



National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory
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DETERMINATION OF BY-PASS VALVE FLOW TEST - OPEN-CIRCUIT, DEMAND AND
PRESSURE-DEMAND, SELF-CONTAINED BREATHING APPARATUS
STANDARD TESTING PROCEDURE (STP)

1. PURPOSE

This document establishes the testing procedure used for ensuring that the level of protection provided by the by-pass valve air flow on Open-Circuit, Demand and Pressure-Demand, Self-Contained Breathing Apparatus (SCBA) submitted for approval, extension of approval, or examined during Certified Product Audits, meets minimum certification standards as provided for in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d) Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of By-Pass Valve Flow Test - Open-Circuit, Demand and Pressure-Demand, Self-Contained Breathing Apparatus test 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.

3. EQUIPMENT/MATERIALS

3.1. The list of necessary test equipment and materials follows.

3.1.1. Bauer MXV8-25H-E3-P5S-CO breathing air compressor equipped with a vertical purifier system, or equivalent, capable of delivering at least 200 lpm at 6000 psig

3.1.2. Teledyne-Hastings Raydist mass flow meter, Model NAHL-25, or equivalent

3.1.3. Breathing air supply test stand incorporating calibrated pressure gauges - NOTE: Calibrated pressure gauges must be selected so that required readings fall near the midpoint, and never within the first or last 10%, of the gauge's pressure range.

3.1.4. Air tight chamber – approximately 24 inches by 24 inches by 24 inches with a door opening lined with gasket material, a 3 inch diameter inlet for accepting hoses or adapters, and a one inch diameter outlet for the flow meter.

4. TESTING REQUIREMENTS AND CONDITIONS

4.1. Prior to beginning any testing, confirm that all measuring equipment employed has been calibrated in accordance with the testing laboratory's calibration procedure and schedule. All measuring equipment utilized for this testing must have been calibrated using a

method traceable to recognized international standards when available.

- 4.2. This test shall be done on a minimum of two respirators or more if additional testing is required (42 CFR, Part 84, Sections 84.12, 84.30, and 84.60.)
- 4.3. Compressed air supplied for testing shall be evaluated on a regular basis to assure that it complies with the qualities specified for CGA Grade D or better.

5. PROCEDURE

- 5.1. Adjust the test stand supply pressure to 25% of the SCBA maximum operating pressure.
- 5.2. Connect the high-pressure test stand to the SCBA in place of the SCBA cylinder, and place the entire unit into the test box. Pass the high-pressure connection through the 3-inch inlet port on the test box and seal pass-thru.
- 5.3. Connect the mass flow meter to the one-inch test box outlet.
- 5.4. Open the regulator by-pass valve fully. If the SCBA being tested has a separate mainline valve then consult the User's Manual to determine if it is to remain open in case of failure, or closed. If the regulator being tested has a donning switch, the donning switch must be set "ON" (awaiting first breath activation).
- 5.5. Slowly pressurize the SCBA and readjust to 25% of SCBA maximum service pressure after air is flowing.
- 5.6. Check all connections for leakage. When connections are properly tightened and air pressure is properly adjusted, record the supply pressure on the By-Pass Valve Flow test data sheet for Open-Circuit SCBA.
- 5.7. After the reading on the mass flow meter stabilizes, then allow an extra two minutes before recording the reading. Record the delivery flow rate of the test SCBA on the By-Pass Valve Flow test data sheet for Open-Circuit SCBA.
- 5.8. Repeat steps 5.1., through 5.7., three more times with the test stand adjusted to 20% of the SCBA maximum service pressure.

Note: This procedure covers the majority of the currently approved SCBA, however because of the many different designs each unit must be examined on its own merit to determine if this procedure is applicable in its current form or if modifications are required.

6. PASS\FAIL CRITERIA

- 6.1. The criterion for passing this test have been established in accordance with Subpart G, Section 84.63(a)(c)(d) Volume 60, Number 110, June 8, 1995.
- 6.2. This test establishes the standard procedure for ensuring that:

84.63 Test requirements; general.

(a) Each respirator and respirator component shall when tested by the applicant and by the Institute, meet the applicable requirements set forth in subparts H through L of this part.

(c) In addition to the minimum requirements set forth in subparts H through L of this part, the Institute reserves the right to require, as a further condition of approval, any additional requirements deemed necessary to establish the quality, effectiveness, and safety of any respirator used as protection against hazardous atmospheres.

(d) Where it is determined after receipt of an application that additional requirements will be required for approval, the Institute will notify the applicant in writing of these additional requirements, and necessary examinations, inspections, or tests, stating generally the reasons for such requirements, examinations, inspections, or tests.

- 6.3. All adjustable-flow by-pass valves on Entry and Escape SCBA shall deliver minimum flow of 130 lpm in the fully open position at 20% to 25% of full service pressure.
- 6.4. All single-flow by-pass valves on Entry and Escape SCBA shall deliver a minimum flow of 85 lpm, and a maximum flow rate of 130 lpm constant flow at 20% to 25% of full service pressure.
- 6.5. All by-pass valves on Escape Only shall deliver a flow of 85 lpm +5 -0 lpm in the fully open position at 20% to 25% of full service pressure.
- 6.6. In addition, the by-pass valves must override donning switches, first breath activation switches, or any other special feature, which in the event of failure, could cause the breathing-air regulator to stop supplying air.

7. RECORDS\TEST SHEETS

- 7.1. Record test data in a format that shall be stored and retrievable. Data are to be reported as shown in attached example data sheet.

8. ATTACHMENTS

- 8.1. Example, By-pass Flow, Open-Circuit Test Data Sheet

Attachment 8.1. Example, By-pass Flow, Open-Circuit Test Data Sheet

**SPECIAL TEST - BY-PASS FLOW - OPEN-CIRCUIT,
SELF-CONTAINED BREATHING APPARATUS**

Project No. : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR Part 84, Subpart G, Section 84.63(a)(c)(d).

Requirements:

1. All adjustable-flow by-pass valves on Entry and Escape SCBA shall deliver minimum flow of 130 lpm in the fully open position at 20% to 25% of full service pressure.

All single-flow by-pass valves on Entry and Escape SCBA shall deliver a minimum flow of 85 lpm, and a maximum flow rate of 130 lpm constant flow at 20% to 25% of full service pressure.

3. All by-pass valves on Escape Only shall deliver a flow of 85 lpm +5 -0 lpm in the fully open position at 20% to 25% of full service pressure.
4. In addition to the flow requirements, the bypass valves must override donning switches, first breath activation switches, or any other special feature which in case of failure could cause the regulator to stop supplying air.

Results:

Unit No.	Supply Pressure (psig)	Flow (Lpm)
1	25%	_____
2	25%	_____
1	20%	_____
2	20%	_____

Comments:

Test Engineer: _____ Pass _____ Fail _____

Revision History

Revision	Date	Reason for Revision
1.0	23 August 2000	Historic document
1.1	20 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method
2.0	15 May 2019	Method updated to replace head form with an air-tight box. Pass/fail requirements, while retaining the same flow values, have been reworded to help address confusion over the meaning of “constant-flow” since most, if not all, bypass mechanisms evaluated are designed to operate in a constant-, or continuous-flow mode. A tolerance range is established for the escape-only bypass.