

flowing at a continuous rate of 85 liters per minute.

(b) The maximum allowable resistance requirements for gas masks are as follows:

MAXIMUM RESISTANCE  
[mm. water-column height]

Type of gas mask	Inhalation		Exhalation
	Initial	Final <sup>1</sup>	
Front-mounted or back-mounted (without particulate filter) .....	60	75	20
Front-mounted or back-mounted (with approved particulate filter) .....	70	85	20
Chin-style (without particulate filter) .....	40	55	20
Chin-style (with approved particulate filter) .....	65	80	20
Escape (without particulate filter) .....	60	75	20
Escape (with approved particulate filter) .....	70	85	20

<sup>1</sup> Measured at end of the service life specified in Tables 5, 6, and 7 of this subpart.

**§ 84.123 Exhalation valve leakage test.**

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

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

**§ 84.124 Facepiece tests; minimum requirements.**

(a) The complete gas mask will be fitted to the faces of persons having varying facial shapes and sizes.

(b) Where the applicant specifies a facepiece size or sizes for the gas mask, together with the approximate measurements of faces they are designed to fit, the Institute will insure that test subjects suit such facial measurements.

(c) Any gas mask parts which must be removed to perform the facepiece or mouthpiece fit test shall be replaceable without special tools and without disturbing the facepiece or mouthpiece fit.

(d) The facepiece or mouthpiece fit test, using positive or negative pressure recommended by the applicant and described in his instructions will be used before each test specified in paragraph (e) of this section, and in § 84.125.

(e)(1) Each wearer will enter a chamber containing 100 p.p.m. isoamyl acetate vapor for a half-mask facepiece and 1,000 p.p.m. isoamyl acetate vapor for a full facepiece or mouthpiece.

(2) The facepiece or mouthpiece may be adjusted, if necessary, in the test chamber before starting the tests.

(3) Each wearer will remain in the chamber for 8 minutes while performing the following activities:

(i) Two minutes, nodding and turning head;

(ii) Two minutes, calisthenic arm movements;

(iii) Two minutes, running in place; and

(iv) Two minutes, pumping with a tire pump into a 28 liter (1 cubic foot) container.

(4) Each wearer shall not detect the odor of isoamyl acetate during the test.

**§ 84.125 Particulate tests; canisters containing particulate filters; minimum requirements.**

Gas mask canisters containing filters for protection against particulates (e.g. dusts, fumes, mists, and smokes) in combination with gases, vapors, or gases and vapors, shall also comply with the requirements as prescribed in §§ 84.170 through 84.183, except for the airflow resistance test of § 84.181.

**§ 84.126 Canister bench tests; minimum requirements.**

(a)(1) Bench tests, except for carbon monoxide tests, will be made on an apparatus that allows the test atmosphere at 50±5 percent relative humidity and room temperature (25±2.5 °C.) to enter the canister continuously at concentrations and rates of flow specified in Tables 5, 6, and 7 of this subpart.

(2) Three canisters will be removed from containers and tested as received from the applicant.

(3) Two canisters, other than those described in paragraph (a)(2) of this section, will be equilibrated at room temperature by passing 25 percent relative humidity air through them at 64 liters per minute for 6 hours.

(4) Two canisters, other than those described in paragraphs (a) (2) and (3) of this section, will be equilibrated at room temperature by passing 85 percent relative humidity air through them at 64 liters per minute for 6 hours.

(5) The equilibrated canisters will be resealed, kept in an upright position at room temperature, and tested within 18 hours.

(b) Front-mounted and back-mounted gas mask canisters will be tested and shall meet the minimum requirements set forth in Table 5 of this subpart.

(c)(1) Front-mounted, and back-mounted, and chin-style canisters designated as providing respiratory pro-

tection against gases, ammonia, organic vapors, carbon monoxide and particulate contaminants shall have a window or other indicator to warn the gas mask wearer when the canister will no longer satisfactorily remove carbon monoxide from the inhaled air.

(2) Other types of front- and back-mounted canisters may also be equipped with a window or other indicator to warn of imminent leakage of other gases or vapors.

(3) The window indicator canisters will be tested as regular canisters, but shall show a satisfactory indicator change or other warning before the allowable canister penetration has occurred.

(d) Chin-style gas mask canisters shall meet the minimum requirements set forth in Table 6 of this subpart.

(e) Escape gas mask canisters shall meet the minimum requirements set forth in Table 7 of this subpart.

TABLES TO SUBPART I OF PART 84

TABLE 5—CANISTER BENCH TESTS AND REQUIREMENTS FOR FRONT-MOUNTED AND BACK-MOUNTED GAS MASK CANISTERS  
[42 CFR part 84, subpart I]

Canister type	Test condition	Test atmosphere			Number of tests	Maximum allowable penetration (parts per million)	Minimum service life (minutes) <sup>1</sup>
		Gas or vapor	Concentration (parts per million)	Flow rate (liters per minute)			
Acid gas .....	As received	SO <sub>2</sub>	20,000	64	3	5	12
	Equilibrated	Cl <sub>2</sub>	20,000	64	3	5	12
		SO <sub>2</sub>	20,000	32	4	5	12
Organic vapor .....	As received	Cl <sub>2</sub>	20,000	32	4	5	12
	Equilibrated	CCl <sub>4</sub>	20,000	64	3	5	12
		CCl <sub>4</sub>	20,000	32	4	5	12
Ammonia .....	As received	NH <sub>3</sub>	30,000	64	3	50	12
	Equilibrated	NH <sub>3</sub>	30,000	32	4	50	12
		CO	20,000	4 <sup>6</sup> 64	2	( <sup>3</sup> )	60
Carbon monoxide .....	As received	CO	20,000	4 <sup>6</sup> 64	2	( <sup>3</sup> )	60
	Equilibrated	CO	5,000	2 <sup>3</sup> 32	3	( <sup>3</sup> )	60
		CO	3,000	2 <sup>3</sup> 32	3	( <sup>3</sup> )	60
Combination of 2 or 3 of above types <sup>5</sup>							
Combination of all above types <sup>6</sup>							

<sup>1</sup> Minimum life will be determined at the indicated penetration.  
<sup>2</sup> Relative humidity of test atmosphere will be 95±3pct; temperature of test atmosphere will be 25±2.5 °C.  
<sup>3</sup> Maximum allowable CO penetration will be 385 cm<sup>3</sup> during the minimum life. The penetration shall not exceed 500 p/m during this time.  
<sup>4</sup> Relative humidity of test atmosphere will be 95±3pct; temperature of test atmosphere entering the test fixture will be 0±2.5 °C–0 °C.  
<sup>5</sup> Test conditions and requirements will be applicable as shown in this table.  
<sup>6</sup> Test conditions and requirements will be applicable as shown in this table, except the minimum service lives for acid gas, organic vapor, and ammonia will be 6 min instead of 12 min.

