



National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory
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Procedure No. RCT-ASRS-STP-0140	Revision: 1.1	Date: 12 September 2005
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MAN TESTS, SELF-CONTAINED BREATHING APPARATUS
STANDARD TESTING PROCEDURE (STP)

1. PURPOSE

This test establishes the procedures for ensuring that the level of protection provided by the Man Test requirements on Self-Contained Breathing Apparatus (SCBA) 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 H, Section 84.79, 84.97, 84.99, 84.100, and 84.103, Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Man Tests, 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. One B-D Yale (2317 100YL) 100cc (Becton, Dickson and Co.) syringe "Luer-Lok", Becton Dickson & Company, Rutherford, NJ, or equivalent.

Approvals:	<u>1st</u> Level	<u>2nd</u> Level	<u>3rd</u> Level
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- 3.1.2. Doric Series 400A Digital Trendicator, Doric Scientific Division, Emerson Electric Company, 3883 Ruffin Road, San Diego, CA 92123 or equivalent.



- 3.1.3. Validyne Digital Readout - Model CD23 or equivalent.



- 3.1.4. Temperature compensated pressure transducer (Validyne Engineering Model No. DP45) or equivalent.



- 3.1.5. Electric timer, calibrated to 100ths of a minute (Precision Scientific Co.) or equivalent.



3.1.6. Multiple outlet box with 6 receptacles or equivalent.



3.1.7. Timer, Digital stopwatch, calibrated to hundredths of a minute (Cronus Precision Products, Inc.) to hand carry. or equivalent.



3.1.8. Applied Electrochemistry CO₂ Analyzer - Model CD-3A or equivalent.



3.1.9. Applied Electrochemistry Oxygen Analyzer - Model S-3A or equivalent.



3.1.10. Oxygen - U.S.P or equivalent.



3.1.11. Carbon dioxide - calibration gas, 4-5%, 1-2%, 3-4% Matheson Scientific Company, E. Rutherford, NJ or equivalent.

3.1.12. Carbon dioxide calibration curve or equivalent.



3.1.13. Fifty-pound sack or equivalent.



3.1.14. Forty-five pound pipe weight or equivalent.



3.1.15. Forty-five pound weight pulling machine (U.S. BOM) or equivalent.

3.1.16. Knee pads or equivalent.



3.1.17. Matheson Gas Products Model # 8320 carbon dioxide regulator, East Rutherford, NJ or equivalent.



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



3.1.19. Model 18-49B Horizontal Treadmill, 0-6 MPH, Quinton Instruments, 3051 44th Avenue, West Seattle, Washington 98199 or equivalent.



3.1.20. National Draeger Endless Ladder, 0-130 feet/minute S/N181-2486 or equivalent.



3.1.21. A crash cart with current dated drugs and equipment at the test scene.

3.1.22. 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.



3.1.23. A hospital type gurney (or a bed for test subject to lay on) or equivalent.



3.1.24. A 4' by 8' pad for test subject to crawl on 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 retesting/requalification.
- 4.3. Normal laboratory safety practices must be observed. This includes 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. Use the test operating procedure as follows:
 - 5.1.1. The man tests are conducted in duplicate in accordance with the specific duration test schedule corresponding to the service time approval requested by the manufacturer.
 - 5.1.2. During the sampling periods the following parameters are sampled/monitored:

Open Circuit

a) breathing resistance

Closed Circuit

a) breathing resistance

- b) gauge pressure
- c) subject pulse rate
- d) subject respiration rate
- e) ambient temperature
- b) gauge pressure
- c) subject pulse rate
- d) subject respiration rate
- e) oxygen in inhalation tube
- f) carbon dioxide in inhalation tube
- g) temperature (mask and ambient)

- 5.1.3. Prior to tests the oxygen and carbon dioxide analyzers must be calibrated with the proper calibration gas (see 3.1.10. and 3.1.11.) and the resistance instrument must be calibrated with a slant manometer.
- 5.1.4. All tests require the services of a physician, and a crash cart with current dated drugs and equipment at the test scene.
- 5.1.5. Test subjects are used for evaluation of SCBA of one-hour or less duration (unless specific application is in the mining industry and mine inspectors and rescue and recovery personnel are utilized for SCBA greater than one hour duration).

