



National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory
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Procedure No. RCT-ASR-STP-0104	Revision: 1.1	Date: 6 June 2005
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DETERMINATION OF AIR-REGULATING VALVE - 100,000 CYCLES, DEMAND AND PRESSURE-DEMAND, TYPE C AND CE, SUPPLIED-AIR RESPIRATORS STANDARD TESTING PROCEDURE (STP)

1. PURPOSE

This test establishes the procedures for ensuring that the level of protection provided by the air-regulating valve requirements on Type C and CE, Demand and Pressure-Demand, Supplied-Air Respirators submitted for Approval, Extension of Approval, or examined during Certified Product Audits, meet the minimum certification standards set forth in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d), and Subpart J, Section 84.150, Table 8; Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of Air-Regulating Valve - 100,000 Cycles, Demand and Pressure-Demand, Type C and CE, Supplied-Air Respirators 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. Mechanical Breather with 622 Kg. m/min. Cam as per U.S. BOM Drawings C-1748 (3/17/69) Breathing Machine and B-1198 (3/6/69) Breathing Cam.
- 3.1.2. Anthropometric test head with tube for measuring breathing resistance (Sierra Engineering Company Model 428) or equivalent.
- 3.1.3. Electric Timer, calibrated to hundredths of a minute (Precision Scientific Company) or equivalent.
- 3.1.4. 1/10 H.P. General Electric Pump Model No. SKH19GGR15AT or equivalent.
- 3.1.5. "U" tube manometer (0-24 in.) or equivalent.
- 3.1.6. A 300 cubic foot gas cylinder of compressed air or equivalent.

Approvals:	<u>1st</u> Level	<u>2nd</u> Level	<u>3rd</u> Level
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3.1.7. Air regulator, Model 8, from Matheson Gas Products or equivalent.

3.1.8. A Helicoid calibrated pressure gauge and connecting fittings or equivalent.

4. TESTING REQUIREMENTS AND CONDITIONS

4.1. Prior to beginning any testing, all measuring equipment to be used must have been calibrated in accordance with the manufacturer's calibration procedure and schedule. At a minimum, all measuring equipment utilized for this testing must have been calibrated within the preceding 12 months using a method traceable to the National Institute of Standards and Technology (NIST).

4.2. The compressed gas cylinder must meet all applicable Department of Transportation requirements for cylinder approval as well as for testing/requalification.

4.3. Normal laboratory safety practices must be observed. This includes all safety precautions described in the current ALOSH Facility Laboratory Safety Manual.

4.3.1. Safety glasses, lab coats, and hard-toe shoes must be worn at all times.

4.3.2. Work benches must be maintained free of clutter and non-essential test equipment.

4.3.3. When handling any glass laboratory equipment, lab technicians and personnel must wear special gloves which protect against lacerations or punctures.

5. PROCEDURE

Note: Reference section 3 for equipment, model numbers and manufacturers. For calibration purposes use those described in the manufacturer's operation and maintenance manuals.

5.1. Obtain tracing of flowrate (refer to procedure RCT-ASR-STP-0105A determination of demand and pressure-demand Type C and CE supplied-air respirators).

5.2. Calibrate breathing machine to 20 rpm and turn off.

5.3. Mount facepiece on anthropometric test head with tube for connecting to breathing machine.

5.4. Connect anthropometric test head to breathing machine.

5.5. Assemble complete respirator to facepiece using minimum hose length as per manufacturer's instructions.

5.6. Connect other end of hose length to a regulated air supply and adjust to maximum pressure as per manufacturer's instructions.

5.7. Turn on breathing machine and timer.

- 5.8. Allow air regulating valve to be cycled for 100,000 cycles.
 - 5.9. At the end of 100,000 cycles turn off timer, breathing machine, and air supply.
 - 5.10. Obtain another tracing of flowrate (refer to procedure RCT-ASR-STP-0105A determination of demand and pressure-demand, Type C and CE supplied-air respirators).
 - 5.11. Hook a tee connection in line with a vacuum pump. Connect one end of tee connection to a U tube manometer and other end of the tee connection to the breathing tube connection on the regulator (if regulating valve is mask mounted then mount facepiece on anthropometric test head used in Step 5.3. and connect the tee connection to the tube running through the test head).
 - 5.12. Adjust vacuum pump until a reading of 10 inches is obtained on the U tube manometer.
 - 5.13. At the end of two minutes turn off vacuum pump.
 - 5.14. Repeat Step 5.10.
 - 5.15. The tracings obtained in steps 5.1., 5.10., and 5.14. shall be compared and no difference found to meet the minimum requirements of 42 CFR Part 84.
 - 5.16. To find how many cycles have been run take the time run and multiply by 20 (rpm of the breathing machine).
6. PASS/FAIL CRITERIA
- 6.1. The criterion for passing this test is set forth in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d), and Subpart J, Section 84.150, Table 8; 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.

