



**National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory**

Procedure No. NPPTL-APR-STP-0014

Revision: 2.0

Date: August 18, 2025

**DETERMINATION OF LEAKAGE OF DRINKING TUBE AND ACCESSORIES
FOR RESPIRATOR FACEPIECES
STANDARD TESTING PROCEDURE**

1. PURPOSE

This document establishes the procedure for ensuring that the level of protection provided by the leakage of drinking tube and accessories test requirements on respirator facepieces submitted for Approval, Extension of Approval, or examined during Certified Product Audits, meets the minimum certification standards set forth in 42 CFR Part 84 Subpart K, Section 84.171(f).

2. GENERAL

This standard testing procedure (STP) describes the named procedure in sufficient detail that a person knowledgeable in the appropriate technical field can select equipment with the necessary resolution, conduct the test, and determine whether or not the product passes the test, and create a record of those results, reporting the measurements obtained in a preestablished, standard format.

3. EQUIPMENT/MATERIALS

- 3.1. Vacuum Source: Capable of supplying a steady negative gauge pressure of 102 millimeters of water (mmH₂O), or 4 inches of water (inH₂O).
- 3.2. Manometer: Meriam, model Z10AA25WM, or equivalent. U-tube style manometer, with a 6 inch (in.) scale in 0.1 in. increments.
- 3.3. Airflow calibrator: Sensidyne, Gilibrator-2 Primary Calibrator System, or equivalent. Range of 1-250 milliliters per minute (mL/min). Accuracy of ± 1.0 percent (%) of reading. NOTE: The Gilibrator system requires Bubble Generator Soap Solution, p/n 800450.
- 3.4. Test fixture: A custom holder or fixture to seal the drinking tube assembly in the proper position while the vacuum is applied. This holder is not specific and may be modified with each valve design submitted. Generic laboratory funnels are typically used for this purpose, where the funnels may be in various sizes (dependent on size of the drinking tube assemblies) that accommodate the drinking tube assembly in a manner allowing an airtight seal to be achieved around its perimeter.
- 3.5. Hot melt glue: 3M, model 3764, or equivalent. With compatible hot melt glue gun.
- 3.6. Hot plate: Thermo Scientific, model HPA1915BQ, or equivalent.
- 3.7. Beaker, stainless steel: Medegen, model 95160, or equivalent.
- 3.8. Tubing: Generic brand appropriate for laboratory use. Nominal 0.25 in. inner diameter. Suitable for use with a pinch clamp for flow stoppage.

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- 3.9. Beeswax, natural.
- 3.10. Caulking cord: Mortite, grey, or equivalent.
- 3.11. Vacuum bottle: Generic brand, approximately 0.5 gallons, suitable for a minimum of 4 inH₂O vacuum. Bottle has been modified to have three 0.25 in. tubing bulkhead ports for connection to the vacuum source, air inlet valve, and tubing to rest of system.
- 3.12. Various general lab supplies, as needed: Equipment may include hose clamps, eye droppers, flux brush, tubing connectors, and tube fittings.

4. TESTING REQUIREMENTS AND CONDITIONS

- 4.1. Equipment shall be operated and calibrated in accordance with the testing laboratory's operation and calibration procedure(s) or the manufacturer's operation and maintenance manual(s). All measuring equipment utilized for this testing should have been calibrated using a method traceable to the National Institute of Standards and Technology (NIST), when available.
- 4.2. Normal laboratory safety practices must be observed. Refer to Safety Data Sheets (SDS) for the proper protection and care in handling, storing, and disposing of the chemicals and gases used in this procedure. All applicable local, state, and federal regulations for the safe handling and use of hazardous substances shall be followed.

5. PROCEDURE

- 5.1. Each drinking tube valve design subjected to testing requires three individual drinking tube assemblies for testing.
 - 5.1.1. Items submitted for testing may be individual drinking tube valve assemblies or complete respirators. It is acceptable to remove the drinking tube valve assemblies from a complete respirator, using care not to distort the drinking tube assemblies.
- 5.2. Position and seal the drinking tube assembly in the test fixture. If available, a test fixture provided by the applicant may be used. Typically, a test fixture is fashioned by seating the drinking tube valve assembly in a funnel and sealing using beeswax, window caulking, and/or hot-melt glue. A second funnel is attached to the first funnel using beeswax or hot-melt glue to seal the assembled test fixture. It is important to make sure that neither the funnels nor supplied test fixtures distort or cover the drinking tube assembly and will not interfere with the operation of the valve itself. NOTE: NIOSH will not be obligated to use applicant supplied test fixtures for approval testing. Applicant supplied test fixtures must be correlated with the NIOSH test method.
- 5.3. Set up test equipment as shown in Attachment A: Drinking Tube Valve Holder Assembly and Bench Top Set-Up. Further details are described in Attachment B: Description of Schematic Diagram of the System. NOTE: The numbers shown and described in Attachment A and Attachment B are repeatedly referenced in this document.