Table 6—Canister Bench Tests and Requirements for Chin-Style Gas Mask Canisters  
[42 CFR part 84, subpart I]

Canister type	Test condition	Test atmosphere			Number of tests	Maximum allowable penetration (parts per million)	Minimum service life (minutes) <sup>1</sup>
		Gas or vapor	Concentration (parts per million)	Flow rate (liters per minute)			
Acid gas .....	As received Equilibrated	SO <sub>2</sub>	50,000	64	3	5	12
		Cl <sub>2</sub>	5,000	64	3	5	12
		SO <sub>2</sub>	5,000	32	4	5	12
Organic vapor .....	As received Equilibrated	Cl <sub>2</sub>	5,000	32	4	5	12
		CCL <sub>4</sub>	5,000	64	3	5	12
		CCL <sub>4</sub>	5,000	32	4	5	12
Ammonia .....	As received Equilibrated	NH <sub>3</sub>	5,000	64	3	50	12
	As received Equilibrated	NH <sub>3</sub>	5,000	32	4	50	12
Carbon monoxide .....	As received	CO	20,000	<sup>2</sup> 64	2	( <sup>3</sup> )	60
		CO	5,000	<sup>4</sup> 32	3	( <sup>3</sup> )	60
		CO	3,000	<sup>2</sup> 32	3	( <sup>3</sup> )	60
Combination of 2 or 3 of above types <sup>5</sup>							
Combination of all above types <sup>6</sup>							

<sup>1</sup> Minimum life will be determined at the indicated penetration.  
<sup>2</sup> Relative humidity of test atmosphere will be 95±3pct; temperature of test atmosphere will be 25±2.5 °C.  
<sup>3</sup> Maximum allowable CO penetration will be 385 cm<sup>3</sup> during the minimum life. The penetration shall not exceed 500 p/m during this time.  
<sup>4</sup> Relative humidity of test atmosphere will be 95±3pct; temperature of test atmosphere entering the test fixture will be 0±2.5 °C–0° C.  
<sup>5</sup> Test conditions and requirements will be applicable as shown in this table.  
<sup>6</sup> Test conditions and requirements will be applicable as shown in this table, except the minimum service lives for acid gas, organic vapor, and ammonia will be 6 min instead of 12 min.

TABLE 7—CANISTER BENCH TESTS AND REQUIREMENTS FOR ESCAPE GAS MASK CANISTERS  
[42 CFR part 84, subpart I]

Canister type	Test condition	Test atmosphere			Number of tests	Maximum allowable penetration (parts per million)	Minimum service life (minutes) <sup>1</sup>
		Gas or vapor	Concentration (parts per million)	Flow rate (liters per minute)			
Acid gas .....	As received .....	SO <sub>2</sub>	5,000	64	3	5	12
	Equilibrated .....	Cl <sub>2</sub>	5,000	64	3	5	12
		SO <sub>2</sub>	5,000	32	4	5	12
		Cl <sub>2</sub>	5,000	32	4	5	12
Organic vapor .....	As received .....	CCL <sub>4</sub>	5,000	64	3	5	12
	Equilibrated .....	CCL <sub>4</sub>	5,000	32	4	5	12
Ammonia .....	As received .....	NH <sub>3</sub>	5,000	64	3	50	12
	Equilibrated .....	NH <sub>3</sub>	5,000	32	4	50	12
Carbon monoxide .....	As received .....	CO	10,000	<sup>2</sup> 32	2	( <sup>3</sup> )	<sup>4</sup> 60
		CO	5,000	<sup>5</sup> 32	3	( <sup>3</sup> )	60
		CO	3,000	<sup>2</sup> 32	3	( <sup>3</sup> )	60

<sup>1</sup> Minimum life will be determined at the indicated penetration.  
<sup>2</sup> Relative humidity of test atmosphere will be 95 ±3 pct; temperature of test atmosphere will be 25 ±2.5 °C.  
<sup>3</sup> Maximum allowable CO penetration will be 385 cm<sup>3</sup> during the minimum life. The penetration shall not exceed 500 p/m during this time.  
<sup>4</sup> If effluent temperature exceeds 100° C during this test, the escape gas mask shall be equipped with an effective heat exchanger.  
<sup>5</sup> Relative humidity of test atmosphere will be 95 ±3 pct; temperature of test atmosphere entering the test fixture will be 0 ±2.5 °C–0 °C.

### Subpart J—Supplied-Air Respirators

#### § 84.130 Supplied-air respirators; description.

Supplied-air respirators, including all completely assembled respirators designed for use as respiratory protection during entry into and escape from atmospheres not immediately dangerous to life or health are described as follows:

(a) *Type “A” supplied-air respirators.* A hose mask respirator, for entry into and escape from atmospheres not immediately dangerous to life or health, which consists of a motor-driven or hand-operated blower that permits the free entrance of air when the blower is not operating, a strong large-diameter hose having a low resistance to airflow, a harness to which the hose and the life-line are attached and a tight-fitting facepiece.

(b) *Type “AE” supplied-air respirators.* A Type “A” supplied-air respirator equipped with additional devices designed to protect the wearer’s head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the window(s) of facepieces, hoods, and helmets which do not unduly interfere with the wearer’s vision and permit easy access to the external surface of such window(s) for cleaning.

(c) *Type “B” supplied-air respirators.* A hose mask respirator, for entry into and escape from atmospheres not immediately dangerous to life or health, which consists of a strong large-diameter hose with low resistance to airflow through which the user draws inspired air by means of his lungs alone, a harness to which the hose is attached, and a tight-fitting facepiece.

(d) *Type “BE” supplied-air respirators.* A type “B” supplied-air respirator equipped with additional devices designed to protect the wearer’s head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the window(s) of facepieces, hoods, and helmets which do not unduly interfere

with the wearer’s vision and permit easy access to the external surface of such window(s) for cleaning.

(e) *Type “C” supplied-air respirators.* An airline respirator, for entry into and escape from atmospheres not immediately dangerous to life or health, which consists of a source of respirable breathing air, a hose, a detachable coupling, a control valve, orifice, a demand valve or pressure demand valve, an arrangement for attaching the hose to the wearer, and a facepiece, hood, or helmet.

(f) *Type “CE” supplied-air respirators.* A type “C” supplied-air respirator equipped with additional devices designed to protect the wearer’s head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the window(s) of facepieces, hoods, and helmets which do not unduly interfere with the wearer’s vision and permit easy access to the external surface of such window(s) for cleaning.

#### § 84.131 Supplied-air respirators; required components.

(a) Each supplied-air respirator described in § 84.130 shall, where its design requires, contain the following component parts:

- (1) Facepiece, hood, or helmet;
- (2) Air supply valve, orifice, or demand or pressure-demand regulator;
- (3) Hand operated or motor driven air blower;
- (4) Air supply hose;
- (5) Detachable couplings;
- (6) Flexible breathing tube; and
- (7) Respirator harness.

(b) The component parts of each supplied-air respirator shall meet the minimum construction requirements set forth in subpart G of this part.

#### § 84.132 Breathing tubes; minimum requirements.

Flexible breathing tubes used in conjunction with supplied-air respirators shall be designed and constructed to prevent:

- (a) Restriction of free head movement;

(b) Disturbance of the fit of facepieces, mouthpieces, hoods, or helmets;

(c) Interference with the wearer's activities; and

(d) Shutoff of airflow due to kinking, or from chin or arm pressure.

**§ 84.133 Harnesses; installation and construction; minimum requirements.**

(a) Each supplied-air respirator shall, where necessary, be equipped with a suitable harness designed and constructed to hold the components of the respirator in position against the wearer's body.

(b) Harnesses shall be designed and constructed to permit easy removal and replacement of respirator parts, and where applicable, provide for holding a full facepiece in the ready position when not in use.

**§ 84.134 Respirator containers; minimum requirements.**

Supplied-air respirators shall be equipped with a substantial, durable container bearing markings which show the applicant's name, the type and commercial designation of the respirator it contains, and all appropriate approval labels.

**§ 84.135 Half-mask facepieces, full facepieces, hoods, and helmets; fit; minimum requirements.**

(a) Half-mask facepieces and full facepieces shall be designed and constructed to fit persons with various facial shapes and sizes either:

(1) By providing more than one facepiece size; or

(2) By providing one facepiece size which will fit varying facial shapes and sizes.

(b) Full facepieces shall provide for optional use of corrective spectacles or lenses, which shall not reduce the respiratory protective qualities of the respirator.

(c) Hoods and helmets shall be designed and constructed to fit persons with various head sizes, provide for the optional use of corrective spectacles or lenses, and insure against any restriction of movement by the wearer.

(d) Facepieces, hoods, and helmets shall be designed to prevent eyepiece fogging.

**§ 84.136 Facepieces, hoods, and helmets; eyepieces; minimum requirements.**

(a) Facepieces, hoods, and helmets shall be designed and constructed to provide adequate vision which is not distorted by the eyepiece.

