

**SEMATECH Provisional Test Method
for Determining the Seat Leakage of
Control Valves Used in UPW
Distribution Systems ("Bubble Leak"
Detection Method)**

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Technology Transfer # **92010946B-STD**

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Abstract: The purpose of this test method is to provide a uniform procedure for determining the sealing characteristics across the internal sealing area (seat) of plastic valve products used in ultrapure water (UPW) distribution systems. This document is in development as an industry standard by Semiconductor Equipment and Materials International (SEMI). When available, adherence to the SEMI standard is recommended.

Keywords: Ultrapure Water Distribution Systems, Testing, Plastic Valves, Leakage, Seals

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SEMASPEC #92010946B–STD

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1. Introduction

1.1 *Purpose*—The purpose of this test method is to provide a uniform procedure for determining the sealing characteristics across the internal sealing area (seat) of plastic valve products used in ultrapure water (UPW) distribution systems.

1.2 *Scope*

1.2.1 This method is applicable to products in which all parts in contact with the fluid are constructed of plastic materials.

1.2.2 This method is designed for evaluation of internal seat leakage characteristics only.

1.3 *Limitations*

1.3.1 This method is intended only for new components to be used in ultrapure water without oxidants.

1.3.2 It is not within the scope of this document to evaluate fittings, tubing, or piping products, unless these products are an integral part of the component being evaluated.

1.3.3 This method is not applicable to external seat leakage characteristics.

2. Referenced Documents

2.1 *ANSI Standards*¹

ANSI 70-2	Quality Control Standard for Control Valve Seat Leakage ²
ANSI B16.34	Valves – Flanged, Threaded, and Welding End
ANSI B16.37	Hydrostatic Testing of Control Valves
ANSI B93.112M	Hydraulic Fluid Power – Valves – Method for Determining the Internal Leakage Characteristics

2.2 ASTM D5127 Standard Guide for Electronic Grade Water³

3. Terminology

3.1 *low surface tension fluid*—liquid with a surface tension less than 28 dynes per centimeter.

¹ American National Standards Institute. 1430 Broadway. New York, NY 10018.

² This standard is copyrighted by Fluid Controls Institute, Inc.

³ American Society for Testing and Materials. 1916 Race St. Philadelphia, PA 19103.

3.2 *submersion container*—a transparent container filled with a low surface tension liquid at $23 \pm 3^\circ\text{C}$, used for observing leakage.

3.3 *ultrapure water (UPW)*—type E-1 electronic grade water as defined in ASTM D5127.

3.4 *valve seat*—the internal sealing area of a valve, either seat or interference fit valve design.

4. **Summary of Test Method**

This test method consists of submerging a tube end into a liquid at a specified angle and depth while observing for bubble leakage. The tube is connected to the port of a valve in order to evaluate the internal sealing characteristics of the valve seat.

5. **Significance and Use**

5.1 This method may be used to obtain repeatable results when verifying the sealing capabilities of the internal seat area of various valve products.

5.2 This method is applicable to the qualification and quality control of new products.

5.3 The results obtained when using this method are applicable only to conditions that specifically duplicate the procedure used within this document.

5.4 When this method is used, it is assumed that the test specimens are truly representative of the material and manufacturing process specified for that product. Departure from this assumption could introduce discrepancies that are greater than those introduced by departure from the details of the procedure outlined in this method.

6. **Apparatus**

6.1 *Clean, Oil-Free, Air or Nitrogen Source*, capable of supplying the maximum rated pressure of the valve, filtered in accordance with manufacturer's recommendations.

6.2 *Pressure-Monitoring Device*, capable of measuring pressure to within $\pm 1\%$ of full scale.

6.3 *Air Pressure Regulator*, relieving type.

6.4 *Tube Size*. Consult the manufacturer for appropriate tube I.D. dimensions.

6.5 *Water Container*. Use a submersion container that allows visual observation of bubbles.

7. **Materials**

7.1 *Clean, Oil-Free Air or Nitrogen*.

7.2 *Test Media*, low surface tension liquid.

8. **Precautions**

8.1 *Safety Precautions*

8.1.1 This test method may involve hazardous materials, operations, and equipment. This test method does not purport to address the safety considerations associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before using this method.

8.1.2 **Warning:** This method involves pressurizing components with compressed air. Adequate precautions must be taken to prevent injury to the person conducting the test.

9. Sampling and Test Specimens

- 9.1 *Specimen Design and Composition*—Specimens shall consist of complete assemblies without modifications.
- 9.2 *Specimen Fabrication*—Specimens are to be assembled per the manufacturer's recommended assembly procedures.
- 9.3 *Sample Size*
- 9.3.1 A minimum of three specimens shall be tested for qualification and general product evaluation purposes.
- 9.3.2 The number of valves to be evaluated for quality control purposes is to be determined according to quality assurance guidelines.

10. Conditioning

- 10.1 This method is intended to be used with product and fluid at $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$).
- 10.2 All specimens must be conditioned for a minimum of one hour in an external air environment of $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$) prior to exposure to the test fluid.
- [Note: Unless the specimen undergoes a change of temperature (e.g., fusion or flaring), the conditioning may be satisfied by the length of time the specimen has been stored at room temperature conditions.]
- 10.3 When conducting the test, maintain the ambient temperature around the specimen at $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$).

