

Standard Operating Procedure No. 37A

Stage I Vapor Recovery

Arizona Department of Agriculture, Weights and Measures Services Division

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Third Revision

Date: 11/18/2021

1. Purpose

The purpose of this procedure is to outline the necessary steps that must be followed by a Weights and Measures Services Division (“WMSD”) Investigator when witnessing compliance tests conducted on Stage I gasoline vapor recovery systems.

2. Stage I Vapor Recovery

Stage I vapor recovery systems (sometimes referred to as “Phase I vapor recovery systems”) are designed to capture gasoline vapors that are displaced from inside a gasoline storage tank when a load of gasoline is transferred from the delivery truck into the storage tank. These systems are mandated at gasoline dispensing sites in [Area A](#) (Phoenix Metro) and [Area B](#) (Tucson). The systems contain gasoline vapors through a series of components including gasoline storage tanks, vapor vent piping, connection ports, and pressure/vacuum “P/V” vent valves. Stage I vapor recovery systems are only intended to release gasoline vapors into the delivery truck when a gasoline delivery occurs, or into the atmosphere if the system pressure goes above a certain limit. In order to effectively contain the gasoline vapors, the Stage I vapor recovery system must be leak-tight and all associated components must operate as intended by design. To verify that a Stage I vapor recovery system is properly installed and operating correctly, compliance tests must be performed on these systems when they are first installed, and annually thereafter (Area A only). Stage I vapor recovery systems are not required for fuels such as diesel or ethanol flex fuel.

Stage I vapor recovery requirements are listed under Arizona Revised Statutes (“A.R.S.”) § 3-3512 and Arizona Administrative Code (A.A.C.) Title 3, Chapter 7, Article 10. The license fee code for Stage I vapor recovery systems is “056” for sites in Area A, and “057” for sites in Area B. In certain cases, exemptions from Stage I vapor recovery requirements are allowed under A.A.C. R3-7-1002.

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3. Witnessed Tests

Stage I vapor recovery compliance tests are conducted by Vapor Recovery Registered Service Representatives (VRRSRs), and witnessed by WMSD Investigators. VRRSRs must possess the necessary equipment to perform the following California Air Resources Board (CARB) test procedures that are adopted under the Arizona Administrative Code:

- TP-201.1E, *Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves*
- TP-201.3, *Determination of 2 Inch WV Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities*
- TP-201.3C, *Determination of Vapor Piping Connections to Underground Gasoline Storage Tanks (Tie-Tank Test)*

Unless specifically stated, CARB test procedures shall be followed in the event of conflicts between this SOP and the test procedure. CARB test procedures may be found at:

<http://www.arb.ca.gov/testmeth/vol2/currentprocedures.htm>

4. Necessary Equipment

In addition to the equipment outlined in SOP No. 13, *Pre-Inspection*, a WMSD Investigator shall have a stopwatch or timer (smartphone timers are acceptable) for the purpose of timing the pressure decay of Stage I vapor recovery systems.

It is the responsibility of the VRRSR to have all of the equipment necessary to conduct the required testing. If the appropriate equipment is not available, or is not calibrated, the test shall be cancelled, and a civil penalty shall be recommended to the VRRSR for violating A.A.C. R3-7-602(A)(1)(b).

5. Initiating the Inspection

Refer to SOP No. 13, *Pre-Inspection*, and SOP No. 12, *Regulatory Bill of Rights*, for guidance when initiating an inspection.

6. System Repairs and Test Cancellations

- a. All allowable repairs must be completed by the VRRSR prior to the start time of the scheduled test.
- b. If the VRRSR must cancel an initial or annual witnessed test less than one hour prior to the scheduled start time, the VRRSR must remain at that location until the WMSD Investigator arrives to review the reason for cancellation and release the location for

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reschedule. If the cancellation is due to a vapor leak, the Investigator shall issue a Stop-Use Order for the vapor recovery system and attach a blue tag to the appropriate tanks. It is the responsibility of the VRRSR to call the Division at 602-542-4373 to notify of the cancellation if the cancellation occurs at least one hour prior to the scheduled start time.

- c. If the VRRSR does not show up for a scheduled test, obtain an inventory report from the tank monitoring system and/or stick the tanks to verify that the fuel level meets the requirements outlined in CARB TP-201.3. Also verify the time of the last fuel delivery to identify if it meets the requirements outlined in CARB TP-201.3. Document any findings in the inspection report.