(b) All eyepieces except those on Types B, BE, C, and CE supplied-air respirators shall be designed and constructed to be impact and penetration resistant. Federal Specification, Mask, Air Line: and Respirator, Air Filtering, Industrial, GGG-M-125d, October 11, 1965 with interim amendment-1, July 30, 1969, is an example of an appropriate standard for determining impact and penetration resistance. Copies of GGG-M-125d may be obtained from the NIOSH, Certification and Quality Assurance Branch, 1095 Willowdale Road, Morgantown, WV 26505-2888.

(c)(1) The eyepieces of AE, BE, and CE type supplied-air respirators shall be shielded by plastic, glass, woven wire, sheet metal, or other suitable material which does not interfere with the vision of the wearer.

(2) Shields shall be mounted and attached to the facepiece to provide easy access to the external surface of the eyepiece for cleaning.

**§ 84.137 Inhalation and exhalation valves; check valves; minimum requirements.**

(a) Inhalation and exhalation valves shall be provided where necessary and protected against distortion.

(b) Exhalation valves shall be:

(1) Protected against damage and external influence; and

(2) Designed and constructed to prevent inward leakage of contaminated air.

(c) Check valves designed and constructed to allow airflow toward the facepiece only shall be provided in the connections to the facepiece or in the hose fitting near the facepiece of all Type A, AE, B, and BE supplied-air respirators.

**§ 84.138 Head harnesses; minimum requirements.**

Facepieces shall be equipped with adjustable and replaceable head harnesses which are designed and constructed to provide adequate tension

**§ 84.139**

during use, and an even distribution of pressure over the entire area in contact with the face.

**§ 84.139 Head and neck protection; supplied-air respirators; minimum requirements.**

Type AE, BE, and CE supplied-air respirators shall be designed and constructed to provide protection against impact and abrasion from rebounding abrasive materials to the wearer's head and neck.

**§ 84.140 Air velocity and noise levels; hoods and helmets; minimum requirements.**

Noise levels generated by the respirator will be measured inside the hood or helmet at maximum airflow obtainable within pressure and hose length requirements and shall not exceed 80 dBA.

**§ 84.141 Breathing gas; minimum requirements.**

(a) Breathing gas used to supply supplied-air respirators shall be respirable breathing air and contain no less than 19.5 volume-percent of oxygen.

(b) 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, NY 10018. Copies may be inspected at the NIOSH, Certification and Quality Assurance Branch, 1095 Willowdale Road, Morgantown, WV 26505-2888, or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

(c) 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.

**42 CFR Ch. I (10-1-03 Edition)**

Copies may be obtained from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018. Copies may be inspected at the NIOSH, Certification and Quality Assurance Branch, 1095 Willowdale Road, Morgantown, WV 26505-2888, or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

**§ 84.142 Air supply source; hand-operated or motor driven air blowers; Type A supplied-air respirators; minimum requirements.**

(a) Blowers shall be designed and constructed to deliver an adequate amount of air to the wearer with either direction of rotation, unless constructed to permit rotation in one direction only, and to permit the free entrance of air to the hose when the blower is not operated.

(b) No multiple systems, whereby more than one user is supplied by one blower, will be approved, unless each hose line is connected directly to a manifold at the blower.

**§ 84.143 Terminal fittings or chambers; Type B supplied-air respirators; minimum requirements.**

(a) Blowers or connections to air supplies providing positive pressures shall not be approved for use on Type B supplied-air respirators.

(b) Terminal fittings or chambers employed in Type B supplied-air respirators, shall be:

- (1) Installed in the inlet of the hose.
- (2) Designed and constructed to provide for the drawing of air through corrosion resistant material arranged so as to be capable of removing material larger than 0.149 mm. in diameter (149 micrometers, 100-mesh, U.S. Standard sieve).

(3) Installed to provide a means for fastening or anchoring the fitting or chamber in a fixed position in a zone of respirable air.

**§ 84.144 Hand-operated blower test; minimum requirements.**

(a) Hand-operated blowers shall be tested by attaching them to a mechanical drive and operating them 6 to 8 hours daily for a period of 100 hours at a speed necessary to deliver 50 liters of

air per minute through each completely assembled respirator. Each respirator shall be equipped with the maximum length of hose with which the device is to be approved and the hose shall be connected to each blower or manifold outlet designed for hose connections.

(b) The crank speed of the hand-operated blower shall not exceed 50 revolutions per minute in order to deliver the required 50 liters of air per minute to each facepiece.

(c) The power required to deliver 50 liters of air per minute to each wearer through the maximum length of hose shall not exceed one-fiftieth horsepower, and the torque shall not exceed a force of 2.3 kg. (5 pounds) on a 20 cm. (8-inch) crank, as defined in §84.146.

(d) The blower shall operate throughout the period without failure or indication of excessive wear of bearings or other working parts.

**§ 84.145 Motor-operated blower test; minimum requirements.**

(a) Motor-operated blowers shall be tested by operating them at their specified running speed 6 to 8 hours daily for a period of 100 hours when assembled with the kind and maximum length of hose for which the device is to be approved and when connected to each blower or manifold outlet designed for hose connections.

(b) The connection between the motor and the blower shall be so constructed that the motor may be disengaged from the blower when the blower is operated by hand.

(c) The blower shall operate throughout the period without failure or indication of excessive wear of bearings or other working parts.

(d) Where a blower, which is ordinarily motor driven, is operated by hand, the power required to deliver 50

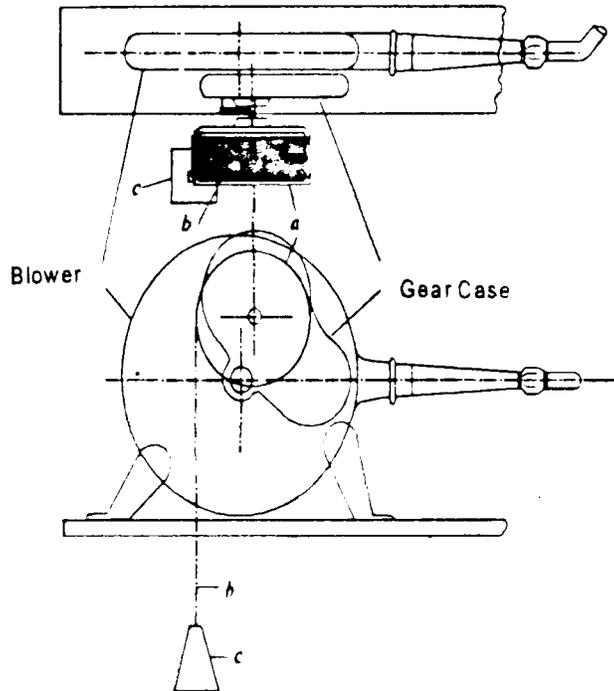
liters of air per minute to each wearer through the maximum length of hose shall not exceed one-fiftieth horsepower, and the torque shall not exceed a force of 2.3 kg. (5 pounds) on a 20 cm. (8-inch) crank, as defined in §84.146.

(e) Where the respirator is assembled with the facepiece and 15 m. (50 feet) of the hose for which it is to be approved, and when connected to one outlet with all other outlets closed and operated at a speed not exceeding 50 revolutions of the crank per minute, the amount of air delivered into the respiratory-inlet covering shall not exceed 150 liters per minute.

**§ 84.146 Method of measuring the power and torque required to operate blowers.**

As shown in Figure 1 of this section, the blower crank is replaced by a wooden drum, a (13 cm. (5 inches) in diameter is convenient). This drum is wound with about 12 m. (40 feet) of No. 2 picture cord, b. A weight, c, of sufficient mass to rotate the blower at the desired speed is suspended from this wire cord. A mark is made on the cord about 3 to 4.5 m. (10 to 15 feet) from the weight, c. Another mark is placed at a measured distance (6-9 m./20-30 feet is convenient) from the first. These are used to facilitate timing. To determine the torque or horsepower required to operate the blower, the drum is started in rotation manually at or slightly above the speed at which the power measurement is to be made. The blower is then permitted to assume constant speed, and then as the first mark on the wire leaves the drum, a stopwatch is started. The watch is stopped when the second mark leaves the drum. From these data the foot-pounds per minute and the torque may be calculated.