TEST SUBJECTS CHECK LIST

Test Subject
1-week Notice

MSHA Personnel
2-week Notice

1. _____ Arrange Test Dates

1. _____ Arrange Test Dates

2. _____ Confirm with Letter

(A) Confirm M.D. Availability

1. _____ on planned test dates

2. _____ call Manufacturer (test dates)

3. _____ Test Prep. Sheet and Man Test Sheet

(B) Subject Arrival

1. _____ Orientation (Data Sheets)

2. _____ Subject Read Protocol

3. _____ Subject Sign NIOSH HSRB Document B

4. _____ Orientation on Exercise Equipment

5. _____ Explain Respirator Operation

(C) _____ Conduct Tests

(D) _____ Meet and Review Comments

(E) _____ Pay Participants

(F) _____ Write Letter of Appreciation

OUTLINE (TEST SUBJECT SAFEGUARDS)

- I. Presubmission - Manufacturer performs tests, as required by Part 84, on their apparatus to demonstrate conformance to regulations.
- II. Apparatus Testing
 - (A) Laboratory tests performed
 - 1. Must meet all applicable performance requirements
 - 2. Must be of safe design
 - (B) Modifications must be made by manufacturer and apparatus retested for performance
- III. Pre-subject preparation
 - (A.) All testing personnel have current CPR training and certificates
 - (B.) Notices of subject tests are sent to appropriate NIOSH personnel including:
 - 1. Staff involved in testing
 - 2. Physician who is on call
 - 3. Front desk guard
 - 4. Administrative Officer
- IV. Pre-test preparation
 - (A.) Physician and Team Leader have pagers for immediate notification of:
 - 1. Emergency
 - 2. Problems
 - (B.) Test subject receives a physical examination by Physician
 - 1. Must meet all physical requirements
 - 2. Must be referred by Physician as satisfactory
 - (C.) Test subject orientation
 - 2. If new, tries out work exercise equipment
 - 3. Is given information regarding test apparatus
 - 4. Reads and signs HSRB document to safeguard subject
 - 5. Reads protocol (test)
 - 6. Given opportunity to ask questions
 - 7. Is told that he is permitted to stop test anytime for any reason he feels justified
 - 8. Asked if he is prepared to begin test
- V. Testing

- A. Two personnel present during tests
- B. Crash cart present with current drugs and calibrated defibrillator
- C. Subject monitored for oxygen concentration. CO₂ levels, resistance, temperatures, respirations, pulse rate (test stopped if regulations levels are exceeded).

5.2. Data Analysis

5.2.1. All sample values must be within the regulations requirements. Other factors are also evaluated during the tests, such as; strap length, position and adjustments; comfort; weight; profile; total performance. Expert test subjects give test feedback and opinions for the SCBA evaluated and are geared towards:

5.2.2. General comments

5.2.3. Specific comments per intended application.

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 H, Section 84.79, 84.97, 84.99, 84.100, 84.103, 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.

84.79 Breathing gas; minimum requirements

(a)-1 Breathing gas used to supply apparatus shall be respirable and contain no less than 19.5 (dry atmosphere) volume percent of oxygen.

(a)-2 Breathing gas used to supply positive-pressure closed-circuit-specific to mixed gas requirements exposure in facepiece to user (See Fed. Regs. Pub. Vol. 50/No. 222/11-18-85) shall not exceed 30% O₂ on tests 2 and 4 during regular scheduled sampling periods using routine syringe averaging sampling techniques.

Additionally, any sample greater than 40% oxygen on tests 1, 3 and 5 shall constitute a failure.

