National Institute for Occupational Safety and Health National Personal Protective Technology Laboratory P.O. Box 18070 Pittsburgh, PA 15236		
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DETERMINATION OF REMAINING SERVICE-LIFE INDICATOR - OPEN-CIRCUIT, DEMAND AND PRESSURE-DEMAND, 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 remaining service-life indicator requirements on Open-Circuit, Demand and Pressure-Demand, Self-Contained Breathing Apparatus (SCBA) 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 84.83(e)(f), Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of Remaining Service-Life Indicator - 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. ISI Anthropometric Test heads with tube for measuring breathing resistance and air flows - Model SR-085 or equivalent.

Approvals:	1st Level	2nd Level	3rd Level

3.1.2. High Pressure Test Stand. A test stand incorporating four Weksler calibrated pressure gauges (two 0-10,000 psig and two 0-3,000 psig) or equivalent.

3.1.3. Source of high pressure air. Ingersoll Rand breathing air compressor (5500 psig)- Model BAP20tv3 equipped with a vertical purifier system, capable of delivering 0-5200 psig, a minimum of 1125 psig or equivalent.

3.1.4. Mechanical breather with 622 Kg m/min. cam as per U.S. BOM Drawings C-l748 (3/l7/69) Breathing Machine and B-ll98 (3/6/69) Breathing Cam or equivalent.

3.1.5. Electric Timer, calibrated to hundredths of a minute (Precision Scientific Company) or equivalent.

3.1.6. Two channel thermal tip recording system (Gould Model No. RS3200) with carrier amplifier (Model No. 13-4615-35) or equivalent.

3.1.7. Temperature compensated pressure transducer (Validyne Engineering Model No. DP45) 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 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. Procedure 1:

5.1.1. Close off tube on anthropometric test head.

5.1.2. Assemble self-contained breathing apparatus as per manufacturer's instructions.

5.1.3. Mount facepiece on anthropometric test head.

5.1.4. Remove air supply bottle and attach test stand in the bottle's place.

5.1.5. Charge the system with the compressor.

5.1.6. Bleed the unit down through the regulator by pass valve.

5.1.7. When the alarm sounds, the pressure on the test stand gauge should be recorded on data sheet.

5.1.8. Repeat steps 5.1.5, 5.1.6, and 5.1.7 six times and record data (see data analysis).

5.2. Procedure 2:

5.2.1. This procedure is carried out simultaneously while running the rated service-time test RCT-ASR-STP-0124.

5.2.2. During the test, note on the chart paper the exact time the remaining service-life indicator sounds and the exact number of cycles indicated by the counter on the breathing machine.

5.2.3. Correct the alarm time by multiplying the recorded time by 24 and compare it to the cycle count taken from the breathing machine counter. Adjust alarm time accordingly.

5.3. Procedure 3:

Note: If a company submits for approval under the new interpretation of the requirement (see TN-05323).

5.3.1. First run rated service time test RCT-ASR-STP-0124.

5.3.2. Subtract 20 to 25% or 23 to 27% (depending on design) of the rated service time from the actual service time. This gives you the new alarm range.

5.4. Data Analysis

5.4.1. The remaining service life indicator must go off within a range of 20 to 25% of its rated service pressure or time to meet the minimum requirements of 420 CFR Part 84.

Note: For apparatus which do not have a method of manually turning off remote gauge in the event of a gauge or gauge line failure the remaining service-life indicator is required to be set at 25% ± 2% of the rated service time or pressure.

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 84.83(e)(f), 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.

84.83 Timers; elapsed time indicators; remaining service-life indicators; minimum requirements.

(e) Remaining service-life indicators or warning devices shall be provided in addition to a pressure gage on compressed gas self-contained breathing apparatus, except apparatus used for escape only, and shall operate automatically without pre-adjustment by the wearer.

(f) Each remaining service-life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced within a range of 20 to 25 percent of its rated service time, or pressure.

6.3. Note: For apparatus which do not have a method of manually turning off the remote gauge in the event of a gauge or gauge line failure the remaining service-life indicator is required to be set at 25% ± 2% of the rated service time or pressure.

7. RECORDS\TEST SHEETS

7.1. All test data will be recorded on the ALARM PRESSURE (#1, #2, #3, and #4) OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS test data sheets.

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.