FIGURE 1—APPARATUS FOR MEASURING POWER REQUIRED TO OPERATE BLOWER. (42 CFR PART 84, SUBPART J, § 84.146)



**§ 84.147 Type B supplied-air respirator; minimum requirements.**

No Type B supplied-air respirator shall be approved for use with a blower or with connection to an air supply device at positive pressures.

**§ 84.148 Type C supplied-air respirator, continuous flow class; minimum requirements.**

(a) Respirators tested under this section shall be approved only when they supply respirable air at the pressures and quantities required.

(b) The pressure at the inlet of the hose connection shall not exceed 863 kN/m.<sup>2</sup> (125 pounds per square inch gage).

(c) Where the pressure at any point in the supply system exceeds 863 kN/m.<sup>2</sup> (125 pounds per square inch gage), the respirator shall be equipped with a pressure-release mechanism that will

prevent the pressure at the hose connection from exceeding 863 kN/m.<sup>2</sup> (125 pounds per square inch gage) under any conditions.

**§ 84.149 Type C supplied-air respirator, demand and pressure demand class; minimum requirements.**

(a) Respirators tested under this section shall be approved only when used to supply respirable air at the pressures and quantities required.

(b) The manufacturer shall specify the range of air pressure at the point of attachment of the air-supply hose to the air-supply system, and the range of hose length for the respirator. For example, he might specify that the respirator be used with compressed air at pressures ranging from 280-550 kN/m.<sup>2</sup> (40 to 80 pounds per square inch) with from 6 to 76 m. (15 to 250 feet) of air-supply hose.

(c) The specified air pressure at the point of attachment of the hose to the air-supply system shall not exceed 863 kN/m.<sup>2</sup> (125 pounds per square inch gage).

(d)(1) Where the pressure in the air-supply system exceeds 863 kN/m.<sup>2</sup> (125 pounds per square inch gage), the respirator shall be equipped with a pressure-release mechanism that will prevent the pressure at the point of attachment of the hose to the air-supply system from exceeding 863 kN/m.<sup>2</sup> (125 pounds per square inch gage).

(2) The pressure-release mechanism shall be set to operate at a pressure not more than 20 percent above the manufacturer's highest specified pressure. For example, if the highest specified pressure is 863 kN/m.<sup>2</sup> (125 pounds per square inch), the pressure-release mechanism would be set to operate at a maximum of 1,035 kN/m.<sup>2</sup> (150 pounds per square inch).

**§ 84.150 Air-supply line tests; minimum requirements.**

Air supply lines employed on Type A, Type B, and Type C supplied-air respirators shall meet the minimum test requirements set forth in Table 8 of this subpart.

**§ 84.151 Harness test; minimum requirements.**

(a)(1) Shoulder straps employed on Type A supplied-air respirators shall be tested for strength of material, joints, and seams and must separately withstand a pull of 113 kg. (250 pounds) for 30 minutes without failure.

(2) Belts, rings, and attachments for life lines must withstand a pull of 136 kg. (300 pounds) for 30 minutes without failure.

(3) The hose shall be firmly attached to the harness so as to withstand a pull of 113 kg. (250 pounds) for 30 minutes without separating, and the hose attachments shall be arranged so that the pull or drag of the hose behind an advancing wearer does not disarrange the harness or exert pull upon the facepiece.

(4) The arrangement and suitability of all harness accessories and fittings will be considered.

(b)(1) The harness employed on Type B supplied-air respirators shall not be

uncomfortable, disturbing, or interfere with the movements of the wearer.

(2) The harness shall be easily adjustable to various sizes.

(3) The hose shall be attached to the harness in a manner that will withstand a pull of 45 kg. (100 pounds) for 30 minutes without separating or showing signs of failure.

(4) The design of the harness and attachment of the line shall permit dragging the maximum length of hose considered for approval over a concrete floor without disarranging the harness or exerting a pull on the facepiece.

(5) The arrangement and suitability of all harness accessories and fittings will be considered.

(c) The harness employed on Type C respirators shall be similar to that required on the Type B respirator, or, it may consist of a simple arrangement for attaching the hose to a part of the wearer's clothing in a practical manner that prevents a pull equivalent to dragging the maximum length of the hose over a concrete floor from exerting pull upon the respiratory-inlet covering.

(d) Where supplied-air respirators have a rigid or partly rigid head covering, a suitable harness shall be required to assist in holding this covering in place.

**§ 84.152 Breathing tube test; minimum requirements.**

(a)(1) Type A and Type B supplied-air respirators shall employ one or two flexible breathing tubes of the nonkinking type which extend from the facepiece to a connecting hose coupling attached to the belt or harness.

(2) The breathing tubes employed shall permit free head movement, insure against closing off by kinking or by chin or arm pressure, and they shall not create a pull that will loosen the facepiece or disturb the wearer.

(b) Breathing tubes employed on Type C supplied-air respirators of the continuous flow class shall meet the minimum requirements set forth in paragraph (a) of this section, however, an extension of the connecting hose may be employed in lieu of the breathing tubes required.

(c)(1) A flexible, nonkinking type breathing tube shall:

**§ 84.153**

(i) Be employed on Type C supplied-air respirators of the demand and pressure-demand class; and

(ii) Extend from the facepiece to the demand or pressure-demand valve, except where the valve is attached directly to the facepiece.

(2) The breathing tube shall permit free head movement, insure against closing off by kinking or by chin or arm pressure, and shall not create a pull that will loosen the facepiece or disturb the wearer.

**§ 84.153 Airflow resistance test, Type A and Type AE supplied-air respirators; minimum requirements.**

(a) Airflow resistance will be determined when the respirator is completely assembled with the respiratory-inlet covering, the air-supply device, and the maximum length of air-supply hose coiled for one-half its length in loops 1.5 to 2.1 m. (5 to 7 feet) in diameter.

(b) The inhalation resistance, drawn at the rate of 85 liters (3 cubic feet) per minute when the blower is not operating or under any practical condition of blower operation shall not exceed the following amounts:

Maximum length of hose for which respirator is approved		Maximum resistance, water column height	
Feet	Meters	Inches	Millimeters
75	23	1.5	38
150	46	2.5	64
250	76	3.5	89
300	91	4.0	102

(c) The exhalation resistance shall not exceed 25 mm. (1 inch) of water-column height at a flow rate of 85 liters (3 cubic feet) per minute when the blower is not operating or under any practical condition of blower operation.

**§ 84.154 Airflow resistance test; Type B and Type BE supplied-air respirators; minimum requirements.**

(a) Airflow resistance shall be determined when the respirator is completely assembled with the respiratory-inlet covering and the hose in the maximum length to be considered for approval, coiled in loops 1.5 to 2.1 m. (5 to 7 feet) in diameter.

(b) Airflow resistance shall not exceed 38 mm. (1.5 inches) of water-col-

**42 CFR Ch. I (10–1–03 Edition)**

umn height to air drawn at the flow rate of 85 liters (3 cubic feet) per minute.

(c) The exhalation resistance shall not exceed 25 mm. (1 inch) of water-column height at this flow rate.

**§ 84.155 Airflow resistance test; Type C supplied-air respirator, continuous flow class and Type CE supplied-air respirator; minimum requirements.**

The resistance to air flowing from the respirator shall not exceed 25 mm. (1 inch) of water-column height when the air flow into the respiratory-inlet covering is 115 liters (4 cubic feet) per minute.

**§ 84.156 Airflow resistance test; Type C supplied-air respirator, demand class; minimum requirements.**

(a) Inhalation resistance shall not exceed 50 millimeters (2 inches) of water at an air flow of 115 liters (4 cubic feet) per minute.