(b) Oxygen, including liquid oxygen, shall contain not less than 99.0 percent, by volume, of pure O₂, not more than 0.03%, by volume, carbon dioxide, and not more than 0.001%, by volume, carbon monoxide. Methods for making these determinations can be found in the U.S. Pharmacopeia National Formulary. Containers used for oxygen must not be treated with any toxic, sleep-inducing, narcosis-producing, or respiratory tract irritating compounds.

(c) Compressed, gaseous breathing air shall meet the applicable minimum grade requirements for Type I gaseous air set forth in the Compressed Gas Association Commodity Specification for Air, G-7.1, 1966 (Grade D or higher quality). G-7.1 is incorporated by reference and has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018. Copies may be inspected at the NIOSH, Respirator Branch, 1095 Willowdale Road, Morgantown, W.V. 26505-2888, or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

(d) Compressed, liquefied breathing air shall meet the applicable minimum grade requirements for Type II liquid air set forth in the Compressed Gas Association Commodity Specification for Air, G-7.1, 1966 (Grade B or higher quality). G-7.1 is incorporated by reference and has been approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018. Copies may be inspected at the NIOSH, Respirator Branch, 1095 Willowdale Road, Morgantown, W.V. 26505-2888, or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

84.97 Test for carbon dioxide in inspired gas; open- and closed-circuit apparatus; maximum allowable limits.

(b) Closed-circuit apparatus. The concentration of carbon dioxide in inspired gas in closed-circuit apparatus will be measured at the mouth while the parts of the apparatus contributing to dead-air space are mounted on a dummy head and operated by the breathing machine as in paragraphs (a)(1) through (5) of this section.

(c) During the testing required by paragraphs (a) and (b) of this section, the concentration of carbon dioxide in inspired gas at the mouth will be continuously recorded, and the maximum average concentration during the inhalation portion of the breathing cycle shall not exceed the following limits:

Where the service time is	Maximum allowable average concentration of carbon dioxide in inspired air percent by volume
Not more than 30 minutes.....	2.5
1 hour.....	2.0
2 hours.....	1.5
3 hours.....	1.0
4 hours.....	1.0

(d) In addition to the test requirements for closed-circuit apparatus set forth in paragraph (b) of this section, gas samples will be taken during the course of the man tests described in Tables 1, 2, 3 and 4. These gas samples will be taken from the closed-circuit apparatus at a point downstream of the carbon dioxide sorbent, and they shall not contain more than 0.5 percent carbon dioxide at any time, exception apparatus for escape only, using a mouthpiece only, the sample shall not contain more than 1.5 percent carbon dioxide at any time.

84.99 Man tests; testing conditions; general requirements.

(a) The man tests described in Tables 1, 2, 3, and 4 represent the workload performed in the mining, mineral, or allied industries by a person wearing the apparatus tested.

(b) The apparatus tested will be worn by personnel trained in the use of self-contained breathing apparatus, and the wearer will, before participating in these tests, pass a physical examination conducted by a qualified physician.

(c) All man tests will be conducted by the Institute.

(d) The apparatus will be examined before each man test to ensure that it is in proper working order.

(e) Breathing resistance will be measured within the facepiece or mouthpiece and the wearer's pulse and respiration rate will be recorded during each 2-minute sample period prescribed in tests 1, 2, 3, and 4.

(f) Man tests 1, 2, 3, 4, 5, and 6 will be conducted in duplicate.

(g) If man tests are not completed through no fault of the apparatus, the test will be repeated.

84.100 Man tests 1, 2, 3, and 4; requirements.

Man tests 1, 2, 3, and 4, set forth in Tables 1, 2, 3, and 4 respectively, prescribe the duration and sequence of specific activities. These tests will be conducted to:

- (a) Familiarize the wearer with the apparatus during use;
- (b) Provide for a gradual increase in activity;
- (c) Evaluate the apparatus under different types of work and physical orientation; and
- (d) Provide information on the operating and breathing characteristics of the apparatus during actual use.