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- 5.3.1. If necessary, the airflow calibrator, item 10, and test fixture, item 8, may be switched in the sequence to accommodate unusual drinking tube assemblies.
- 5.4. Seal the drinking tube valve assembly in the test fixture in the same orientation as the normal operating position of the drinking tube in the facepiece when worn.
- 5.5. If necessary, verify and adjust the water level in the manometer.
- 5.6. If necessary, wet the flow cell of the airflow calibrator by applying a low flow vacuum to the system and take multiple readings in quick succession. Reset the control unit.
- 5.7. Test the system for leaks.
 - 5.7.1. Completely close off tubing at 9 using a pinch clamp. Apply a 102 ± 5 mmH₂O (4 inH₂O.) vacuum to the system using the vacuum source. If the vacuum source is insufficient to maintain 4 inH₂O vacuum pressure, restrict the flow through the system using the needle valve at 2.
 - 5.7.2. Close valve 5. If the pressure reading of the manometer starts to fall, then there is a leak at the manometer connection, and it must be corrected before proceeding to the next step.
 - 5.7.3. Open valve 5. Close off valves 7 and 3 in that order. If the pressure reading of the manometer falls, then there is a leak at or near the "T" connector, and it must be corrected before proceeding to the next step.
 - 5.7.4. Open valves 3 and 7. Close off valve 3. If the pressure reading of the manometer falls, then there is a leak around the test fixture, and it must be corrected before conducting the actual leakage test.
- 5.8. Attach the test fixture with mounted drinking tube valve assembly at 8 and apply a $75 +5/-0$ mm ($3 +0.2/-0$ in.) inH₂O vacuum pressure.
- 5.9. Measure the drinking tube valve leakage using the airflow calibrator.
- 5.10. Repeat step 5.9 for a total of 3 measurements per drinking tube valve assembly.
- 5.11. Repeat steps 5.2 through 5.10 for the remaining drinking tube valve assemblies.
6. PASS/FAIL CRITERIA
 - 6.1. The basis for passing this test is set forth in 42 CFR Part 84, Subpart K, Section 84.171(f).
 - 6.2. Drinking tube valve, seat, seal leakage test.
 - 6.2.1. Dry drinking tube valves, valve seats, seals, or assemblies will be subjected to a vacuum of 75 mmH₂O while oriented in a normal operating position.

6.2.2. The average rate of leakage of three (3) readings for a single drinking tube valve assembly shall not exceed 30 mL/min.

7. RECORDS/TEST SHEETS

7.1. Record the test data in a format that shall be stored and retrievable. Data should be reported similar to Attachment C: Sample Test Data Sheet.

8. LIST OF ABBREVIATIONS AND ACRONYMS

Table 1: List of Abbreviations and Acronyms Used Within This Document

Abbreviation or Acronym	Definition
%	percent
CFR	Code of Federal Regulations
in.	inch(es)
inH ₂ O	inches of water
mL/min	milliliters/minute
mmH ₂ O	millimeters of water
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standard and Technology
NPPTL	National Personal Protective Technology Laboratory
SDS	safety data sheet
STP	standard testing procedure

