

**§ 84.92**

**§ 84.92 Exhalation valve leakage test.**

(a) Dry exhalation valves and valve seats will be subjected to a suction of 25 mm. (1 inch) water-column height while in a normal operating position.

(b) Leakage between the valve and the valve seat shall not exceed 30 milliliters per minute.

**§ 84.93 Gas flow test; open-circuit apparatus.**

(a) A static-flow test will be performed on all open-circuit apparatus.

(b) The flow from the apparatus shall be greater than 200 liters per minute when the pressure in the facepiece of demand-apparatus is lowered by 51 mm. (2 inches) water-column height when full container pressure is applied.

(c) Where pressure demand apparatus are tested, the flow will be measured at zero gage pressure in the facepiece.

(d) Where apparatus with compressed-breathing-gas containers are tested, the flow test shall also be made with 3,450 kN/m.<sup>2</sup> (500 p.s.i.g.) container pressure applied.

**§ 84.94 Gas flow test; closed-circuit apparatus.**

(a) Where oxygen is supplied by a constant-flow device only, the rate of flow shall be at least 3 liters per minute for the entire rated service time of the apparatus.

(b) Where constant flow is used in conjunction with demand flow, the constant flow shall be greater than 1.5 liters per minute for the entire rated service time.

(c) All demand-flow devices shall provide at least 30 liters of oxygen per minute when in the fully open position.

**§ 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.

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**§ 84.96 Service time test; closed-circuit apparatus.**

(a) The closed-circuit apparatus will be classified according to the length of time it supplies adequate breathing gas to the wearer during man test No. 4 described in Table 4 of this subpart.

(b) The service time obtained on man test No. 4 will be used to classify the closed-circuit apparatus in accordance with § 84.53.

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

(a) *Open-circuit apparatus.* (1) The concentration of carbon dioxide in inspired gas in open-circuit apparatus will be measured at the mouth while the apparatus mounted on a dummy head is operated by a breathing machine. An acceptable method for measuring the concentration of carbon dioxide is described in Bureau of Mines Report of Investigations 6865, A Machine-Test Method for Measuring Carbon Dioxide in the Inspired Air of Self-Contained Breathing Apparatus, 1966. Copies of Report of Investigations 6865 may be inspected or obtained from the NIOSH, Certification and Quality Assurance Branch, 1095 Willowdale Road, Morgantown, WV. 26505-2888.

(2) The breathing rate will be 14.5 respirations per minute with a minute-volume of 10.5 liters.

(3) A sedentary breathing machine cam will be used.

(4) The apparatus will be tested at a temperature of 27 ±2 °C. (80 ±5 °F.).

(5) A concentration of 5 percent carbon dioxide in air will be exhaled into the facepiece.

(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 of this subpart. 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, except on apparatus for escape only, using a mouthpiece only, the sample shall not contain more than 1.5 percent carbon dioxide at any time.

**§ 84.98 Tests during low temperature operation.**

(a) The applicant shall specify the minimum temperature for safe operation and two persons will perform the tests described in paragraphs (c) and (d) of this section, wearing the apparatus according to applicant's directions. At the specified temperature, the apparatus shall meet all the requirements described in paragraph (e) of this section.

(b) The apparatus will be precooled at the specified minimum temperature for 4 hours.

(c) The apparatus will be worn in the low temperature chamber for 30 minutes, or for the service time of the apparatus, whichever is less.

(d) During the test period, alternate 1-minute periods of exercise and rest will be required with the exercise periods consisting of stepping onto and off a box 21.5 cm. (8½ inches) high at a rate of 30 cycles per minute.

(e)(1) The apparatus shall function satisfactorily at the specified minimum temperature on duplicate tests.

(2) The wearer shall have sufficient unobscured vision to perform the work.

(3) The wearer shall not experience undue discomfort because of airflow restriction or other physical or chemical changes in the operation of the apparatus.

(f) Auxiliary low-temperature parts which are commercially available to the user may be used on the apparatus to meet the requirements described in paragraph (e) of this section.

**§ 84.99 Man tests; testing conditions; general requirements.**

(a) The man tests described in Tables 1, 2, 3, and 4 of this subpart 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 Institute 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 of this subpart, 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.