84.103 Man tests; performance requirements.

- (a) The apparatus shall satisfy the respiratory requirements of the wearer for the classified service time.
- (b) Fogging of the eyepiece shall not obscure the wearer's vision, and the wearer shall not experience undue discomfort because of fit or other characteristics of the apparatus.
- (c) When the ambient temperature during testing is 24 degrees \pm 6 degrees C. (75 degrees \pm 10 degrees F.), the maximum temperature of inspired air recorded during man tests shall not exceed the following, after correction for deviation from 24 degrees C. (75 degrees F.):

Where service life of apparatus is--	Where percent relative humidity of inspired air is--	Maximum permissible temperature of inspired air shall not exceed--	
1/4 hour or less	0-100	135	57
1/2 hour to 3/4 hour	0-50	125	52
	50-100	¹ 110	¹ 43
1 to 2 hours	0-50	115	46
	50-100	¹ 105	¹ 41
3 hours	0-50	110	43
	50-100	¹ 100	¹ 38
4 hours	0-50	105	41
	50-100	¹ 95	¹ 35

¹Where percent relative humidity is 50-100 and apparatus is designed for escape only, these maximum permissible temperatures will be increased by 5°C (10°F).

Tables to Subpart H of Part 84

Table 1-Duration and Sequence of Specific Activities for Test 1, in Minutes
 [42 CFR part 84, subpart H]

Activity	Service time-							
				15 minutes	30 minutes	45 minutes	1 hour	2, 3, and 4 hours
Sampling and readings				2	2	2	2	Perform 1 hour test 2, 3, or 4 times respectively
Walks at 4.8 km. (3 miles) per hour	3	5	3	4	8	12	18	
Sampling and readings			2	2	2	2	2	
Walks at 4.8 km. (3 miles) per hour			3	5	8	12	18	
Sampling and readings			2	2	2	2	2	
Walks at 4.8 km. (3 miles) per hour					6	13	16	
Sampling and readings					2	2	2	

Table 2-Duration and Sequence of Specific Activities For Test 2, in Minutes
 [42 CFR part 84, subpart H]

Activity	Service time-							
	3 minutes	5 minutes	10 minutes	15 minutes	30 minutes	45 minutes	1 hour	2, 3 and 4 hours ¹
Sampling and readings				2	2	2	2	2.
Walks at 4.8 km. (3 miles) per hour			1	1	3	4	6	10.
Carries 23 kg. (50 pound) weight over overcast			1 time in 2 minutes	1 time in 2 minutes	2 times in 4 minutes	3 times in 6 minutes	4 times in 8 minutes	5 times in 10 minutes.
Walks at 4.8 km. (3 miles) per hour				1	3	3	3	5.
Climbs vertical treadmill 2 (or equivalent)	1	1	1	1	1	1	1	1.
Walks at 4.8 km. (3 miles) per hour		1	1			2	3	5.
Climbs vertical treadmill (or equivalent)		1				1	1	1.
Sampling and readings					2	2	2	2.
Walks at 4.8 km. (3 miles) per hour				2	2	3	5	11.
Climbs vertical treadmill (or equivalent)				1	1	1	1	1.
Carries 23 kg. (50 pound) weight over overcast				1 time in 2 minutes	3 times in 6 minutes	4 times in 8 minutes	5 times in 10 minutes	5 times in 10 minutes.
Sampling and readings			2			2	2	2.
Walks at 4.8 km. (3 miles) per hour				1	3	3	3	
Climbs vertical treadmill (or equivalent)			1		1	1	1	Then repeat above activities once.
Walks at 4.8 km. (3 miles) per hour			2			2	3	
Climbs vertical treadmill (or equivalent)						1	1	
Carries 20 kg. (45 pound) weight and walks at 4.8 km. (3 miles) per hour	1						2	
Walks at 4.8 km. (3 miles) per hour	1	2				1	4	
Sampling and readings				2	2	2	2	

¹Total test time for Test 2 for 2-hour, 3-hour, and 4-hour apparatus is 2 hours.

Procedure No. RCT-ASRS-STP-0140	Revision: 1.1	Date: 12 September 2005	Page 19 of 34
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²Treadmill shall be inclined 15° from vertical and operated at a speed of 1 foot per second.