(b) The exhalation resistance to a flow of air at a rate of 85 liters (3 cubic feet) per minute shall not exceed 25 millimeters (1 inch) of water.

**§ 84.157 Airflow resistance test; Type C supplied-air respirator, pressure-demand class; minimum requirements.**

(a) The static pressure in the facepiece shall not exceed 38 mm. (1.5 inches) of water-column height.

(b) The pressure in the facepiece shall not fall below atmospheric at inhalation airflows less than 115 liters (4 cubic feet) per minute.

(c) The exhalation resistance to a flow of air at a rate of 85 liters (3 cubic feet) per minute shall not exceed the static pressure in the facepiece by more than 51 mm. (2 inches) of water-column height.

**§ 84.158 Exhalation valve leakage test.**

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

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

**§ 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.

**§ 84.160 Man test for gases and vapors; Type A and Type AE respirators; test requirements.**

(a) The completely assembled respirator will be worn in a chamber containing  $0.1 \pm 0.025$  percent isoamyl acetate vapor, and the blower, the intake of the hose, and not more than 25 percent of the hose length will be located in isoamyl acetate-free air.

(b) The man in the isoamyl acetate atmosphere will draw his inspired air through the hose, connections, and all parts of the air device by means of his lungs alone (blower not operating).

(c) The 10-minute work test will be repeated with the blower in operation at any practical speed up to 50 revolutions of the crank per minute.

**§ 84.161 Man test for gases and vapors; Type B and Type BE respirators; test requirements.**

(a) The completely assembled respirator will be worn in a chamber containing  $0.1 \pm 0.025$  percent isoamyl ace-

tate vapor, and the intake of the hose, and not more than 25 percent of the hose length will be located in isoamyl acetate-free air.

(b) The man in the isoamyl acetate atmosphere will draw his inspired air through the hose and connections by means of his lungs alone.

**§ 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  $0.1 \pm 0.025$  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 throughout 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  $0.1 \pm 0.025$  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.

TABLES TO SUBPART J OF PART 841

TABLE 8—AIR-SUPPLY-LINE REQUIREMENTS AND TESTS  
[42 CFR part 84, subpart J]

Specific requirements	Requirements for the air-supply lines of the indicated type of supplied-air respirators		
	Type A	Type B	Type C
Length of hose .....	Maximum of 91 m. (300 feet), in multiples of 7.6 m. (25 feet).	Maximum of 23 m. (75 feet) in multiples of 7.6 m. (25 feet).	Maximum of 91 m. (300 feet) in multiples of 7.6 m. (25 feet). It will be permissible for the applicant to supply hose of the approved type of shorter length than 7.6 m. (25 feet) provided it meets the requirements of the part.
Air flow .....	None .....	None .....	The air-supply hose with air regulating valve or orifice shall permit a flow of not less than 115 liters (4 cubic feet) per minute to tight-fitting and 170 liters (6 cubic feet) per minute to loose-fitting respiratory-inlet coverings through the maximum length of hose for which approval is granted and at the minimum specified air-supply pressure. The maximum flow shall not exceed 425 liters (15 cubic feet) per minute at the maximum specified air-supply pressure with the minimum length of hose for which approval is granted.
Air flow .....	.....do .....	.....do .....	The air-supply hose, detachable coupling, and demand valve of the demand class or pressure-demand valve of the pressure-demand class for Type C supplied-air respirators, demand and pressure-demand classes, shall be capable of delivering respirable air at a rate of not less than 115 liters (4 cubic feet) per minute to the respiratory-inlet covering at an inhalation resistance not exceeding 50 millimeters (2 inches) of water-column height measured in the respiratory-inlet covering with any combination of air-supply pressure and length of hose within the applicant's specified range of pressure and hose length. The air-flow rate and resistance to inhalation shall be measured while the demand or pressure-demand valve is actuated 20 times per minute by a source of intermittent suction. The maximum rate of flow to the respiratory-inlet covering shall not exceed 425 liters (15 cubic feet) per minute under the specified operating conditions.

TABLE 8—AIR-SUPPLY-LINE REQUIREMENTS AND TESTS—Continued  
[42 CFR part 84, subpart J]

Specific requirements	Requirements for the air-supply lines of the indicated type of supplied-air respirators		
	Type A	Type B	Type C
Air-regulating valve .....	.....do .....	.....do .....	If an air-regulating valve is provided, it shall be so designed that it will remain at a specific adjustment, which will not be affected by the ordinary movement of the wearer. The valve must be so constructed that the air supply with the maximum length of hose and at the minimum specified air-supply pressure will not be less than 115 liters (4 cubic feet) of air per minute to tight-fitting and 170 liters (6 cubic feet) of air per minute of loose-fitting respiratory inlet coverings for any adjustment of the valve. If a demand or pressure-demand valve replaces the air-regulating valve, it shall be connected to the air-supply at the maximum air pressure for which approval is sought by means of the minimum length of air-supply hose for which approval is sought. The outlet of the demand or pressure-demand valve shall be connected to a source of intermittent suction so that the demand or pressure-demand valve is actuated approximately 20 times per minute for a total of 100,000 inhalations. To expedite this test, the rate of actuation may be increased if mutually agreeable to the applicant and NIOSH. During this test the valve shall function without failure and without excessive wear of the moving parts. The demand or pressure-demand valve shall not be damaged in any way when subjected at the outlet to a pressure or suction of 25 cm. (10 inches) of water gage for 2 minutes.
Noncollapsibility .....	The hose shall not collapse or exhibit permanent deformation when a force of 90 kg. (200 pounds) is applied for 5 minutes between 2 planes 7.6 cm. (3 inches) wide on opposite sides of the hose.	Same as Type A .....	None.
Nonkinkability .....	None .....	None .....	A 7.6 m. (25 foot) section of the hose will be placed on a horizontal-plane surface and shaped into a one-loop coil with one end of the hose connected to an airflow meter and the other end of the hose supplied with air at the minimum specified supply pressure. The connection shall be in the plane of the loop. The other end of the hose will be pulled tangentially to the loop and in the plane of the loop until the hose straightens. To meet the requirements of this test the loop shall maintain a uniform near-circular shape and ultimately unfold as a spiral, without any localized deformation that decreases the flow of air to less than 90 percent of the flow when the hose is tested while remaining in a straight line.
Strength of hose and couplings.	Hose and couplings shall not separate or fail when tested with a pull of 113 kg. (250 pounds) for 5 minutes.	Same as Type A .....	Hose and couplings shall not exhibit any separation or failure when tested with a pull of 45 kg. (100 pounds) for 5 minutes and when tested by subjecting them to an internal air pressure of 2 times the maximum respirator-supply pressure that is specified by the applicant or at 173 kN/m. 2 (25 pounds per square inch) gage, whichever is higher.

TABLE 8—AIR-SUPPLY-LINE REQUIREMENTS AND TESTS—Continued  
[42 CFR part 84, subpart J]

Specific requirements	Requirements for the air-supply lines of the indicated type of supplied-air respirators		
	Type A	Type B	Type C
Tightness .....	No air leakage shall occur when the hose and couplings are joined and the joint(s) are immersed in water and subjected to an internal air pressure of 35 kN/m. <sup>2</sup> (5 pounds per square inch) gage.	None .....	Leakage of air exceeding 50 cc. per minute at each coupling shall not be permitted when the hose and couplings are joined and are immersed in water, with air flowing through the respirator under a pressure of 173 kN/m. <sup>2</sup> (25 pounds per square inch) gage applied to the inlet end of the air-supply hose, or at twice the maximum respirator-supply pressure that is specified by the applicant, whichever is higher.
Permeation of hose by gasoline.	The permeation of the hose by gasoline will be tested by immersing 7.6 m. (25 feet) of hose and one coupling in gasoline, with air flowing through the hose at the rate of 8 liters per minute for 6 hours. The air from the hose shall not contain more than 0.01 percent by volume of gasoline vapor at the end of the test.	Same as for Type A .....	Same as for Type A, except the test period shall be 1 hour.
Detachable coupling .....	None .....	None .....	A hand-operated detachable coupling by which the wearer can readily attach or detach the connecting hose shall be provided at a convenient location. This coupling shall be durable, remain connected under all conditions of normal respirator use, and meet the prescribed tests for strength and tightness of hose and couplings.