ALARM PRESSURE #1, OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS

Project No. : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR Part 84, Subpart H, 84.83(e)(f).

Requirement: Each remaining service-life indicator or warning device shall give an alarm when the remaining service-life of the apparatus is reduced within a range of 20 to 25% of its rates service time or pressure.

Procedure: Pressure is recorded from test stand. Time is recorded from the rated service time test.

Results:

	Alarm Time/Min.	Alarm Pressure/Psig
Unit #1	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Unit #2	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

Comments:

_____

_____

_____

_____

Test Engineer: _____ Pass _____ Fail _____

ALARM PRESSURE #2, OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS

Project No. : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR Part 84, Subpart H, 84.83(e)(f)

Requirement: When a unit does not have a remote gauge shutoff then, each remaining service-life indicator or warning device shall give an alarm when the remaining service-life of the apparatus is reduced within a range of 23 to 27% of its rated service time or pressure.

Procedure: Pressure is recorded from test stand. Time is recorded from the Rated service time test.

Results:

	Alarm Time/Min.	Alarm Pressure/Psig
Unit #1	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Unit #2	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

Comments:

_____

_____

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_____

Test Engineer: _____ Pass _____ Fail_____

ALARM PRESSURE #3, OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS

Project No. : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR Part 84, Subpart H, 84.83(e)(f)

Requirement: Each remaining service-life indicator or warning device shall give an alarm when the remaining service-life of the apparatus is reduced within a range of 20 to 25% of its rated service time or pressure.

Procedure: In order to test the alarms under the new interpretation of the requirement (see TN-05323), first the rated service time test is performed, then 20 to 25% of the rated service time is subtracted from the actual service time in order to get the alarm range.

Results:

Actual Service Time	- 20% of Rated Service Time	= High Point of Alarm Range
_____	_____	_____

Actual Service Time	- 25% of Rated Service Time	= Low Point of Alarm Range
_____	_____	_____

	High Point of Alarm Range	Low Point of Alarm Range	Recorded Alarm Time
Unit 1	_____Min	_____Min	_____Min
Unit 2	_____Min	_____Min	_____Min

Comments:

_____

_____

_____

_____

Test Engineer: _____ Pass _____ Fail _____

ALARM PRESSURE #4, OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS

Project No. : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR Part 84, Subpart H, 84.83(e)(f)

Requirement: When a unit does not have a remote gauge shut off then each remaining service-life of the apparatus is reduced within a range of 23 to 27% of its rated service time or pressure.

Procedure: In order to test the alarms under the new interpretation of the requirement (see TN-05323), first the rated service time test is performed, then 23 to 27% of the rated service time is subtracted from the actual service time in order to get the alarm range.

Results:

Actual Service Time	- 23% of Rated Service Time	= High Point of Alarm Range
_____	_____	_____

Actual Service Time	- 27% of Rated Service Time	= Low Point of Alarm Range
_____	_____	_____

	High Point of Alarm Range	Low Point of Alarm Range	Recorded Alarm Time
Unit 1	_____Min	_____Min	_____Min
Unit 2	_____Min	_____Min	_____Min

Comments:

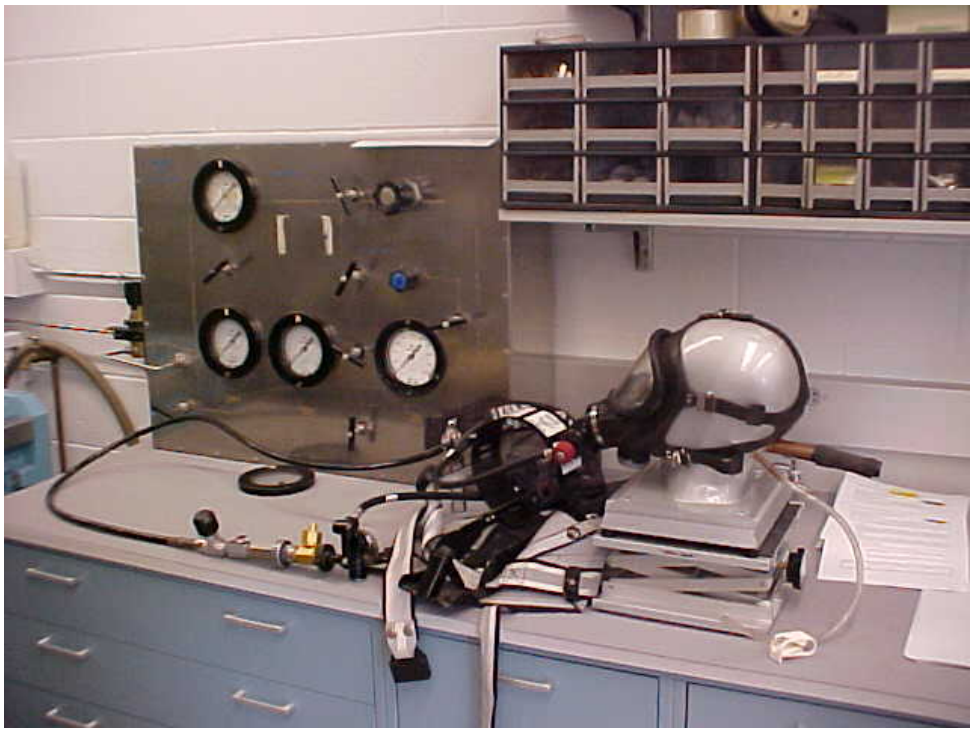
_____

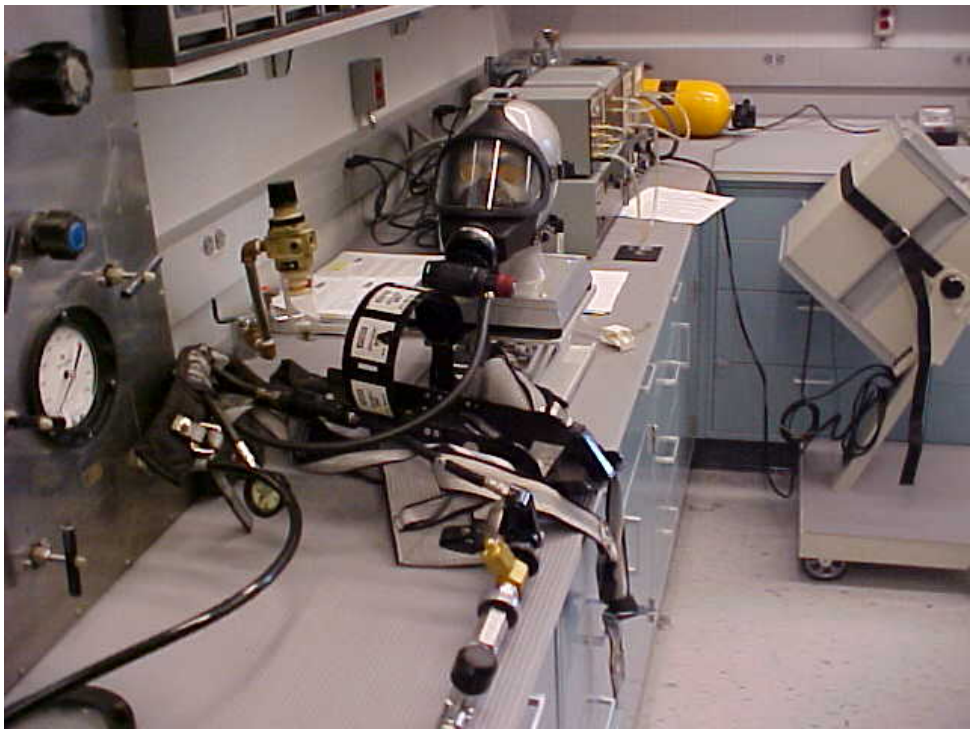
_____

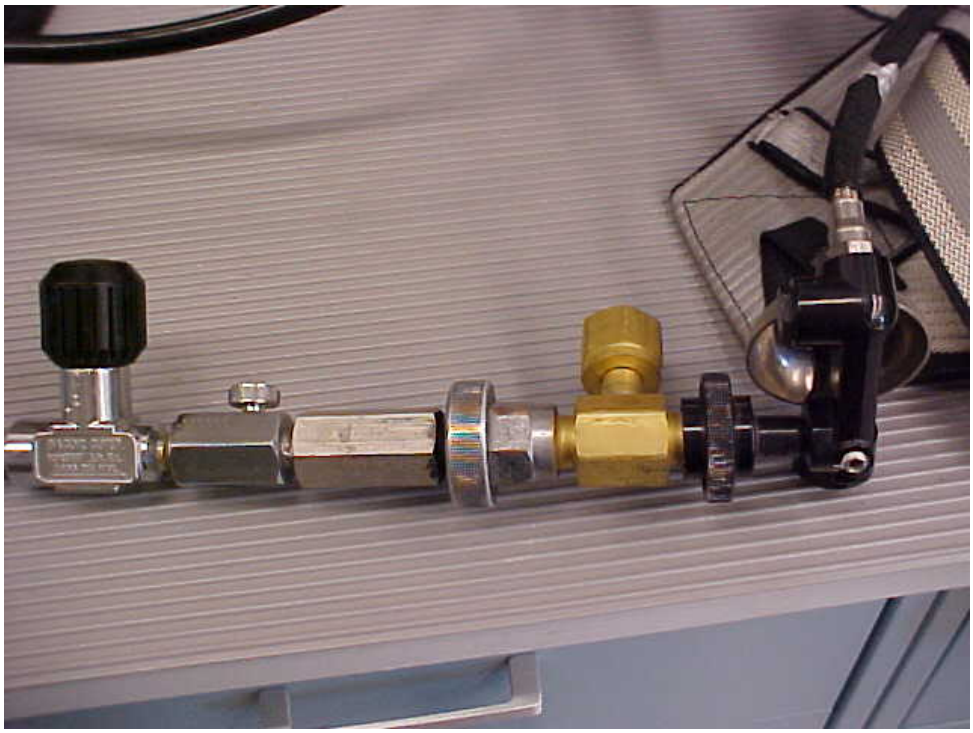
_____

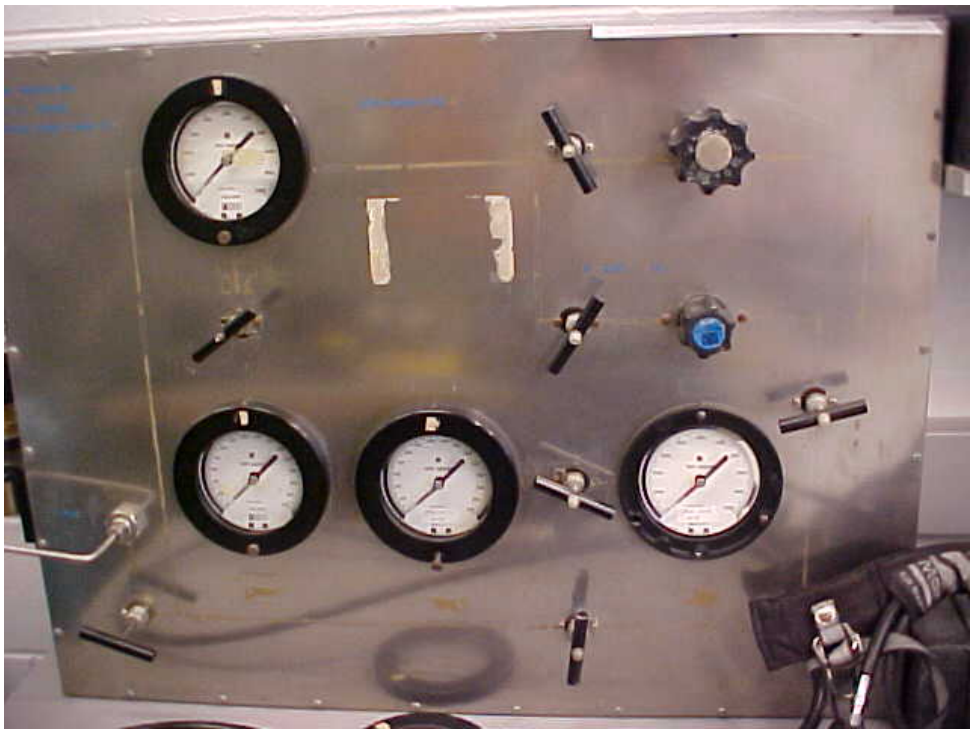
_____

Test Engineer: _____ Pass _____ Fail _____









Revision History

Revision	Date	Reason for Revision
1.0	5 July 2000	Historic document
1.1	21 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method