Table 3-Duration and Sequence of Specific Activities For Test 3, in Minutes
[42 CFR part 84, subpart H]

Activity	Service time-							
	3 minutes	5 minutes	10 minutes	15 minutes	30 minutes	45 minutes	1 hour	2, 3 and 4 hours ¹
Sampling and readings				2	2	2	2	(²)
Walks at 4.8 km. (3 miles) per hour			1	1	2	2	3	
Runs at 9.7 km. (6 miles) per hour	1	1	1	1	1	1	1	
Pulls 20 kg. (45 pound) weight to 5 feet.		15 times in 1 minute		30 times in 2 minutes	30 times in 2 minutes	30 times in 2 minutes	60 times in 6 minutes	
Lies on side	1/2	1	1	2	3	4	5	
Lies on back	1/2	1	1	2	2	3	3	
Crawls on hands and knees	1	1	1	2	2	2	2	
Sampling and readings			2		2	2	2	
Runs at 9.7 km. (6 miles) per hour				1	1	1	1	
Walks at 4.8 km. (3 miles) per hour					2	8	10	
Pulls 20 kg. (45 pound) weight to 5 feet.			30 times in 2 minutes.		60 times in 6 minutes.	60 times in 6 minutes	60 times in 6 minutes	
Sampling and readings				2		2	2	
Walks at 4.8 km. (3 miles) per hour			1		3	4	10	
Lies on side						2	4	
Lies on back						2	1	
Sampling and readings					2	2	2	

¹Total test time for Test 3 for 2-hour, 3-hour, and 4-hour apparatus is 2 hours.

²Perform test No. 3 for 1 hr. apparatus; then perform test No. 1 for 1 hour apparatus.

Table 4-Duration and Sequence of Specific Activities for Test 4, in Minutes
 [42 CFR part 84, subpart H]

Activity	Service time-									
	3 minutes	5 minutes	10 minutes	15 minutes	30 minutes	45 minutes	1 hour	2 hours	3 hours	4 hours
Sampling and readings				2	2	2	2	(²)	(³)	(⁴)
Walks at 4.8 km. (3 miles) per hour				1	2	2	2			
Climbs vertical treadmill 1 (or equivalent)	1	1	1	1	1	1	1			
Walks at 4.8 km. (3 miles) per hour		1	1	1	2	2	2			
Pulls 20 kg. (45 pound) weight to 5 feet		30 times in 2 minutes	30 times in 2 minutes	30 times in 2 minutes	60 times in 5 minutes	60 times in 5 minutes	60 times in 5 minutes			
Walks at 4.8 km. (3 miles) per hour			1	1	1	2	3			
Carries 23 kg. (50 pound) weight over overcast				1 time in 1 minute	1 time in 1 minute	2 times in 3 minutes	4 times in 8 minutes			
Sampling and readings			2		2	2	2			
Walks at 4.8 km. (3 miles) per hour				1	3	3	4			
Runs at 9.7 km. (6 miles) per hour		1	1	1	1	1	1			
Carries 23 kg. (50 pound) weight over overcast			1 time in 1 minute	1 time in 1 minute	2 times in 3 minutes	4 times in 6 minutes	6 times in 9 minutes			
Pulls 20 kg (45 pound) weight to 5 feet	15 times in 1 minute			15 times in 1 minute	60 times in 5 minutes	30 times in 2 minutes	36 times in 3 minutes			
Sampling and readings				2	2	2	2			
Walks at 4.8 km. (3 miles) per hour	1		1			2	6			
Pulls 20 kg. (45 pound) weight to 5 feet						60 times in 5 minutes	60 times in 5 minutes			
Carries 20 kg. (45 pound) weight and walks at 4.8 km. (3 miles) per hour						3	3			
Sampling and readings						2	2			

¹Treadmill shall be inclined 15° from vertical and operated at a speed of 30 cm. (1 foot) per second.