**Subpart K—Non-Powered Air-Purifying Particulate Respirators**

**§ 84.170 Non-powered air-purifying particulate respirators; description.**

(a) Non-powered air-purifying particulate respirators utilize the wearer's negative inhalation pressure to draw the ambient air through the air-purifying filter elements (filters) to remove particulates from the ambient air. They are designed for use as respiratory protection against atmospheres with particulate contaminants (e.g., dusts, fumes, mists) that are not immediately dangerous to life or health and that contain adequate oxygen to support life.

(b) Non-powered air-purifying particulate respirators are classified into three series, N-, R-, and P-series. The N-series filters are restricted to use in those workplaces free of oil aerosols. The R- and P-series filters are intended

for removal of any particulate that includes oil-based liquid particulates.

(c) Non-powered air-purifying particulate respirators are classified according to the efficiency level of the filter(s) as tested according to the requirements of this part.

(1) N100, R100, and P100 filters shall demonstrate a minimum efficiency level of 99.97 percent.

(2) N99, R99, and P99 filters shall demonstrate a minimum efficiency level of 99 percent.

(3) N95, R95, and P95 filters shall demonstrate a minimum efficiency level of 95 percent.

**§ 84.171 Non-powered air-purifying particulate respirators; required components.**

(a) Each non-powered air-purifying particulate respirator described in §84.170 shall, where its design requires, contain the following component parts:

- (1) Facepiece, mouthpiece with noseclip, hood, or helmet;
- (2) Filter unit;
- (3) Harness;
- (4) Attached blower; and
- (5) Breathing tube.

(b) The components of each non-powered air-purifying particulate respirator shall meet the minimum construction requirements set forth in subpart G of this part.

**§ 84.172 Breathing tubes; minimum requirements.**

Flexible breathing tubes used in conjunction with respirators shall be designed and constructed to prevent:

- (a) Restriction of free head movement;
- (b) Disturbance of the fit of facepieces, mouthpieces, hoods, or helmets;
- (c) Interference with the wearer's activities; and
- (d) Shutoff of airflow due to kinking, or from chin or arm pressure.

**§ 84.173 Harnesses; installation and construction; minimum requirements.**

(a) Each respirator shall, where necessary, be equipped with a suitable harness designed and constructed to hold the components of the respirator in position against the wearer's body.

(b) Harnesses shall be designed and constructed to permit easy removal and replacement of respirator parts, and, where applicable, provide for holding a full facepiece in the ready position when not in use.

**§ 84.174 Respirator containers; minimum requirements.**

(a) Except as provided in paragraph (b) of this section each respirator shall be equipped with a substantial, durable container bearing markings which show the applicant's name, the type of respirator it contains, and all appropriate approval labels.

(b) Containers for single-use respirators may provide for storage of more than one respirator, however, such containers shall be designed and constructed to prevent contamination of respirators which are not removed, and to prevent damage to respirators during transit.

**§ 84.175 Half-mask facepieces, full facepieces, hoods, helmets, and mouthpieces; fit; minimum requirements.**

(a) Half-mask facepieces and full facepieces shall be designed and constructed to fit persons with various facial shapes and sizes either:

- (1) By providing more than one facepiece size; or
- (2) By providing one facepiece size which will fit varying facial shapes and sizes.

(b) Full facepieces shall provide for optional use of corrective spectacles or lenses, which shall not reduce the respiratory protective qualities of the respirator.

(c) Hoods and helmets shall be designed and constructed to fit persons with various head sizes, provide for the optional use of corrective spectacles or lenses, and insure against any restriction of movement by the wearer.

(d) Mouthpieces shall be equipped with noseclips which are securely attached to the mouthpiece or respirator and provide an airtight seal.

(e) Facepieces, hoods, and helmets shall be designed to prevent eyepiece fogging.

(f) Half-mask facepieces shall not interfere with the fit of common industrial safety corrective spectacles.

**§ 84.176 Facepieces, hoods, and helmets; eyepieces; minimum requirements.**

Facepieces, hoods, and helmets shall be designed and constructed to provide adequate vision which is not distorted by the eyepieces.

**§ 84.177 Inhalation and exhalation valves; minimum requirements.**

(a) Inhalation and exhalation valves shall be protected against distortion.

(b) Inhalation valves shall be designed and constructed and provided where necessary to prevent excessive exhaled air from adversely affecting filters, except where filters are specifically designed to resist moisture.

(c) Exhalation valves shall be:

- (1) Provided where necessary;
- (2) Protected against damage and external influence; and

**§ 84.178**

(3) Designed and constructed to prevent inward leakage of contaminated air.

**§ 84.178 Head harnesses; minimum requirements.**

(a) All facepieces shall be equipped with head harnesses designed and constructed to provide adequate tension during use and an even distribution of pressure over the entire area in contact with the face.

(b) Facepiece head harnesses, except those employed on single-use respirators, shall be adjustable and replaceable.

(c) Mouthpieces shall be equipped, where applicable, with adjustable and replaceable harnesses, designed and constructed to hold the mouthpiece in place.

**§ 84.179 Non-powered air-purifying particulate respirators; filter identification.**

(a) The respirator manufacturer, as part of the application for certification, shall specify the filter series and the filter efficiency level (i.e., "N95", "R95", "P95", "N99", "R99", "P99", "N100", "R100", or "P100") for which certification is being sought.

(b) Filters shall be prominently labeled as follows:

(1) N100 filters shall be labeled "N100 Particulate Filter (99.97% filter efficiency level)" and shall be a color other than magenta.

(2) R100 filters shall be labeled "R100 Particulate Filter (99.97% filter efficiency level)" and shall be a color other than magenta.

(3) P100 filters shall be labeled "P100 Particulate Filter (99.97% filter efficiency level)" and shall be color coded magenta.

(4) N99 filters shall be labeled "N99 Particulate Filter (99% filter efficiency level)" and shall be a color other than magenta.

(5) R99 filters shall be labeled "R99 Particulate Filter (99% filter efficiency level)" and shall be a color other than magenta.

(6) P99 filters shall be labeled "P99 Particulate Filter (99% filter efficiency level)" and shall be a color other than magenta.

**42 CFR Ch. I (10-1-03 Edition)**

(7) N95 filters shall be labeled as "N95 Particulate Filter (95% filter efficiency level)" and shall be a color other than magenta.

(8) R95 filters shall be labeled as "R95 Particulate Filter (95% filter efficiency level)" and shall be a color other than magenta.

(9) P95 filters shall be labeled as "P95 Particulate Filter (95% filter efficiency level)" and shall be a color other than magenta.

**§ 84.180 Airflow resistance tests.**

(a) Resistance to airflow will be measured in the facepiece, mouthpiece, hood, or helmet of a particulate respirator (complete respirator) mounted on a test fixture with air flowing at continuous rate of  $85 \pm 2$  liters per minute, before each test conducted in accordance with § 84.182.

(b) The resistances for particulate respirators upon initial inhalation shall not exceed 35 mm water column height pressure and upon initial exhalation shall not exceed 25 mm water column height pressure.

**§ 84.181 Non-powered air-purifying particulate filter efficiency level determination.**

(a) Twenty filters of each non-powered air-purifying particulate respirator model shall be tested for filter efficiency against:

(1) A solid sodium chloride particulate aerosol as per this section, if N-series certification is requested by the applicant.

(2) A dioctyl phthalate or equivalent liquid particulate aerosol as per this section, if R-series or P-series certification is requested by the applicant.