7. Pre-Test Determinations

- a. Upon arrival at the gasoline dispensing site, the VRRSR shall provide the WMSD investigator with the following information:
 - i. Current tank inventory report (from tank monitor system)
 - ii. Last fuel delivery report (from tank monitor system)
 - iii. Location device license
 - iv. Stage I vapor recovery inspection and maintenance logs for the site

Pictures or scans of the tank inventory and fuel delivery reports shall be uploaded with the final inspection report.

- b. The WMSD Investigator shall compare the tank information on the inventory report with the information recorded in the Compliance Tracking Unit (CTU) database. If there are any discrepancies, the WMSD Investigator shall contact the WMSD Compliance Manager for guidance.
- c. If this is the initial inspection for a newly installed or modified Stage I vapor recovery system, the WMSD Investigator shall review to the ATC plan approval records for the site that are housed on Google Drive at the following location:

WMSD-Mgmt > ATC

ATC files are organized by the location's BMF number, followed by the vapor record number. Compare the ATC plan approval with the actual installation. If there are any discrepancies, the WMSD Investigator shall contact the WMSD Compliance Manager for guidance.

- d. The WMSD Investigator may request to see the VRRSR's license to verify that it is valid and permits them to conduct the annual or initial test for the vapor recovery system.

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- e. The WMSD Investigator will verify that the test equipment used by the VRRSR is correct and has been calibrated as required by A.A.C. R3-7-602(A)(3) and CARB test procedures.
- f. The WMSD Investigator shall verify that no gasoline deliveries have occurred within 3 hours prior to the start of the inspection.
- g. The WMSD Investigator shall verify that no gasoline sales have occurred at least 30 minutes prior to the start of the test procedures. Gasoline shall not be dispensed at the test location at any time during the test procedures. If gasoline dispensing occurs, the WMSD Investigator shall ensure that all gasoline dispensers are secured from customer use before restarting the 30 minute countdown prior to the start of the test procedures.
- h. 20 minutes prior to the start of testing, the electronic manometer shall begin warming up. The electronic manometer shall have a warm-up period of 15 minutes, followed by a 5 minute drift check. If the drift exceeds 0.01 inches H₂O, the instrument shall not be used. The manometer shall be warmed up in a location with consistent temperatures that will be observed during testing (i.e. the manometer shall not be maintained in an air conditioned vehicle during warm up and then introduced to warmer temperatures during the test).
- i. Test equipment shall meet the range, sensitivity, and precision as indicated in the test procedures (TP-201.3, section 3 and TP-201.1E, section 4). Equipment shall be calibrated at least one time every 6 months and the calibration certification shall be maintained on site with the VRRSR as well as provided to the State Metrology Laboratory.
- j. The WMSD Investigator shall calculate the tank capacity and ullage based on the tank monitor report, and record these values in the inspection report.

CALCULATION:

Fuel volume (**V**) subtracted from tank capacity (**C**) equals ullage (**U**)...

$$(C - V = U)$$

The tank ullage must meet the following requirements:

- a. Minimum total ullage for each individual tank must be 1,000 gallons or 25% of the tank capacity, whichever is less.
- b. A maximum combined ullage of 25,000 gallons.

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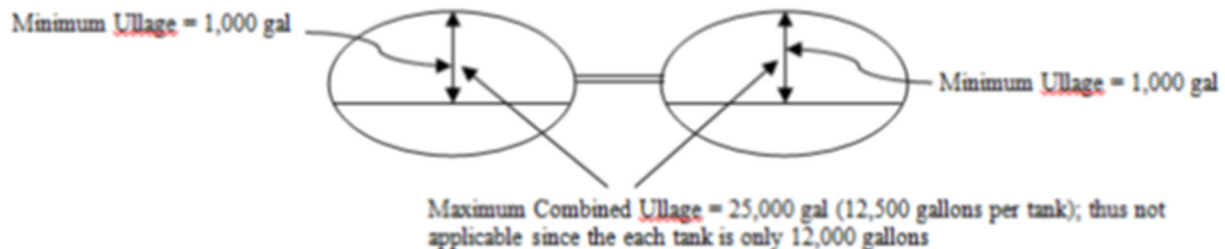
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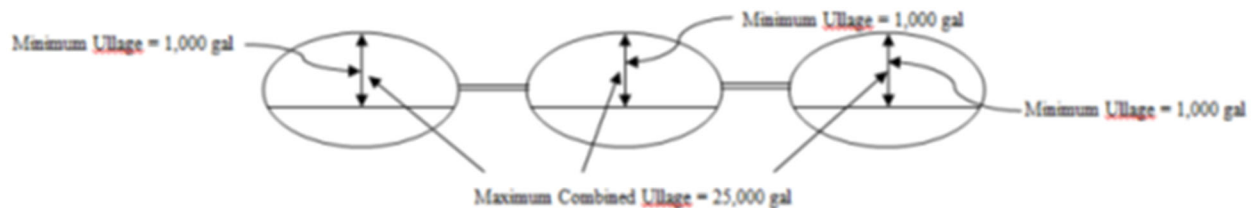
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Example: Site with 2 \square 12,000 gallon manifolded tanks:



Example: Site with 3 \square 30,000 gallon manifolded tanks:



Once the tank ullage has been obtained, refer to the last page of this document or Table 1 in A.A.C. Title 3, Article 10 to determine the allowable pressure decay rate for the vapor recovery system. You will need this decay rate for the Pressure Decay Test TP \square 201.3. **DO NOT** use the pressure decay table provided in CARB TP-201.3.

8. Component Inspection

- a. The WMSD Investigator shall check the product fill tube (drop tube) length at each gasoline product storage tank. The distance between the bottom of the product storage tank and the bottom of the product fill tube at its highest point may not be greater than 6 inches. If the measured distance is greater than 6 inches, a Stop Sale-Stop Use Order shall be issued. If this is found during a test that is not witnessed by WMSD, the VRRSR shall stop gasoline sales and notify WMSD of the issue.
- b. During a witnessed test, the WMSD Investigator will examine the tanks for fuel levels, water content, and drop tube length. This examination must be performed with no pressure introduced into the tanks. Physically "stick" the tanks using water finding paste to check for water content and to obtain fuel volume levels. Record liquid volume amount and stick readings in the inspection report. If any water content is discovered as a result of this examination, the WMSD Investigator shall open a fuel quality inspection and issue a Stop Sale-Stop Use Order if the gasoline is oxygenated. If the gasoline or

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other fuel product is not oxygenated, a Stop Sale-Stop Use Order shall be issued only if the water level exceeds 1 inch.

- c. The WMSD Investigator shall verify that the liquid level in the storage tank is at least 4 inches above the highest opening at the bottom of the submerged product fill tube.
- d. The WMSD Investigator shall ensure that the P/V Vent Valve risers are painted to meet the requirements of A.A.C. R3-7-1004(D)(13) (55% or greater reflectivity). Note that some sites may have vent risers installed on top of the fuel station canopy. In this case, WMSD Investigators shall attempt to perform a visual inspection of the P/V Vent Valve risers from the ground.
- e. The WMSD Investigator shall ensure that all installed equipment meets the CARB requirements for the approved vapor recovery system. Site components that differ from the site's vapor record shall be updated in the CTU database.

9. CARB TP-201.1E (P/V Vent Valve Test)

- a. The Pressure/Vacuum (P/V) Vent Valves shall be removed from the vent risers by the VRRSR and tested prior to conducting the Pressure Decay Test. The VRRSR is allowed to clean the interior and exterior surfaces of the P/V Vent Valve in accordance with manufacturer instructions before placement on the test stand. Prior to testing, Investigators shall verify that all surfaces of the P/V Vent Valve are dry and free of soap or oils. If the VRRSR attempts to test a P/V Vent Valve that is not completely dry, the Investigator shall immediately fail the test for that P/V Vent Valve.
- b. The P/V Vent Valve shall be tested following CARB TP 201.1E to verify that the pressure, vacuum, and leak rates are within the following CARB limits:
 - 2.5 to 6.0 inches H₂O Positive Cracking Pressure
 - 6.0 to 10.0 inches H₂O Negative Cracking Vacuum
- c. The following leak rates are applicable as a combined leak rate for the entire vapor recovery system (e.g. if there are 3 P/V Vent Valves for the vapor system, the total leak rate for all three P/V Vent Valves must meet the following limits):
 - Leak rate at +2.0 inches H₂O ≤ 0.17 CFH
 - Leak rate at -4.0 inches H₂O ≤ 0.63 CFH
- d. Test results shall be documented on the form for recording the Pressure/Vacuum Vent Valve Test using TP 201.1E. If a P/V Vent Valve cannot meet these requirements, note the failure on the inspection form, document this failure on the original inspection in

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CTU and recommend a civil penalty. If the VRRSR has an extra P/V Vent Valve available (usually new out of the box), they may test this P/V Vent Valve to see if it meets the requirements and is suitable for replacement of the non-compliant P/V Vent Valve. In this case, create a re-inspection for the same date and time and document the results for the replacement P/V Vent Valve on the re-inspection form. If the replacement P/V Vent Valve passes the test, it may be installed on the vent riser.