²Perform test No. 1 for 30-minute apparatus; then perform test No. 4 for 1-hour apparatus; then perform test No. 1 for 30-minute apparatus.

³Perform test No. 1 for 1-hour apparatus; then perform test No. 4 for 1-hour apparatus; then perform test No. 1 for 1-hour apparatus.

⁴Perform test No. 1 for 1-hour apparatus; then perform test No. 4 for 1-hour apparatus; then perform test No. 1 for 1-hour apparatus twice (i.e., two one-hour tests).

7. RECORDS\TEST SHEETS

- 7.1. All test data will be recorded on the MAN TESTS, SELF-CONTAINED BREATHING APPARATUS 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.

Test/Data Sheets

1. Four Hour Man Test(1,2,3,&4)--Example of Work and Sample Schedule.

Figures

1. Overcast (NIOSH)
2. Overcast (U.S.BOM)

MAN TESTS, SELF-CONTAINED BREATHING APPARATUS #1 - 4 HOUR

PROJECT NO: _____ DATE : _____

Subject: _____ Age : _____

Subject weight: Initial - _____ Final - _____

RESPIRATOR TYPE: 4 hr positive pressure

Unit weight: Initial - _____ Final - _____

Observers: _____

Sampling Schedule

Time/Min. _____	Gas Percent		Pulse bpm	Resp. rpm	Resistance		Temperature		Press. gauge
	CO ₂	O ₂			inh.	exh.	unit	amb.	
0-2	_____	_____	_____	_____	_____	_____	_____	_____	_____
20-22	_____	_____	_____	_____	_____	_____	_____	_____	_____
40-42	_____	_____	_____	_____	_____	_____	_____	_____	_____
58-62	_____	_____	_____	_____	_____	_____	_____	_____	_____
80-82	_____	_____	_____	_____	_____	_____	_____	_____	_____
100-102	_____	_____	_____	_____	_____	_____	_____	_____	_____
118-122	_____	_____	_____	_____	_____	_____	_____	_____	_____
140-142	_____	_____	_____	_____	_____	_____	_____	_____	_____
160-162	_____	_____	_____	_____	_____	_____	_____	_____	_____
178-182	_____	_____	_____	_____	_____	_____	_____	_____	_____
200-202	_____	_____	_____	_____	_____	_____	_____	_____	_____
220-222	_____	_____	_____	_____	_____	_____	_____	_____	_____
238-240	_____	_____	_____	_____	_____	_____	_____	_____	_____

alarm - _____ min. at _____ psig.

WORK Schedule

<u>Time/Min.</u>	<u>Exercise</u>
2-20	walk - 3mph
22-40	walk - 3mph
42-58	walk - 3mph
62-80	walk - 3mph
82-100	walk - 3mph
102-118	walk - 3mph
122-140	walk - 3mph
142-160	walk - 3mph
162-178	walk - 3mph
182-200	walk - 3mph
202-220	walk - 3mph
222-238	walk - 3mph

Comments :

Test Engineer: _____ PASS _____ FAIL _____

MAN TESTS, SELF-CONTAINED BREATHING APPARATUS #2 - 2, 3, and 4 HOUR

PROJECT NO: _____ DATE : _____

Subject: _____ Age : _____

Subject weight: Initial - _____ Final - _____

RESPIRATOR TYPE: 4 hour

Unit weight: Initial - _____ Final - _____

Observers: _____

Sampling Schedule

Time/Min. _____	Gas Percent		Pulse bpm	Resp. rpm	Resistance		Temperature		Press. gauge
	CO ₂	O ₂			inh.	exh.	unit	amb.	
0-2	_____								
34-36	_____								
58-62	_____								
94-96	_____								
118-120	_____								

Comments :