(b) Filters including holders and gaskets; when separable, shall be tested for filter efficiency level, as mounted on a test fixture in the manner as used on the respirator.

(c) Prior to filter efficiency testing of 20 N-series filters, the 20 to be tested shall be taken out of their packaging and placed in an environment of  $85 \pm 5$  percent relative humidity at  $38 \pm 2.5$  °C for  $25 \pm 1$  hours. Following the pre-conditioning, filters shall be sealed in a gas-tight container and tested within 10 hours.

(d) When the filters do not have separable holders and gaskets, the exhalation valves shall be blocked so as to ensure that leakage, if present, is not included in the filter efficiency level evaluation.

(e) For non-powered air-purifying particulate respirators with a single filter, filters shall be tested at a continuous airflow rate of 85±4 liters per minute. Where filters are to be used in pairs, the test-aerosol airflow rate shall be 42.5±2 liters per minute through each filter.

(f) *Filter efficiency test aerosols.* (1) When testing N-series filters, a sodium chloride or equivalent solid aerosol at 25±5 °C and relative humidity of 30±10 percent that has been neutralized to the Boltzmann equilibrium state shall be used. Each filter shall be challenged with a concentration not exceeding 200 mg/m<sup>3</sup>.

(2) When testing R-series and P-series filters, a neat cold-nebulized dioctyl phthalate (DOP) or equivalent aerosol at 25±5 °C that has been neutralized to the Boltzmann equilibrium state shall be used. Each filter shall be challenged with a concentration not exceeding 200 mg/m<sup>3</sup>.

(3) The test shall continue until minimum efficiency is achieved or until an aerosol mass of at least 200±5 mg has contacted the filter. For P-series filters, if the filter efficiency is decreasing when the 200±5 mg challenge point is reached, the test shall be continued until there is no further decrease in efficiency.

(g) The sodium chloride test aerosol shall have a particle size distribution with count median diameter of 0.075±0.020 micrometer and a standard geometric deviation not exceeding 1.86 at the specified test conditions as determined with a scanning mobility particle sizer or equivalent. The DOP aerosol shall have a particle size distribution with count median diameter of 0.185±0.020 micrometer and a standard geometric deviation not exceeding 1.60 at the specified test conditions as determined with a scanning mobility particle sizer or equivalent.

(h) The efficiency of the filter shall be monitored and recorded throughout the test period by a suitable forward-

light-scattering photometer or equivalent instrumentation.

(i) The minimum efficiency for each of the 20 filters shall be determined and recorded and be equal to or greater than the filter efficiency criterion listed for each level as follows:

- P100, R100 and N100: Efficiency ≥99.97%
- P99, R99 and N99: Efficiency ≥99%
- P95, R95 and N95: Efficiency ≥95%

**§ 84.182 Exhalation valve leakage test; minimum requirements.**

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

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

**Subpart L—Chemical Cartridge Respirators**

**§ 84.190 Chemical cartridge respirators: description.**

(a) Chemical cartridge respirators including all completely assembled respirators which are designed for use as respiratory protection during entry into or escape from atmospheres not immediately dangerous to life and health, are described according to the specific gases or vapors against which they are designed to provide respiratory protection, as follows:

Type of chemical cartridge respirator <sup>1</sup>	Maximum use concentration, parts per million
Ammonia .....	300
Chlorine .....	10
Hydrogen chloride .....	50
Methyl amine .....	100
Organic vapor .....	≥ 1,000
Sulfur dioxide .....	50
Vinyl chloride .....	10

<sup>1</sup> Not for use against gases or vapors with poor warning properties (except where MSHA or Occupational Safety and Health Administration standards may permit such use for a specific gas or vapor) or those which generate high heats of reaction with sorbent material in the cartridge.

<sup>2</sup> Maximum use concentrations are lower for organic vapors which produce atmospheres immediately hazardous to life or health at concentrations equal to or lower than this concentration.

(b) Chemical cartridge respirators for respiratory protection against gases or vapors, which are not specifically listed with their maximum use concentration, may be approved if the applicant

**§ 84.191**

submits a request for such approval, in writing, to the Institute. The Institute shall consider each such application and accept or reject the application after a review of the effects on the wearer's health and safety and in the light of any field experience in use of chemical cartridge respirators as protection against such hazards.

**§ 84.191 Chemical cartridge respirators; required components.**

(a) Each chemical cartridge respirator described in § 84.190 shall, where its design requires, contain the following component parts:

- (1) Facepiece, mouthpiece, and nose-clip, hood, or helmet;
- (2) Cartridge;
- (3) Cartridge with filter;
- (4) Harness;
- (5) Breathing tube; and
- (6) Attached blower.

(b) The components of each chemical cartridge respirator shall meet the minimum construction requirements set forth in subpart G of this part.

**§ 84.192 Cartridges in parallel; resistance requirements.**

Where two or more cartridges are used in parallel, their resistance to airflow shall be essentially equal.

**§ 84.193 Cartridges; color and markings; requirements.**

The color and markings of all cartridges or labels shall conform with the requirements of the American National Standards Institute, American National Standard for Identification of Air-Purifying Respirator Canisters and Cartridges, ANSI K13.1-1973. ANSI K13.1 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, NY 10018. Copies may be inspected at the NIOSH, Certification and Quality Assurance Branch, 1095 Willowdale Road, Morgantown, WV 26505-2888, or at the Office of

**42 CFR Ch. I (10-1-03 Edition)**

the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

**§ 84.194 Filters used with chemical cartridges; location; replacement.**

(a) Particulate matter filters used in conjunction with a chemical cartridge shall be located on the inlet side of the cartridge.

(b) Filters shall be incorporated in or firmly attached to the cartridge and each filter assembly shall, where applicable, be designed to permit its easy removal from and replacement on the cartridge.

**§ 84.195 Breathing tubes; minimum requirements.**

Flexible breathing tubes used in conjunction with respirators shall be designed and constructed to prevent:

- (a) Restriction of free head movement;
- (b) Disturbance of the fit of facepieces, mouthpieces, hoods, or helmets;
- (c) Interference with the wearer's activities; and
- (d) Shutoff of airflow due to kinking, or from chin or arm pressure.

**§ 84.196 Harnesses; installation and construction; minimum requirements.**

(a) Each respirator shall, where necessary, be equipped with a suitable harness designed and constructed to hold the components of the respirator in position against the wearer's body.

(b) Harnesses shall be designed and constructed to permit easy removal and replacement of respirator parts and, where applicable, provide for holding a full facepiece in the ready position when not in use.

**§ 84.197 Respirator containers; minimum requirements.**

Respirators shall be equipped with a substantial, durable container bearing markings which show the applicant's name, the type and commercial designation of the respirator it contains and all appropriate approval labels.

**§ 84.198 Half-mask facepieces, full facepieces, mouthpieces, hoods, and helmets; fit; minimum requirements.**

(a) Half-mask facepieces and full facepieces shall be designed and constructed to fit persons with various facial shapes and sizes either:

(1) By providing more than one facepiece size; or

(2) By providing one facepiece size which will fit varying facial shapes and sizes.

(b) Hoods and helmets shall be designed and constructed to fit persons with various head sizes, provide for the optional use of corrective spectacles or lenses, and insure against any restriction of movement by the wearer.

(c) Mouthpieces shall be equipped with noseclips which are securely attached to the mouthpiece or respirator and provide an airtight fit.

(d) Full facepieces shall provide for optional use of corrective spectacles or lenses which shall not reduce the respiratory protective qualities of the respirator.

(e) Facepieces, hoods, and helmets shall be designed to prevent eyepiece fogging.

**§ 84.199 Facepieces, hoods, and helmets; eyepieces; minimum requirements.**

Facepieces, hoods, and helmets shall be designed and constructed to provide adequate vision which is not distorted by the eyepieces.

**§ 84.200 Inhalation and exhalation valves; minimum requirements.**

(a) Inhalation and exhalation valves shall be provided where necessary and protected against distortion.