If no replacement P/V Vent Valve is available at the time of the test, issue a blue tag and Stop Sale-Stop Use Order for the associated vapor recovery system and note that a re-inspection and passed test of a replacement P/V Vent Valve will be required to allow the vapor recovery system to resume operation.

NOTE: If the VRRSR tests a new “out of the box” P/V Vent Valve, and this valve fails the test, the WMSD Investigator shall follow the procedure noted in section “d” with the exception of recommending a civil penalty. In addition, an email shall be sent to **dwm@azda.gov** providing notification of the new P/V Vent Valve failure along with the make and model information of the non-compliant valve.

- e. The P/V Vent Valves shall be re-installed by the VRRSR following a pass result for TP-201.1E, prior to conducting the Pressure Decay Test.

10. CARB TP-201.3 (Pressure Decay Test)

NOTE: For the purposes of this test, “stabilized” is defined as a measured pressure fluctuation of no more than +/- 0.02 inches H₂O over a period of 30 seconds.

- a. The introduction of nitrogen for the Pressure Decay Test shall begin within 30 minutes of the scheduled test time. **NO REPAIRS** shall be made after the start of the inspection.
- b. If the spill containment bucket is equipped with a drain valve, the test shall be conducted with the drain valve installed and the manhole cover removed.
- c. Before introducing nitrogen into the product storage tank(s), ensure that the headspace pressure in the tank(s) is below 0.50 inches H₂O. If the headspace pressure measures greater than 0.50 inches H₂O, the pressure shall be carefully relieved in accordance with all safety requirements and CARB test procedures. The headspace pressure shall only be relieved through a small relief valve.

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- d. The Pressure Decay Test shall be performed with all gasoline fill tube and vapor recovery dust caps removed, and the P/V Vent Valve(s) installed on the riser(s) in accordance with CARB TP 201.3.
- e. The WMSD Investigator shall ensure a zero ("0.00") reading on the manometer prior to the start of pressurization and at the end of the test.
- f. At the start of the scheduled test time or at a time mutually agreed upon with the WMSD Investigator, the VRRSR may start introducing nitrogen into the vapor recovery system. Nitrogen shall be introduced into the system at a constant flow rate between 1 and 5 cubic feet per minute (CFM). This rate shall be verified by the WMSD Investigator by observing the air flow meter/rotameter installed on the nitrogen tank.
- g. The VRRSR shall pressurize the tank(s) to 2.0 inches H₂O while the WMSD Investigator measures the initial pressurization time calculated using Equation 9.3 found in TP 201.3.

Equation 9.3:

$$\frac{V}{(1522) F} = t_2$$

Where...

- **V** = The total ullage affected by the test (gallons)
- **F** = The nitrogen flowrate into the system as measured in the air flow meter/rotameter (CFM)
- **1522** = The conversion factor for pressure and gallons (multiply this number by the flow rate)
- **t₂** = The minimum time to pressurize the ullage to two inches H₂O (minutes)

Example:

Total ullage (**V**): 19000 gallons

Nitrogen flowrate (**F**): 2.5 CFM

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For this example the equation should look like...

$$\frac{19000}{(1522) 2.5} = t_2$$

$$1522 \times 2.5 = 3805$$

$$\frac{19000}{3805} = 4.9934297$$

The result of the example equation shows that the pressure reading should reach 2.0 inches H₂O in approximately 5 minutes (when rounding 4.99 to 5) by introducing nitrogen at a constant rate of 2.5 CFM into a vapor recovery system with 19,000 gallons of ullage.

NOTE: The initial pressurization time to reach 2.0 inches H₂O shall not exceed twice the calculated initial pressurization time. Using our example equation from above where the initial pressurization time is approximately 5 minutes, the WMSD Investigator shall multiply this value by 2 to obtain our maximum time to achieve system pressurization to 2.0 inches H₂O.

