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

Procedure No. RCT-ASR-STP-0110	Revision: 1.1	Date: 12 September 2005

DETERMINATION OF MAN TEST FOR GASES AND VAPORS - GAS TIGHTNESS TEST - ISOAMYL ACETATE, TYPE C, AND CE, SUPPLIED-AIR RESPIRATORS STANDARD TESTING PROCEDURE (STP)

1. PURPOSE

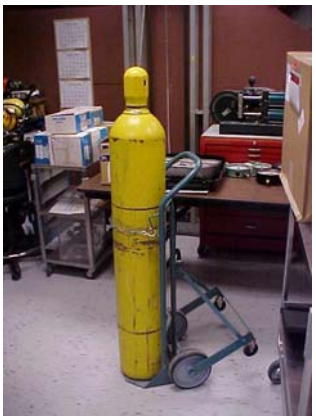
This test establishes the procedures for ensuring that the level of protection provided by the man test for gases and vapors requirements on Type C, and CE Supplied-Air Respirators submitted for Approval, Extension of Approval, or examined during Certified Product Audits, meet the minimum certification standards set forth in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d), and Subpart J, Sections 84.159, 84.162, and 84.163; Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of Man Test for Gases and Vapors, Gas Tightness Test - Isoamyl Acetate, 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 Grade D air or equivalent.

Approvals:	1st Level	2nd Level	3rd Level

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. Isoamyl acetate - 99%. Source - Mallinckrodt P/N 2491 or equivalent.

3.1.5 10' x 12' Isoamyl acetate gas tight chamber or equivalent.

3.1.6. Two test subjects meeting requirements of the NIOSH Human Subject Review Board (HSRB) approved Protocol. Refer to HSRB-73-DSR-01, “Protocol for the Testing of Respiratory Protective Devices” for the proper consent form and complete details on the use of human test subjects in respirator certification testing.

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 during all testing.

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. Close the inside and outside vents, and turn off vacuum. Replace rubber stoppers in side bulkhead fittings.

5.2. Measure 87.5 ml. of isoamyl acetate and pour into cloth wick in chamber. Allow the isoamyl acetate to completely evaporate.

5.3. When the isoamyl acetate is evaporated, then begin test. Each time the test subject enters or exits the chamber the following procedure must be used:

1. Subject enters small room.
2. Outside vent is opened.
3. Vacuum is turned on for approximately 15 seconds.
4. Vacuum is turned off.
5. Vent is closed.
6. Subject is then allowed to enter large chamber or exit into the room.

5.4. A subject will don the apparatus as per the manufacturer's instructions.

5.5. If Type C, and CE, continuous flow class, demand, or pressure demand is being tested, **use the maximum and minimum hose length**. Locate not more than 25% of the total hose length outside the chamber, the rest of the hose will be in the chamber.

5.6. A subject will wear the respirator into the chamber and connect to the hose. The subject will remain in the chamber for ten minutes. Time during the test period will be divided as follows:

(1) Five minutes - walking, turning head, dipping chin.

(2) Five minutes - pumping air with a tire pump into a 28 liter container.

5.7. If Type C, and CE, the minimum air supply pressure and the maximum hose length will be used. After being tested in this configuration this type of unit will be retested (Step 5.5.) using maximum air supply pressure and minimum hose length.

5.8. This procedure will be repeated by at least two different subjects. All subjects' comments will be written on the test data sheet.

5.9. Open door vent and inside door, remove rubber stopper in side bulkhead fittings, and exhaust.

5.10. Allow chamber to exhaust for 3-4 hours, replace stoppers and turn off vacuum.

Note: This test should 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.)

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, Sections 84.159, 84.162, and 84.163, 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.

84.159 Man tests for gases and vapors; supplied-air respirators; general performance requirements.

(a) Wearers will enter a chamber containing a gas or vapor as prescribed in 84.160, 84.161, 84.162, and 84.163.

(b) Each wearer will spend 10 minutes in work to provide observations on freedom of the device from leakage. The freedom and comfort allowed the wearer will also be considered.

(c) Time during the test period will be divided as follows:

(1) Five minutes. Walking, turning head, dipping chin, and

(2) Five minutes. Pumping air with a tire pump into a 28-liter (1 cubic foot) container, or equivalent work..

(d) No odor of the test gas or vapor shall be detected by the wearer in the air breathed during any such test, and the wearer shall not be subjected to any undue discomfort or encumbrance because of the fit, air delivery, or other features of the respirator during the testing period.

