2,600	1.49
2,800	1.52
3,000	1.55
4,000	1.65
5,000	1.72
6,000	1.76
7,000	1.79
8,000	1.82
9,000	1.84
10,000	1.85
15,000	1.90
20,000	1.93

Form 38-1

<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	
GDF Name and Address	GDF Representative and Title	Compartment Size, Gallons	
_____	_____	COMPARTMENT #1	_____
_____	_____	COMPARTMENT #2	_____
_____	GDF Phone No. ()	COMPARTMENT #3	_____
_____	Source: GDF Vapor Recovery System		
Permit Conditions	BAAQMD GDF # _____		
	BAAQMD A/C # _____	Manifolded?	Y or N

Operating Parameters:	
Make and Model of Tank _____	Phase II System Type _____
Number of Gasoline Nozzles _____	Make and Model of P/V Valve _____
Applicable Regulations: BAAQMD REGULATION 8, RULE 7	FOR OFFICE USE ONLY

Source Test Results and Comments:

COMPARTMENT #:	1	2	3	TOTAL
1. Product Grade	_____	_____	_____	_____
2. Actual Compartment Capacity, gallons	_____	_____	_____	_____
3. Gasoline Volume, Gallons	_____	_____	_____	_____
4. Ullage, gallons (#2 -#3)	_____	_____	_____	_____
5. Phase I System Type	_____	_____	_____	_____
6. Initial Test Pressure, Inches H ₂ O (2.0)	_____	_____	_____	_____
7. Pressure After 1 Minute, Inches H ₂ O	_____	_____	_____	_____
8. Pressure After 2 Minutes, Inches H ₂ O	_____	_____	_____	_____
9. Pressure After 3 Minutes, Inches H ₂ O	_____	_____	_____	_____
10. Pressure After 4 Minutes, Inches H ₂ O	_____	_____	_____	_____
11. Final Pressure After 5 Minutes, Inches H₂O	_____	_____	_____	_____
12. Allowable Final Pressure from Table 38-I	_____	_____	_____	_____
13. Test Status [Pass or Fail]	_____	_____	_____	_____

Test Conducted by:	Test Company Name _____ Address _____ City _____	Date and Time of Test:
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