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

Procedure No. RCT-ASR-STP-0121	Revision: 1.1	Date: 20 September 2005

DETERMINATION OF RATED SERVICE TIME - 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 rated service time 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 84.95; Volume 60, Number 110, June 8, 1995.

2. GENERAL

This STP describes the Determination of Rated Service Time - 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. Two channel thermal tip recording system (Gould Model No. RS3200) with carrier amplifier (Model No.13-4615-35) or equivalent.

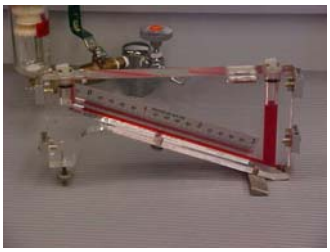
Approvals:	1st Level	2nd Level	3rd Level

3.1.2. 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.

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

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

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



3.1.6. Dwyer Slant Manometer 0-3", F. W. Dwyer Manufacturing Co., Michigan City, Indiana 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. Turn on recorder and allow at least 30-minutes warmup.

PRE-TEST BALANCING OF TRANSDUCER AND RECORDER

5.1.1. Connect the transducer to be used during testing in parallel with a manometer. Attach the manometer and transducer to a pressure regulated air source. A pinch clamp, used for slight pressure changes, is placed inline with two equal lengths of tubing for the manometer and transducer connections.

5.1.2. Connect the transducer cable to the carrier amplifier in the chart. Calibrate the

recorder and carrier amplifier per instruction manual. Press the 5 mm/sec chart speed button. With no load applied to the transducer/manometer system, adjust the "POSITION" potentiometer on the chart recorder until the pen is at the mid-scale position. Press the STOP button on the chart recorder.

5.1.3. Apply a pressure of 0.5 inches of water to the transducer/manometer system. Press the 5 mm/sec chart speed button. Adjust the "CAL" potentiometer on the carrier amplifier until the pen on the chart recorder is at the next bold line left of mid-scale position. This represents 0.5 inches of water. Press the STOP button on the chart recorder.

5.1.4. Reduce the pressure to 0.0 inches of water to the transducer/manometer system. Press the 5 mm/sec chart speed button and check the chart recorder pen is at zero mid-scale position. Make any necessary adjustments. Press the STOP button on the chart recorder.

5.1.5. Repeat steps 5.1.3. and 5.1.4. with a pressures of 1.0 , 1.5, and 2.0 inches of water until no adjustments are necessary at the "CAL" potentiometer on the carrier amplifier.

5.1.6. After the calibration sequence is complete remove the pressure source from the system.

5.2. Assemble the apparatus as shown in Figure 1. Mount the pressure transducer where shock and vibration are minimal.

5.3. Fill SCBA cylinder with air to pressure as noted in the instruction manual. Make sure the pressure is within the DOT certified pressure range. A "+" indicates that the DOT pressure may be exceeded by 10%.

5.4. Assemble respirator. Mount facepiece on anthropometric head, taking care not to block resistance port below and left of nose, particularly if a nosecup is used. Make sure that the face seal is leak tight by blocking-off inhalation port of facepiece and inhaling through the breathing tube port exiting back of head. After building up several inches of negative pressure hold breath several seconds, which will enable you to determine if a leak is present. If there is a leak, readjust headstraps and facepiece position and repeat leak test until a seal is obtained.

5.5. Lay out respirator on workbench taking care to ensure regulator, (if belt or waist mounted) is situated in the normal use position

5.6. Connect regulator or breathing tube to facepiece. Do not connect head to breathing machine. Turn on breathing machine and use a timer to determine to determine that the cam is operating at 24 rpm. (This will give a 40 lpm volume). The breathing machine contains a cycle counter for obtaining exact and total cycle counts and is used to make precise corrections at end of test.

5.7. Zero the recorder base-line to mid point of chart paper. (while this is being done the

transducer should be connected to the recorder but the transducer should not have any load on it).

5.8. Connect the anthropocentric head with the facepiece to the breathing machine. Connect transducer to resistance port with a short length of tubing. Open cylinder valve full and open main line valve full. Make sure the by-pass valve is closed.