84.150 Air-supply line tests; minimum requirements.

Air supply lines employed on Types C and CE supplied-air respirators shall meet the minimum test requirements set forth in Table 8 of this subpart.

If an air regulating valve is provided, it shall be so designed that it will remain at a specific adjustment, which will not be affected by the ordinary movement of the wearer. The valve must be so constructed that the air supply with the maximum length of hose and at the minimum specified air-supply pressure will not be less than 115 liters (4 cubic feet) of air per minute to tight-fitting and 170 liters (6 cubic feet) of air per minute of loose-fitting respiratory inlet coverings for any adjustment of the valve. If a demand or pressure-demand valve replaced the air-regulating valve, it shall be connected to the air-supply at the maximum air pressure for which approval is sought by means of the minimum length of air-supply hose for which approval is sought. The outlet of the demand or pressure-demand valve shall be connected to a source of intermittent suction so that the demand or pressure-demand valve is actuated approximately 24 times per minute for a total of 100,000 inhalations. To expedite this test, the rate of actuation may be increased if mutually agreeable to the applicant and the Institute. During this test the valve shall function without failure and without excessive wear of the moving parts. The demand or pressure-demand valve shall not be damaged in any way when subjected at the outlet to a pressure or suction of 25 cm (10 inches) of water gauge for 2 minutes.

7. RECORDS\TEST SHEETS

- 7.1. All test data will be recorded on the AIR-REGULATING VALVE - 100,000 CYCLES, DEMAND AND PRESSURE-DEMAND, TYPE C AND CE, SUPPLIED-AIR RESPIRATORS test data sheet.
- 7.2. All videotapes and photographs of the actual test being performed, or of the tested equipment shall be maintained in the task file as part of the permanent record.
- 7.3. All equipment failing any portion of this test will be handled as follows:
 - 7.3.1. If the failure occurs on a new certification application, or extension of approval application, send a test report to the RCT Leader and prepare the hardware for return to the manufacturer.
 - 7.3.2. If the failure occurs on hardware examined under an Off-the-Shelf Audit the hardware will be examined by a technician and the RCT Leader for cause. All equipment failing any portion of this test may be sent to the manufacturer for examination and then returned to NIOSH. However, the hardware tested shall be held at the testing laboratory until authorized for release by the RCT Leader, or his designee, following the standard operating procedures outlined in Procedure for Scheduling, and Processing Post-Certification Product Audits, RB-SOP-0005-00.

**AIR-REGULATING VALVE - 100,000 CYCLES, DEMAND AND PRESSURE-DEMAND,
TYPE C AND CE, SUPPLIED-AIR RESPIRATORS**

Project No : _____ Date:

Company :

Respirator Type:

Reference: 42 CFR, Part 84, Subpart J, Section 84.150, Table 8.

Requirement: The outlet of the demand or pressure-demand valve shall be connected to a source of intermittent suction so that the demand or pressure-demand valve is actuated approximately 20 times per minute for a total of 100,000 inhalations. During this test, the valve shall function without failure and without excessive wear of the moving parts. It shall be connected to the air-supply at the maximum air pressure for which the approval is sought by means of the minimum length of air-supply hose.

Results:

Hose length - ft.: _____ Pressure - psig:

Flow (before 100,000 cycle test):

Flow (after 100,000 cycle test):

Flow (after 10 inches of suction):

	<u>BOTTLE #</u>	<u>DATE</u>	<u>TIME</u>	<u>MINUTE</u>	<u>X</u>	<u>RPM</u>	<u>=</u>	<u>ACTUATIONS</u>	<u>ACTUATION</u>	<u>TIME</u>
1.	_____	_____	_____	_____						
2.	_____	_____	_____	_____						
3.	_____	_____	_____	_____						
4.	_____	_____	_____	_____						
5.	_____	_____	_____	_____						
6.	_____	_____	_____	_____						
7.	_____	_____	_____	_____						

- 8. _____
- 9. _____
- 10. _____
- 11. _____
- 12. _____
- 13. _____
- 14. _____
- 15. _____
- 16. _____
- 17. _____
- 18. _____
- 19. _____
- 20. _____

Was all equipment used for this test in calibration? Yes _____ No

Comments:

Test Engineer: _____ PASS _____ FAIL

Revision History

Revision	Date	Reason for Revision
1.0	27 June 2001	Historic document
1.1	6 June 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method