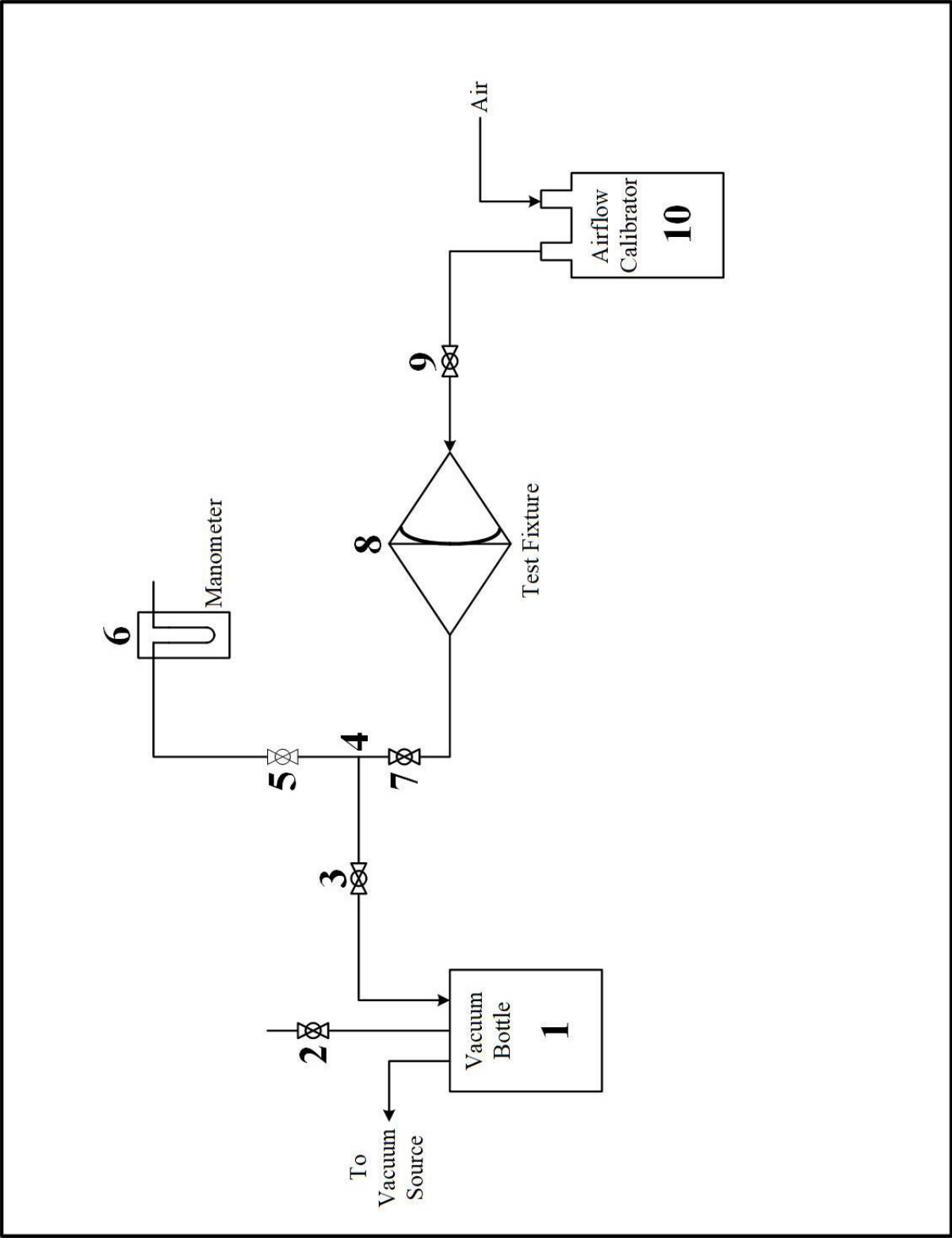
9. ATTACHMENTS

9.1. Attachment A: Drinking Tube Valve Holder Assembly and Bench Top Set-Up

9.2. Attachment B: Description of Schematic Diagram of the System

9.3. Attachment C: Sample Test Data Sheet

Attachment A: Drinking Tube Valve Holder Assembly and Bench Top Set-Up



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Attachment B: Description of Schematic Diagram of the System

Description of Schematic Diagram of the System

This attachment is a written description of Attachment A: Drinking Tube Valve Holder Assembly and Bench Top Set-Up, with each number written here corresponding to a number shown in Attachment A. NOTE: The components described here are approximations and may vary depending on the equipment used.

1. Vacuum bottle. The vacuum bottle assembly allows an accurate control of small negative pressures to the system.
2. 0.25 in. needle valve for control of flow.
3. 0.25 in. ball valve.
4. 3-Way "T" tube fitting.
5. 0.25 in. ball valve.
6. Manometer.
7. 0.25 in. ball valve. Tubing, approximately 30 in. in length.
8. Test fixture.
9. Tubing, approximately 30 in. in length, with pinch clamp.
10. Airflow calibrator system. For airflow measurement.

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Revision History

Revision	Date	Reason for Revision
1.0	11 July 2001	Historic document
1.1	6 June 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method
2.0	18 August 2025	Editorial rewrite of the document. Equipment model numbers updated. Updated Attachment B to match current test setup.