Test Engineer: _____ PASS _____ FAIL _____

WORK Schedule

<u>Time/Min.</u>	<u>Exercise</u>
0-2	sample
2-12	walk - 3mph
12-22	carry wt.- overcast (5x10)
22-27	walk - 3mph
27-28	vertical treadmill
28-33	walk - 3mph
33-34	vertical treadmill
34-36	sample
36-47	walk - 3mph
47-48	vertical treadmill
48-58	carry wt.- overcast (5x10)
58-62	sample
62-72	walk - 3mph
72-82	carry wt.- overcast (5x10)
82-87	walk - 3mph
87-88	vertical treadmill
88-93	walk - 3m
93-94	vertical treadmill
94-96	sample
96-107	walk - 3mph
107-108	vertical treadmill
108-118	carry wt.- overcast (5x10)
118-120	sample

MAN TESTS, SELF-CONTAINED BREATHING APPARATUS #3 - 2, 3, and 4 HOUR

PROJECT NO: _____ DATE : _____

Subject: _____ Age : _____

Subject weight: Initial - _____ Final - _____

RESPIRATOR TYPE: 4 hour

Unit weight: Initial - _____ Final - _____

Observers: _____

Sampling Schedule

Time/Min.	Gas Percent		Pulse bpm	Resp. rpm	Resistance		Temperature		Press. gauge
	CO ₂	O ₂			inh.	exh.	unit	amb.	
0-2	_____	_____	_____	_____	_____	_____	_____	_____	_____
22-24	_____	_____	_____	_____	_____	_____	_____	_____	_____
41-43	_____	_____	_____	_____	_____	_____	_____	_____	_____
58-62	_____	_____	_____	_____	_____	_____	_____	_____	_____
80-82	_____	_____	_____	_____	_____	_____	_____	_____	_____
100-102	_____	_____	_____	_____	_____	_____	_____	_____	_____
118-120	_____	_____	_____	_____	_____	_____	_____	_____	_____

Comments :

Test Engineer: _____ PASS _____ FAIL _____

WORK Schedule

<u>Time/Min.</u>	<u>Exercise</u>
0-2	sample
2-5	walk - 3mph
5-6	run - 6mph
6-12	rope pull - 60x6min
12-17	lie on side
17-20	lie on back
20-22	crawl on hands & knees
22-24	sample
24-25	run - 6mph
25-35	walk - 3mph
35-41	rope pull - 60x6min
41-43	sample
43-53	walk - 3mph
53-57	lie on side
57-58	lie on back
58-62	sample
62-80	walk - 3mph
80-82	sample
82-100	walk - 3mph
100-102	sample
102-118	walk - 3mph
118-120	sample

MAN TESTS, SELF-CONTAINED BREATHING APPARATUS #4 - 4 HOUR

PROJECT NO: _____ DATE : _____

Subject: _____ Age : _____

Subject weight: Initial - _____ Final - _____

RESPIRATOR TYPE: 4 hour

Unit weight: Initial - _____ Final - _____

Observers: _____

Sampling Schedule

Time/Min. _____	Gas Percent		Pulse bpm	Resp. rpm	Resistance		Temperature		Press gauge
	CO ₂	O ₂			inh.	exh.	unit	amb.	
0-2	_____								
20-22	_____								
40-42	_____								
58-62	_____								
83-85	_____								
102-104	_____								
118-122	_____								
140-142	_____								
160-162	_____								
178-182	_____								
200-202	_____								
220-222	_____								
238-240	_____								

Alarm - _____ min. at _____ psig.

Work Schedule

<u>Time/Min.</u>	<u>Exercise</u>
0-2	sample
2-20	walk - 3mph
20-22	sample
22-40	walk - 3mph
40-42	sample
42-58	walk - 3mph
58-62	sample
62-64	walk - 3mph
64-65	vertical
65-67	walk - 3mph
67-72	rope pull - 60x5min
72-75	walk - 3mph
75-83	overcast - 4x8min
83-85	sample
85-89	walk - 3mph
89-90	run - 6mph
90-99	overcast - 6x9min
99-102	rope pull - 36x3min
102-104	sample
104-110	walk - 3mph
110-115	rope pull - 60x6min
115-118	carry 45lb weight & walk 3mph

Work Schedule (cont)