5.9. Operate recorder at 1 mm/sec and set attenuator to a high value. Record all settings directly on chart. Set counter on breathing machine to "0". Turn on breathing machine and timer simultaneously.

5.10. Adjust recorder attenuation to the lowest value where complete tracing is still being recorded. Periodically, close to the end of the service time, or at any point during the test, adjust the speed to 20mm/sec to obtain a more accurate reading.

5.11. When alarm activation is heard, record time and the exact number of cycles indicated by the counter on the breathing machine on strip chart. Continue recording until inhalation portion of the breathing curve falls below baseline, and record this time on strip chart.

5.12. When tracings are complete - Turn off breathing machine, recorder, and cylinder valve on SCBA and then bleed down high-pressure air trapped in breathing hose by opening the by-pass valve, then shut the by-pass off. Disconnect transducer from head, and record counter setting on chart paper.

5.13. Retrieve the tracings on chart paper for data analysis.

5.14. Data Analysis

5.14.1. The recorder produced a trace showing the inhalation (negative) and exhalation (positive) breathing resistance. The inhalation phase is the component for analysis. With a chart speed of 20 mm/sec, the inhalation phase should measure approximately 50 mm.

5.14.2. A calibrated electric timer is used to determine the length of time between starting the breathing machine and the point at which the inhalation portion of the breathing curve falls below minimum requirements.

5.14.3. Correct end of test time by multiplying the recorded time by 24 and compare it to the cycle count taken from the breathing machine counter. Adjust test time accordingly.

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 84.95; 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.

84.95 Service time test; open-circuit apparatus.

(a) Service time will be measured with a breathing machine as described in 84.88.

(b) The open-circuit apparatus will be classified according to the length of time it supplies air or oxygen to the breathing machine.

(c) The service time obtained on this test will be used to classify the open-circuit apparatus in accordance with 84.53.

7. RECORDS\TEST SHEETS

7.1. All test data will be recorded on the RATED SERVICE TIME, OPEN-CIRCUIT, 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.

RATED SERVICE TIME, OPEN-CIRCUIT, SELF-CONTAINED BREATHING APPARATUS

Project No : _____ Date: _____

Company : _____

Respirator Type: _____

Reference: 42 CFR, Part 84, Subpart H, Section 84.95.

Requirement: (a) Service time will be measured with a breathing machine as described in 84.88.

(b) The open-circuit apparatus will be classified according to the length of time it supplies air or oxygen to the breathing machine.

(c) The service time obtained on this test will be used to classify the open-circuit apparatus in accordance with 84.53.

Use 622 kg-m/min. cam and rate unit according to flow duration and classify as in 84.53.

Results:

TIME-MIN	PSIG	CYCLES
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Corrected End of Service-life: _____

Corrected alarm time: _____

Comments:

_____

_____

Test Engineer: _____ Pass _____ Fail_____

Test Set-up for Measuring Rated Service Time.