84.162 Man test for gases and vapors; Type C respirators, continuous-flow class and Type CE supplied-air respirators; test requirements.

(a) The completely assembled respirator will be worn in a chamber containing 0.05 $\pm$ 0.025 percent isoamyl acetate vapor, the intake of the hose will be connected to a suitable source of respirable air, and not more than 25 percent of the hose length will be located in isoamyl acetate-free air.

(b) The minimum flow of air required to maintain a positive pressure in the respiratory-inlet covering through the entire breathing cycle will be supplied to the wearer, provided however, that airflow shall not be less than 115 liters per minute for tight-fitting and not less than 170 liters per minute for loose-fitting respiratory inlet-coverings.

(c) The test will be repeated with the maximum rate of flow attainable within specified operating pressures.

84.163 Man test for gases and vapors; Type C supplied-air respirators, demand and pressure-demand classes; test requirements.

(a) The completely assembled respirator will be worn in a chamber containing 0.05 $\pm$ 0.025 percent isoamyl acetate vapor, the intake of the hose will be connected to a suitable source of respirable air, and not more than 25 percent of the hose length will be located in isoamyl acetate free air.

(b) The test will be conducted at the minimum pressure with the maximum hose length and will be repeated at the maximum pressure with the minimum hose length.

7. RECORDS\TEST SHEETS

7.1. All test data will be recorded on the GAS TIGHTNESS TEST - ISOAMYL ACETATE, 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.

GAS TIGHTNESS TEST - ISOAMYL ACETATE, TYPE C, AND CE, SUPPLIED-AIR RESPIRATORS

Project No : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR, Part 84, Subpart J, Sections 84.159, 84.162, and 84.163.

Requirement: Type C and Type CE continuous-flow class; test requirements.

The completely assembled respirator will be worn in a chamber containing 0.05 $\pm$ 0.025 percent isoamyl acetate vapor, the intake of the hose will be connected to a suitable source of respirable air, and not more than 25 percent of the hose length will be located in isoamyl acetate free air.

The minimum flow of air required to maintain a positive pressure in the respiratory-inlet covering through the entire breathing cycle will be supplied to the wearer, provided however, that airflow shall not be less than 115 liters per minute for tight-fitting and not less than 170 liters per minute for loose-fitting respiratory inlet-coverings.

The test will be repeated with the maximum rate of flow attainable within specified operating pressures.

Type C demand and pressure-demand classes; test requirements.

The completely assembled respirator will be worn in a chamber containing 0.05 $\pm$ 0.025 percent isoamyl acetate vapor, the intake of the hose will be connected to a suitable source of respirable air, and not more than 25 percent of the hose length will be located in isoamyl acetate free air.

The test will be conducted at the minimum pressure with the maximum hose length and will be repeated at the maximum pressure with the minimum hose length.

Note: The test will be conducted with minimum flow (i.e., pressure) and maximum hose length; and maximum flow (i.e., pressure) and minimum hose length, as requested by manufacturer.

Results:

Test Subject: #1._____ #2._____

	Unit #1	Unit #2	Unit #1	Unit #2
Min. Hose Length:	_____	_____	_____	_____
Max. Pressure:	_____	_____	_____	_____
Max. Hose Length:	_____	_____	_____	_____
Min. Pressure:	_____	_____	_____	_____

Device: Continuous _____ Demand _____ Pressure-Demand_____

5 Minutes nodding and turning head, walking, and bending:

Comments:

_____

_____

_____

_____

_____

5 Minutes pumping:

Comments:

_____

_____

_____

_____

_____

Test Engineer: _____ Pass: _____ Fail:_____

Revision History

Revision	Date	Reason for Revision
	February 1996	NIOSH has reduced the IDLH for isoamyl acetate in the Pocket Guide to Chemical Hazards from 3000 ppm to 1000 ppm. This resulted in the NIOSH STP being run at the IDLH concentration contrary to good work practices, and OSHA standards which stipulate the "concentrations during the test shall not exceed an OSHA permissible exposure limit, the ACGIH threshold limit values, or any known recommended exposure limit, when there is no OSHA PEL or ACGIH TLV, and not create a health or physical hazard for the test subject or operator." In the face of these facts, the test concentration was reduced to the OSHA PEL and NIOSH REL of 500 ppm with commitment to revisit the appropriateness of the test, and of isoamyl acetate as the test agent of choice in future regulation change modules.
1.0	31 May 2001	Historic document
1.1	12 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method