11. Procedure

- 11.1 Connect the test specimen to the regulated air supply. Note on the test report which port is being pressurized.
- [Note: In most cases, the connection will be made at the inlet side of the specimen; however, in some cases, depending on the component being evaluated or on the product requirements, the air supply may be connected to another port.]
- 11.2 Actuate the valve several times before supplying inlet pressure to the component.
- [Note: In the case of components such as check valves, which cannot be remotely opened and closed, the above statement does not apply.]
- 11.3 With the valve in the closed position, pressurize the test (inlet) port to the maximum rated pressure.
- 11.4 Actuate the valve several times with the test port pressurized and the outlet port open to atmosphere.
- 11.5 With the seat closed, connect a tube to the outlet port.
- 11.6 Submerge the end of the tube into a submersion container. See Figure 1 for a typical submersion fixture.

- 11.6.1 The angle of the tube must be less than 85° from the surface of the liquid.
[Note: The angle must remain constant for consistent results and must be indicated in the test data throughout each test.]
- 11.6.2 The tube depth must be a minimum 1 ± 0.3 cm from the surface of the liquid. The depth must remain constant and be reported on the data sheet for each test.
- 11.7 Ensure that no liquid is inside the tube; presence of liquid will restrict the passage and incorrect data may be obtained.
- 11.8 Consult the manufacturer for the recommended test pressure profile.
- 11.9 Monitor the immersed end of the tube and record results in bubbles per minute. The test report should indicate the number of bubbles observed over a fixed period of time.

12. Data Presentation

- 12.1 *Test Data Sheet*—The report shall include the following information:
- 12.1.1 Date Tested.
- 12.1.2 Test Objective.
- 12.1.3 Test Parameters, including test pressure profile and port(s) that were evaluated.
- 12.1.4 Test Results, including all observations.
- 12.1.5 Description of Items Tested
- 12.1.6 Test Conclusions.
- 12.1.7 Deviations, to the test method or specimens tested, in appropriate detail. Any material deviations or modifications to the assembly are to be noted in the report, including a complete description of the alterations made to the product.

13. Precision and Bias

- 13.1 The precision of the procedure in SEMASPEC #92010946B–STD for determining the sealing characteristics across the internal sealing area (seat) of plastic valve products is being determined.
- 13.2 Bias of the procedure in SEMASPEC #92010946B–STD for determining the sealing characteristics across the internal sealing area (seat) of plastic valve products is being determined.

14. Illustrations

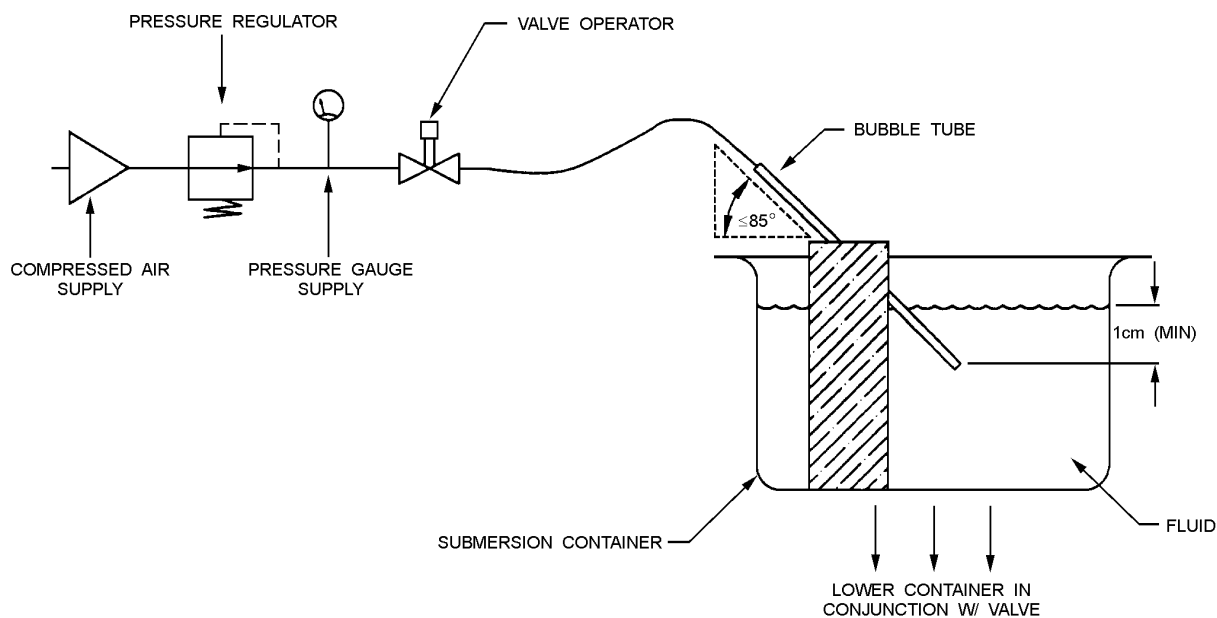


Figure 1 Typical Tube Submersion Fixture

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