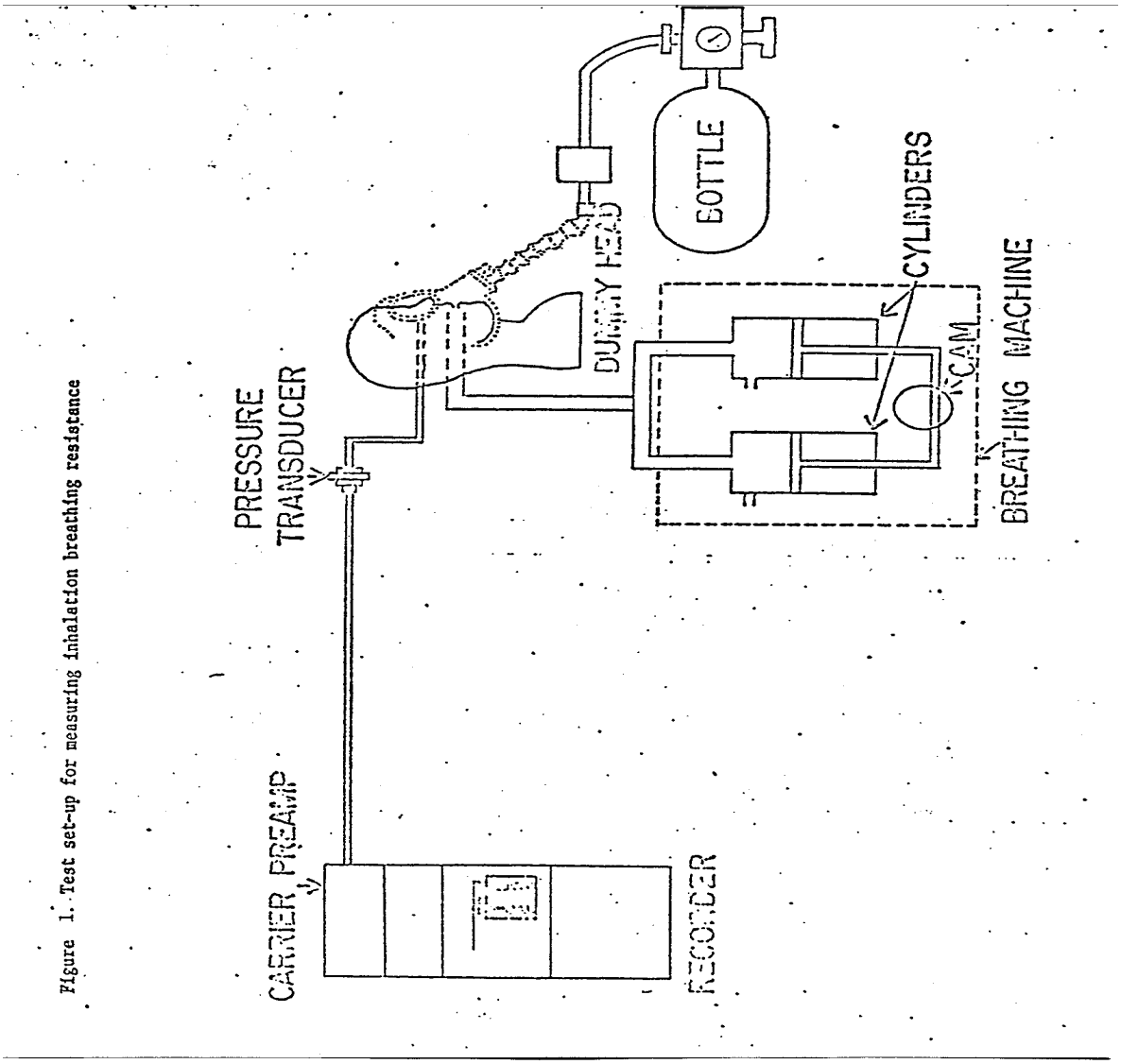
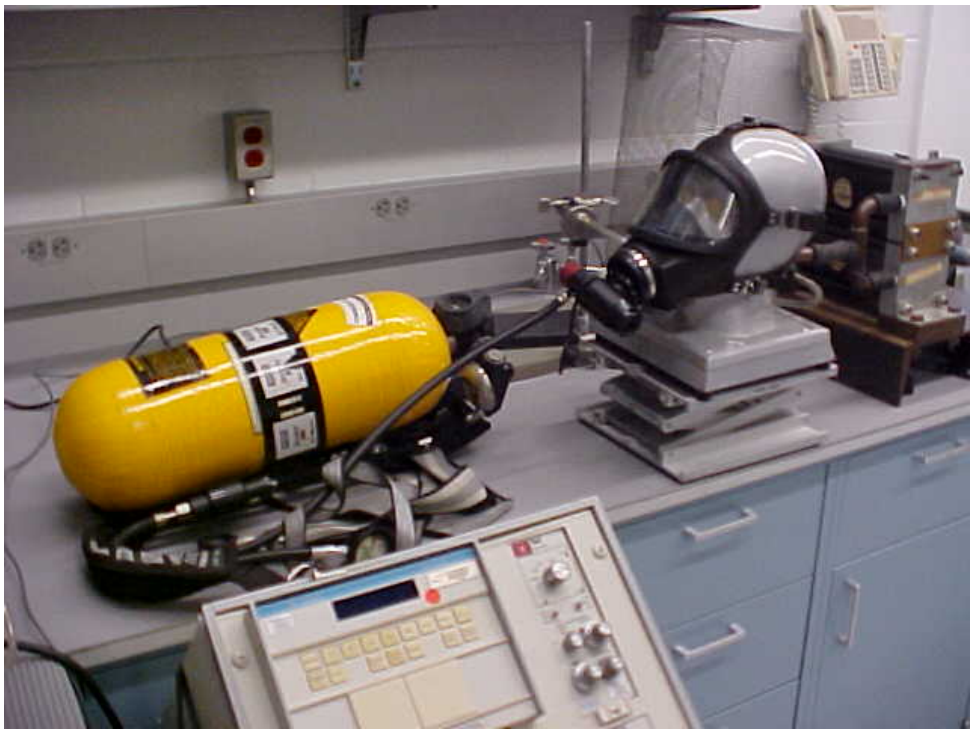
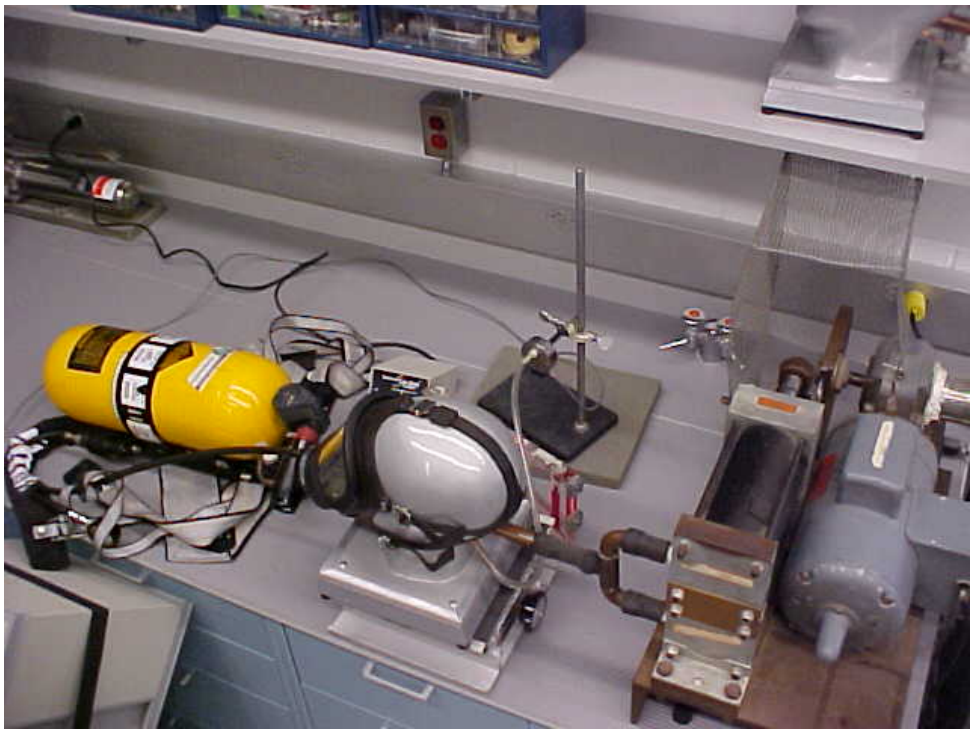
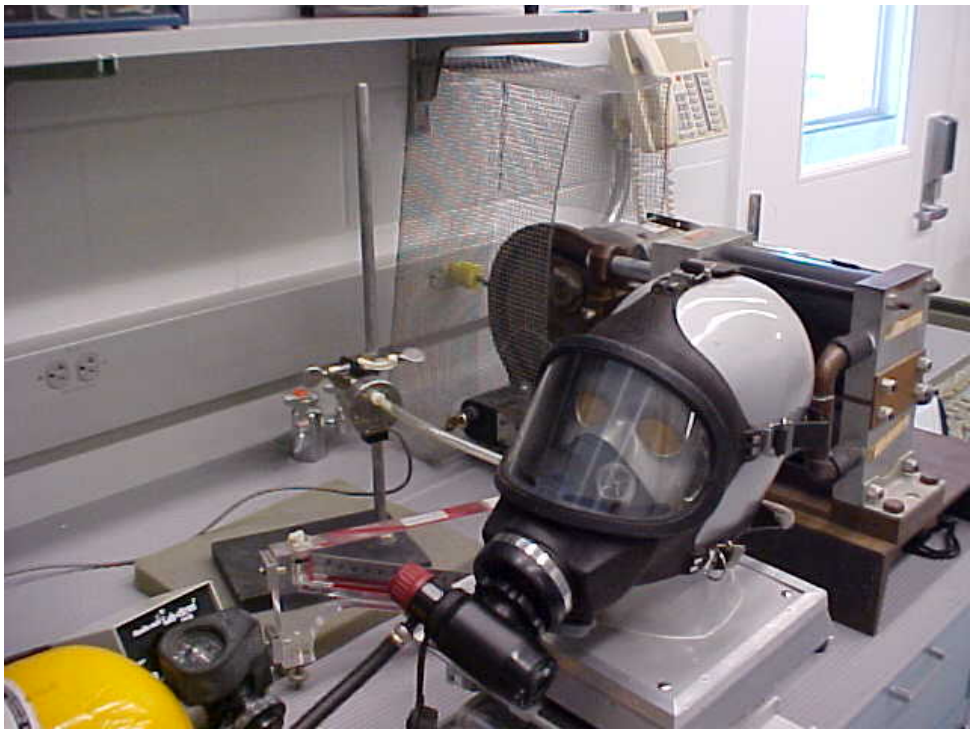