Equation Continued...

$$5 \times 2 = 10$$

Therefore, if it takes more than 10 minutes to pressurize the vapor recovery system to 2.0 inches H₂O at a constant flow rate of 2.5 CFM, this demonstrates the inability of the vapor recovery system to meet the performance criteria. In this situation, the WMSD Investigator shall stop the Pressure Decay Test, document the initial failure in the inspection report, and direct the VRRSR to investigate for possible leaks and/or faulty components. If the VRRSR is able to identify and correct a leak and/or faulty component within a reasonable time frame (approximately 30 minutes), the Pressure Decay Test shall be restarted. If the VRRSR is unable to identify a leak and/or faulty component, the Pressure Decay Test may be restarted. If the restarted test fails to achieve a pressure of 2.0 inches H₂O in the allowable time frame, attempt to complete the remaining portion of the Pressure Decay Test with the knowledge that leak tightness integrity of the vapor recovery system may be compromised, which could adversely affect the final test results.

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- h. If the initial pressurization time does not exceed twice the time derived from Equation 9.3, the VRRSR shall continue to pressurize the tank(s) to at least 2.2 inches H₂O, and maintain nitrogen flow until the pressure stabilizes.
- i. After the pressure has stabilized at 2.2 inches H₂O, the VRRSR shall carefully bleed the system pressure down to 2.0 inches H₂O. This pressure shall only be relieved through a small relief valve.
- j. Once the pressure has stabilized at 2.0 inches H₂O, the WMSD Investigator will start the stopwatch or timer for the 5 minute pressure decay countdown.
- k. At the 5 minute mark the WMSD Investigator shall record the pressure reading shown on the manometer. This reading shall be compared with the allowable decay rate based on system ullage that was obtained prior to the start of the Pressure Decay Test. If the final system pressure value is higher than the allowable final pressure result, the test passes. If the final system pressure value is lower than the allowable final pressure result, the test fails and the WMSD Investigator shall issue a blue tag and a Stop Sale-Stop Use Order for the associated vapor recovery system
- l. **NOTE:** *This portion of the procedure will be done in conjunction with the Tie Tank Test below:*

Upon successful completion of the Pressure Decay Test the VRRSR shall check the dry breaks to ensure leak tightness integrity. This will be determined by quickly depressing and releasing the plunger and testing the seal with a soapy water solution. The soapy water solution will bubble around any areas where a vapor leak is present. If a leak is identified, the dry break shall be tested no more than 3 times (2 additional after the initial test), before it is considered defective. If the dry break fails, the WMSD Investigator shall issue a Stop-Use Order for the component and associated system, and the defective dry break must be repaired or replaced. After repair or replacement occurs, the Pressure Decay Test procedure must be repeated to test the leak-tightness integrity of the vapor recovery system with the newly repaired or replaced component installed. If the repair/replacement and a re-test can be completed in a reasonable amount of time, the WMSD investigator may create a re-inspection for the same date and time to document the test of the repaired vapor recovery system. If the repair cannot be completed in a reasonable amount of time, a re-test shall be scheduled at a later date and time, and WMSD shall be notified of any repairs and/or re-tests in accordance with A.A.C. R3-7-1010.

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11. CARB TP-201.3C (Tie-Tank Test)

NOTE: This test procedure only applies if there is more than one gasoline storage tank at the site.

- a. After successful completion of the Pressure Decay Test, the VRRSR shall leave the manometer connected to the vapor recovery dry break.
- b. At the instruction of the WMSD Investigator, the VRRSR will depress the vapor recovery dry break starting at a tank other than the one where the nitrogen was introduced during the Pressure Decay Test.
- c. The WMSD Investigator will observe the pressure readings on the manometer as the VRRSR depresses each dry break. If there is a similar release of pressure as each dry break is depressed, the tanks are adequately manifolded.
- d. If the pressure gauge indicates a minimal drop or no drop in pressure, the tanks are not manifolded and a separate Pressure Decay Test shall be performed on each non manifolded tank.
- e. If the tanks are not manifolded, the WMSD Investigator shall perform new ullage and pressure decay calculations for the tank involved in the initial Pressure Decay Test to ensure that the measured 5 minute decay rate is not lower than the allowable decay rate based on the ullage of that single tank. Ullage and allowable decay rate determination shall also be performed for each subsequent Pressure Decay Test for each of the remaining non manifolded tanks.
- f. The WMSD Investigator shall verify that the vapor recovery system is accurately described on the CTU vapor record for the site (e.g. tanks are listed as manifolded, but are not manifolded or vice versa).

