



National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory
P.O. Box 18070
Pittsburgh, PA 15236

Procedure No. RCT-ASR-STP-0107	Revision: 1.1	Date: 26 September 2005
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DETERMINATION OF EXHALATION AIRFLOW RESISTANCE, 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 exhalation resistance requirements on Type C and CE, 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 84.157(c); Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of Exhalation Airflow Resistance, 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. A 300 cubic foot gas cylinder of compressed air or equivalent.

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

3.1.3. Air regulator, Model 8, from Matheson Gas Products or equivalent.

3.1.4. Dwyer Slant Manometer 0-3", F. W. Dwyer Manufacturing Co., Michigan City, Indiana

3.1.5. ISI Anthropometric Test heads with tube for measuring breathing resistance and air flows - Model SR-085 or equivalent.

3.1.6. Ground Glass Joint

Approvals:	<u>1st</u> Level	<u>2nd</u> Level	<u>3rd</u> Level
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3.1.7. Pinch Clamp

3.1.8. Positive pressure source calibrated at 85 lpm or silica dust chamber or equivalent. (See Figure 1. and 3.)

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 retesting/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. Set up respirator as per manufacturer's instructions using maximum pressure and minimum hose length.
- 5.2. Mount the facepiece on an anthropometric head with tube for measuring breathing resistance. Insert a ground glass joint connector at the breathing port at backside of head. Use a pinch clamp to pinch off the small breathing port tube on back of head.

Note: If a dust test is in progress, you must check with the lab technician before touching the silica dust chamber.

- 5.3. The procedure for turning on the silica dust chamber (positive pressure source) is:
 - 5.3.1. Turn on the main power for the silica dust chamber.
 - 5.3.2. Turn on the exhaust on the silica dust chamber.

- 5.3.3. Turn on the air-supply (on front of silica dust chamber).
- 5.3.4. Turn on the positive pressure blower, and adjust.
- 5.3.5. Set chamber pressure to .5 in of H₂O.
- 5.4. Turn on air supply to respirator and adjust to manufacturer's maximum air pressure.
- 5.5. Plug anthropometric head into port on chamber marked positive resistance. (See Figure 3.)
- 5.6. Turn on positive flow control valve on front panel of silica dust chamber. (See Figure 1. and 2.)
- 5.7. Adjust bottom of meniscus to calibrated 85 lpm line. (See Figure 1. and 2.)
- 5.8. Read the scale on the slant manometer. Readings will be in inches of water. (See data analysis).
- 5.9. The procedure for turning off the silica dust chamber is as follows:
 - 5.9.1. Turn off the positive flow control.
 - 5.9.2. Turn off the main air valve.
 - 5.9.3. Shut off the exhaust on the silica dust chamber.
 - 5.9.4. Turn off the air supply to the respirator.
- 5.10. Data Analysis
 - 5.10.1. To convert inches of water to mm of water, multiply reading in inches by 25.4.
 - 5.10.2. If pressure-demand unit is being tested, take reading obtained in step 5.8 and subtract static pressure obtained in bench test for air flow resistance (inhalation).

Note: This test should be done on a minimum of two respirators, or more if additional testing is required (42 CFR, Part 84, Section 84.12, 84.30, and 84.60).

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 84.157(c); 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.

84.157 Air Flow Resistance Test; Type C Supplied-Air Respirator, Pressure-Demand Class, minimum requirements.

(c) The exhalation resistance to a flow of air at a rate of 85 liters (3 cubic feet) per minute shall not exceed the static pressure in the facepiece by more than 51 mm (2 inches) of water-column height.

7. RECORDS/TEST SHEETS

- 7.1. All test data will be recorded on the AIRFLOW EXHALATION RESISTANCE, PRESSURE-DEMAND CLASS, 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 test 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.

**AIRFLOW EXHALATION RESISTANCE, PRESSURE-DEMAND CLASS,
TYPE C AND CE, SUPPLIED-AIR RESPIRATORS**

Project No : _____ Date:

Company :

Respirator Type:

Reference: 42 CFR, Part 84, Subpart J, Section 84.157(c).