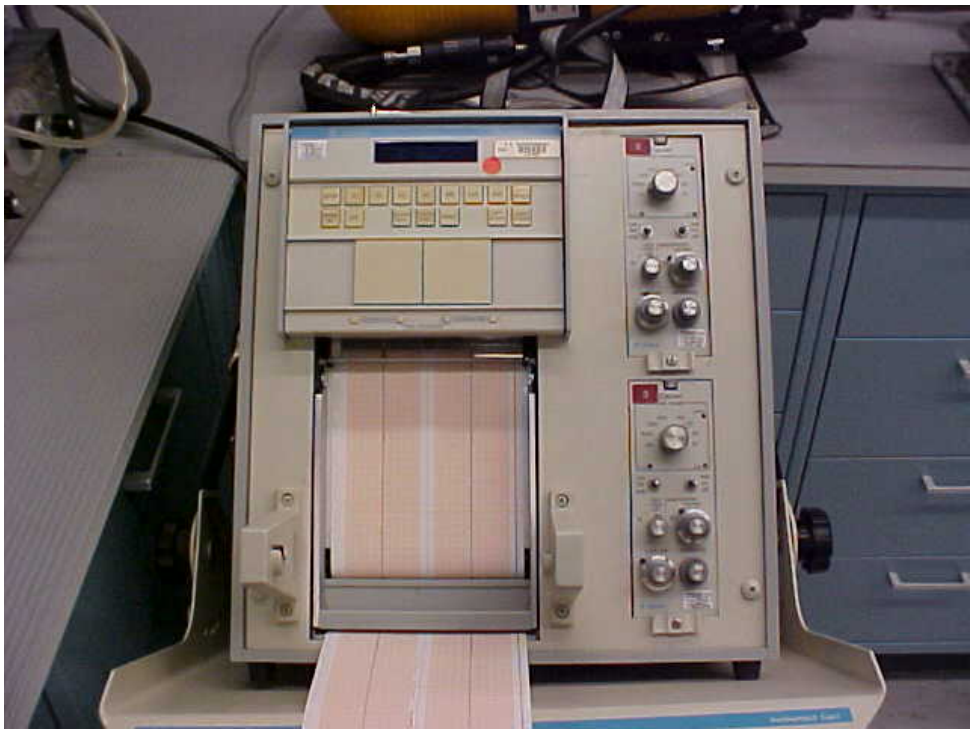


Figure 1. Test set-up for measuring inhalation breathing resistance










REDINGTON
COUNTERS INC.
Windsor, Conn U.S.A.
MODEL 5-2835

Revision History

Revision	Date	Reason for Revision
1.0	23 May 2001	Historic document
1.1	20 September 2005	Update header and format to reflect lab move from Morgantown, WV No changes to method