12. Enforcement Guidelines

- a. During a witnessed test, any documented failure during the Pressure Decay Test will result in the issuance of a blue tag and Stop-Sale Stop-Use Order in order to prevent fuel deliveries if the vapor recovery system is unable to be repaired and retested. The product fill tube(s) associated with the vapor recovery system shall be placed out of service. The blue tag does not prohibit gasoline sales at a Stage I vapor recovery site.
- b. During a witnessed test, if any failure occurs that results in immediate repair or replacement of a component and/or a re-test that is performed within a reasonable

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amount of time, the WMSD Investigator shall document a failure with the appropriate violation code and citations on the original inspection and close this inspection. The WMSD Investigator shall then create an immediate re-inspection for the same date and time to document the re-test. This procedure must occur to allow the final pass result to be documented in the CTU database.

- c. In the event of a failure that occurs during a test not witnessed by WMSD, it is the responsibility of the VRRSR to place the system or component out of service until it can be repaired, retested, and send in the appropriate test report (including results), along with a Placed-in-Service Report to the Department. The VRRSR shall notify the Department as required under A.A.C. R3-7-602(B)(2).
- d. If a location has not passed the required vapor recovery test procedures by the last day of the assigned test month, a Stop-Sale, Stop-Use order shall be issued for the associated gasoline vapor recovery system. A blue tag shall be attached to the fill port of the storage tank in a manner to prevent future fuel deliveries. The location may continue the sale of the existing gasoline products until these product are depleted. Once the products are depleted, the location shall not receive new gasoline deliveries or sell additional gasoline product until the location passes the required vapor recovery test procedures. The location shall contact WMSD at the dwm@azda.gov email address or (602) 542-4373 phone number to coordinate corrective actions such as scheduling a vapor recovery test.
- e. Inform the location they shall contact WMSD for authorization to remove the blue tag to receive fuel deliveries for testing purposes. Notify the site a test shall be conducted within 24 hours of the fuel delivery, and that sales of the delivered gasoline product shall not occur until the location passes the required vapor recovery test procedure.

13. Post Inspection

Refer to SOP No. 14, *Post-Inspection*, for guidance.

Please contact your supervisor in any case of doubt or uncertainty.

X *Kevin Allen*

Kevin Allen

Associate Director, AZDA-WMSD

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Table 1. Acceptability of Final System Pressure Results for Systems Tested Using TP-201.3

| <u>Ullage (gallons)</u> | <u>Minimum Pressure after Five Minutes (Inches Water Column)</u> |
|-------------------------|--|
| <u>500</u> | <u>0.73</u> |
| <u>550</u> | <u>0.80</u> |
| <u>600</u> | <u>0.87</u> |
| <u>650</u> | <u>0.93</u> |
| <u>700</u> | <u>0.98</u> |
| <u>750</u> | <u>1.03</u> |
| <u>800</u> | <u>1.07</u> |
| <u>850</u> | <u>1.11</u> |
| <u>900</u> | <u>1.15</u> |
| <u>950</u> | <u>1.18</u> |
| <u>1000</u> | <u>1.21</u> |
| <u>1200</u> | <u>1.32</u> |
| <u>1400</u> | <u>1.40</u> |
| <u>1600</u> | <u>1.46</u> |
| <u>1800</u> | <u>1.51</u> |
| <u>2000</u> | <u>1.56</u> |
| <u>2400</u> | <u>1.62</u> |
| <u>2600</u> | <u>1.65</u> |
| <u>2800</u> | <u>1.67</u> |
| <u>3000</u> | <u>1.69</u> |
| <u>3500</u> | <u>1.73</u> |
| <u>4000</u> | <u>1.76</u> |
| <u>4500</u> | <u>1.79</u> |
| <u>5000</u> | <u>1.81</u> |
| <u>6000</u> | <u>1.84</u> |
| <u>7000</u> | <u>1.86</u> |
| <u>8000</u> | <u>1.88</u> |
| <u>9000</u> | <u>1.89</u> |
| <u>10000</u> | <u>1.90</u> |
| <u>15000</u> | <u>1.93</u> |
| <u>20000</u> | <u>1.95</u> |
| <u>25000</u> | <u>1.96</u> |