Requirement: (c) The exhalation resistance to a flow of air at a rate of 85 lpm. (3 cfm.) Shall not exceed the static pressure in the facepiece by more than 51 mm (2 inches) of H₂O col. Ht.

Results: Exhalation Resistance at 85 lpm:

Comments:

Test Engineer: _____ PASS _____ FAIL

Figure 1.
Silica dust chamber control panel

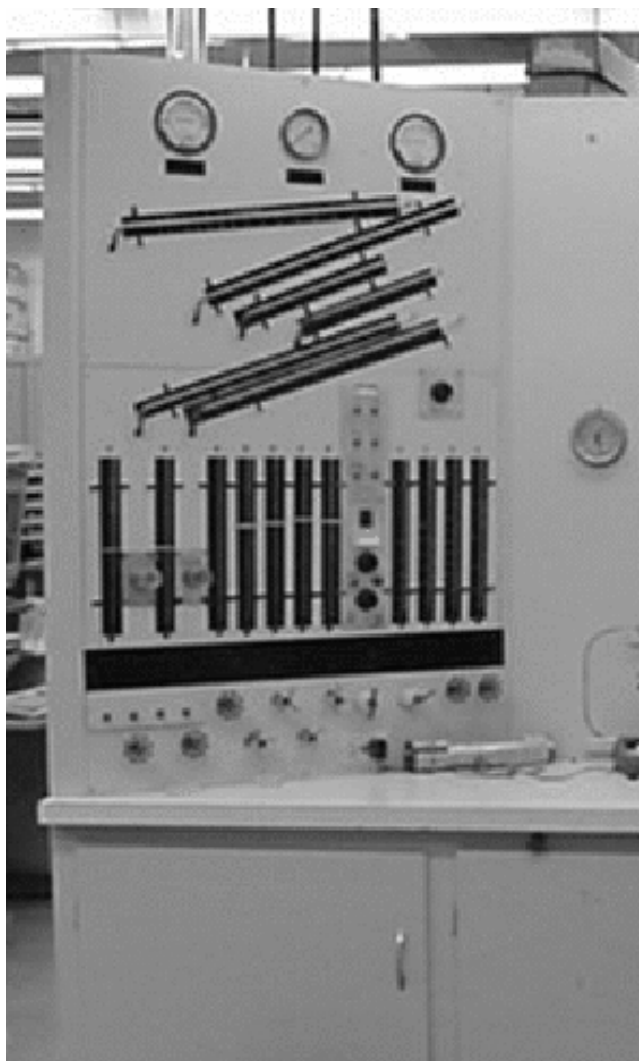


Figure 2.
Exhalation Resistance Test Setup

Silica dust chamber control panel