<u>Time/Min.</u>	<u>Exercise</u>
118-122	sample
122-140	walk - 3mph
140-142	sample
142-160	walk - 3mph
160-162	sample
162-178	walk - 3mph
178-182	sample
182-200	walk - 3mph
200-202	sample
202-220	walk - 3mph
220-222	sample
222-238	walk - 3mph
238-240	sample

Comments :

Test Engineer: _____ PASS _____ FAIL _____

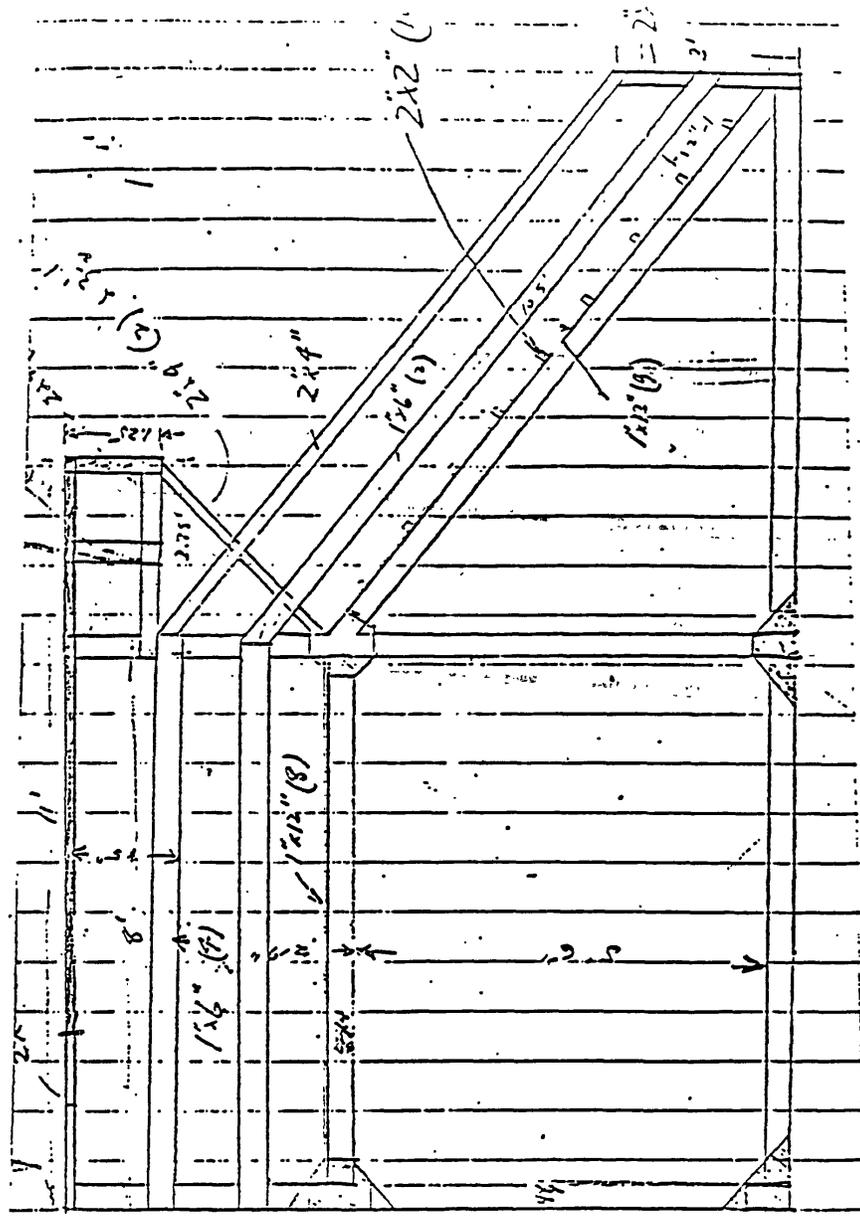


Figure 10

Revision History

Revision	Date	Reason for Revision
1.0	16 March 2001	Historic document
1.1	12 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method