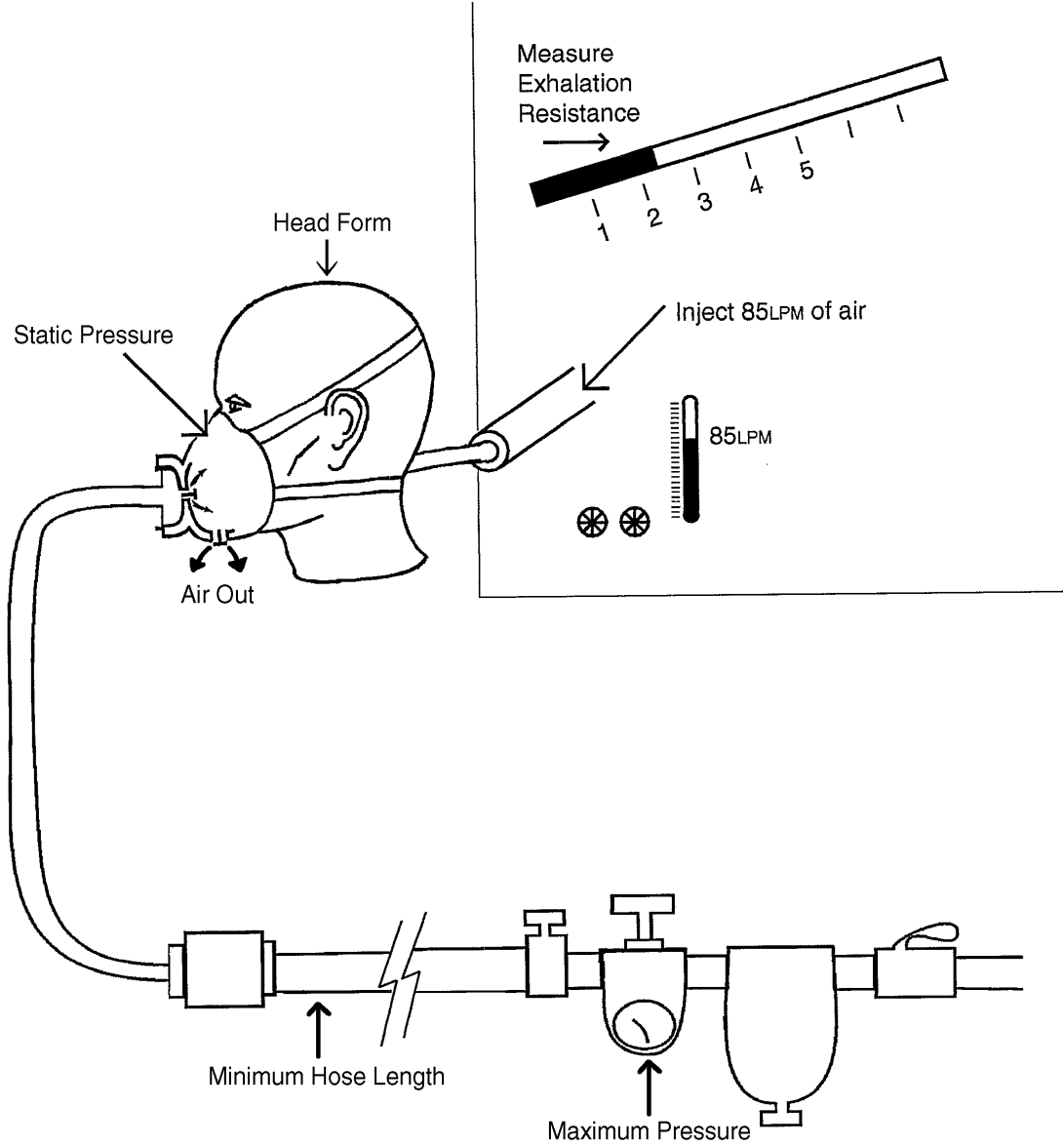
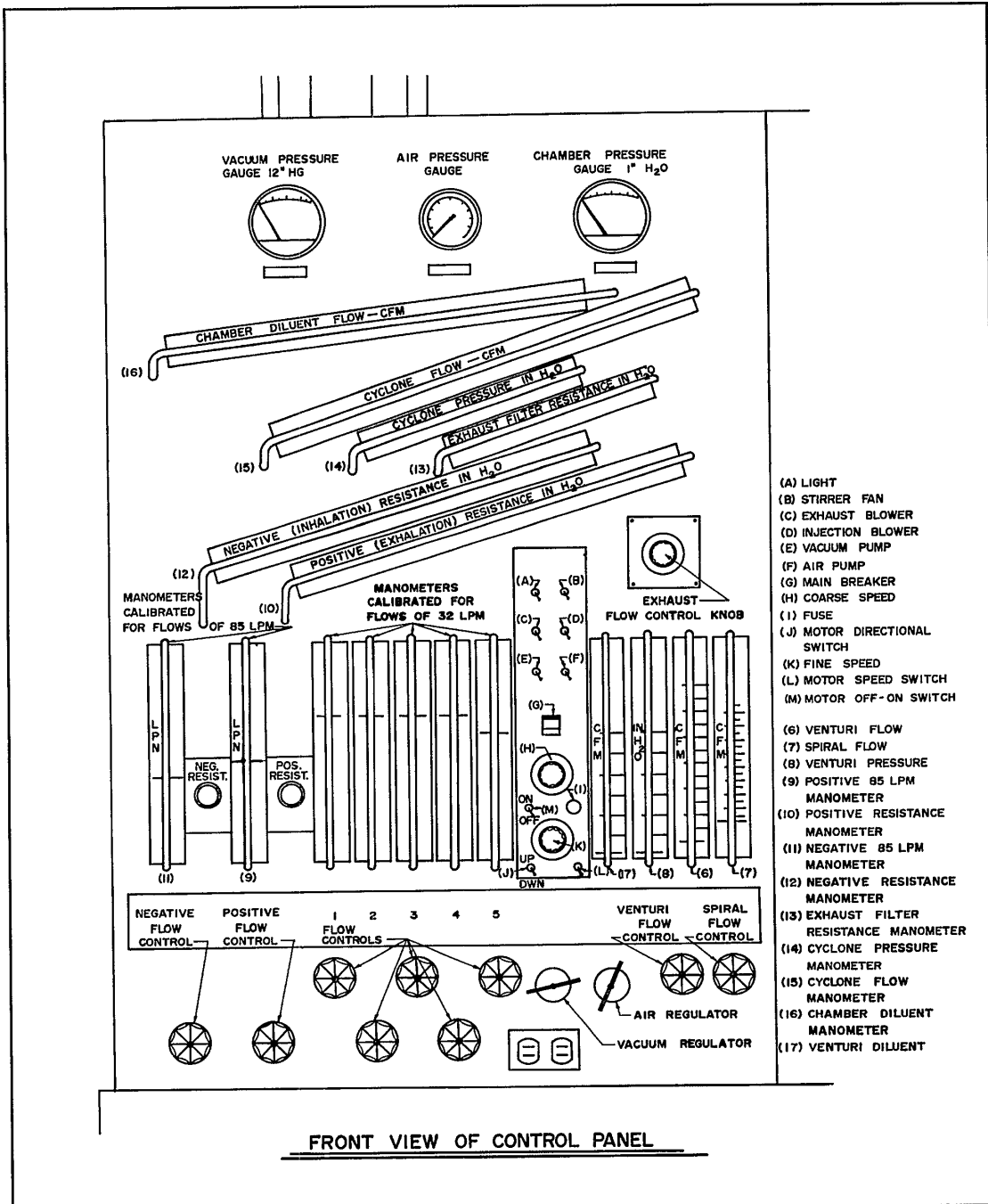


Figure 3.
Silica dust chamber control panel



- (A) LIGHT
- (B) STIRRER FAN
- (C) EXHAUST BLOWER
- (D) INJECTION BLOWER
- (E) VACUUM PUMP
- (F) AIR PUMP
- (G) MAIN BREAKER
- (H) COARSE SPEED
- (I) FUSE
- (J) MOTOR DIRECTIONAL SWITCH
- (K) FINE SPEED
- (L) MOTOR SPEED SWITCH
- (M) MOTOR OFF-ON SWITCH
- (6) VENTURI FLOW
- (7) SPIRAL FLOW
- (8) VENTURI PRESSURE
- (9) POSITIVE 85 LPM MANOMETER
- (10) POSITIVE RESISTANCE MANOMETER
- (11) NEGATIVE 85 LPM MANOMETER
- (12) NEGATIVE RESISTANCE MANOMETER
- (13) EXHAUST FILTER RESISTANCE MANOMETER
- (14) CYCLONE PRESSURE MANOMETER
- (15) CYCLONE FLOW MANOMETER
- (16) CHAMBER DILUENT MANOMETER
- (17) VENTURI DILUENT

Revision History

Revision	Date	Reason for Revision
1.0	27 June 2001	Historic document
1.1	26 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method