(b) Inhalation valves shall be designed and constructed to prevent excessive exhaled air from entering cartridges or adversely affecting canisters.

(c) Exhalation valves shall be—

(1) Protected against damage and external influence; and

(2) Designed and constructed to prevent inward leakage of contaminated air.

**§ 84.201 Head harnesses; minimum requirements.**

(a)(1) Facepieces for chemical cartridge respirators other than single-use vinyl chloride shall be equipped with adjustable and replaceable head harnesses designed and constructed to provide adequate tension during use and an even distribution of pressure over the entire area in contact with the face.

(2) Facepieces for single-use vinyl chloride respirators shall be equipped with adjustable head harnesses designed and constructed to provide adequate tension during use and an even distribution of pressure over the entire area in contact with the face.

(b) Mouthpieces shall be equipped where applicable, with an adjustable and replaceable harness designed and constructed to hold the mouthpiece in place.

**§ 84.202 Air velocity and noise levels; hoods and helmets; minimum requirements.**

Noise levels generated by the respirator will be measured inside the hood or helmet at maximum airflow obtainable and shall not exceed 80 dBA.

**§ 84.203 Breathing resistance test; minimum requirements.**

(a) Resistance to airflow will be measured in the facepiece, mouthpiece, hood, or helmet of a chemical cartridge respirator mounted on a test fixture with air flowing at a continuous rate of 85 liters per minute, both before and after each test conducted in accordance with §§ 84.206 through 84.207.

(b) The maximum allowable resistance requirements for chemical cartridge respirators are as follows:

MAXIMUM RESISTANCE  
[Millimeter water column height]

Type of chemical-cartridge respirator	Inhalation		Exhalation
	Initial	Final <sup>1</sup>	
Other than single-use vinyl chloride respirators: For gases, vapors, or gases and vapors .....	40	45	20

MAXIMUM RESISTANCE—Continued  
[Millimeter water column height]

Type of chemical-cartridge respirator	Inhalation		Exhalation
	Initial	Final <sup>1</sup>	
For gases, vapors, or gases and vapors, and particulates .....	50	70	20
Single-use respirator with valves:			
For vinyl chloride .....	20	25	20
For vinyl chloride and particulates .....	30	45	2
Single-use respirator without valves:			
For vinyl chloride .....	15	20	( <sup>2</sup> )
For vinyl chloride and particulates .....	25	40	( <sup>2</sup> )

<sup>1</sup> Measured at end of service life specified in Table 11 of this subpart.

<sup>2</sup> Same as inhalation.

**§ 84.204 Exhalation valve leakage test; minimum requirements.**

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

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

**§ 84.205 Facepiece test; minimum requirements.**

(a) The complete chemical cartridge respirator will be fitted to the faces of persons having varying facial shapes and sizes.

(b) Where the applicant specifies a facepiece size or sizes for the respirator together with the approximate measurement of faces they are designed to fit, the Institute will provide test subjects to suit such facial measurements.

(c) Any chemical cartridge respirator part which must be removed to perform the facepiece or mouthpiece fit test shall be replaceable without special tools and without disturbing facepiece or mouthpiece fit.

(d) The facepiece or mouthpiece fit test using the positive or negative pressure recommended by the applicant and described in his instructions will be used before each test.

(e)(1) Each wearer will enter a chamber containing 100 p.p.m. isoamyl acetate vapor for half-mask facepieces, and 1,000 p.p.m. for full facepieces, mouthpieces, hoods, and helmets.

(2) The facepiece or mouthpiece may be adjusted, if necessary, in the test chamber before starting the test.

(3) Each wearer will remain in the chamber for 8 minutes while performing the following activities:

(i) Two minutes, nodding and turning head;

(ii) Two minutes, calisthenic arm movements;

(iii) Two minutes, running in place; and

(iv) Two minutes, pumping with a tire pump into a 28-liter (1 cubic-foot) container.

(4) Each wearer shall not detect the odor of isoamyl-acetate vapor during the test.

**§ 84.206 Particulate tests; respirators with filters; minimum requirements; general.**

(a) Three respirators with cartridges containing, or having attached to them, filters for protection against particulates will be tested in accordance with the provisions of § 84.207.

(b) In addition to the test requirements set forth in paragraph (a) of this section, three such respirators will be tested, as appropriate, in accordance with the provisions of §§ 84.179 through 84.183; however, the maximum allowable resistance of complete particulate, and gas, vapor, or gas and vapor chemical cartridge respirators shall not exceed the maximum allowable limits set forth in § 84.203.

**§ 84.207 Bench tests; gas and vapor tests; minimum requirements; general.**

(a) Bench tests will be made on an apparatus that allows the test atmosphere at 50±5 percent relative humidity and room temperature, approximately 25 °C, to enter the cartridges continuously at predetermined concentrations and rates of flow, and that has means

for determining the test life of the cartridges.

(b) Where two cartridges are used in parallel on a chemical cartridge respirator, the bench test will be performed with the cartridges arranged in parallel, and the test requirements will apply to the combination rather than to the individual cartridges.

(c) Three cartridges or pairs of cartridges will be removed from containers and tested as received from the applicant.

(d) Two air purifying cartridges or pairs of cartridges will be equilibrated at room temperature by passing 25 per-

cent relative humidity air through them at the flow rate of 25 liters per minute (l.p.m.) for 6 hours.

(e) Two air purifying cartridges or pairs of cartridges will be equilibrated by passing 85 percent relative humidity air through them at the flow rate of 25 l.p.m.

(f) All cartridges will be resealed, kept in an upright position, at room temperatures, and tested within 18 hours.

(g) Cartridges will be tested and shall meet the minimum requirements set forth in Table 11 of this subpart.

TABLES TO SUBPART L OF PART 84

TABLES 9-10 [RESERVED]

TABLE 11—CARTRIDGE BENCH TESTS AND REQUIREMENTS

[42 CFR part 84, subpart L]

Cartridge	Test condition	Test atmosphere		Flowrate (l.p.m.)	Number of tests	Penetration <sup>1</sup> (p.p.m.)	Minimum life <sup>2</sup> (min.)
		Gas or vapor	Concentration (p.p.m.)				
Ammonia .....	As received .....	NH <sub>3</sub>	1000	64	3	50	50
Ammonia .....	Equilibrated .....	NH <sub>3</sub>	1000	32	4	50	50
Chlorine .....	As received .....	Cl <sub>2</sub>	500	64	3	5	35
Chlorine .....	Equilibrated .....	Cl <sub>2</sub>	500	32	4	5	35
Hydrogen chloride.	As received .....	HCl	500	64	3	5	50
Hydrogen chloride.	Equilibrated .....	HCl	500	32	4	5	50
Methylamine .....	As received .....	CH <sub>3</sub> NH <sub>2</sub>	1000	64	3	10	25
Methylamine .....	Equilibrated .....	CH <sub>3</sub> NH <sub>2</sub>	1000	32	4	10	25
Organic vapors ..	As received .....	CCl <sub>4</sub>	1000	64	3	5	50
Organic vapors ..	Equilibrated .....	CCl <sub>4</sub>	1000	32	4	5	50
Sulfur dioxide .....	As received .....	SO <sub>2</sub>	500	64	3	5	30
Sulfur dioxide .....	Equilibrated .....	SO <sub>2</sub>	500	32	4	5	30

<sup>1</sup> Minimum life will be determined at the indicated penetration.

<sup>2</sup> Where a respirator is designed for respiratory protection against more than one type of gas or vapor, as for use in ammonia and in chlorine, the minimum life shall be one-half that shown for each type of gas or vapor. Where a respirator is designed for respiratory protection against more than one gas of a type, as for use in chlorine and sulfur dioxide, the stated minimal life shall apply.

Subpart M [Reserved]

Subpart N—Special Use Respirators

§ 84.250 Vinyl chloride respirators; description.

Vinyl chloride respirators, including all completely assembled respirators which are designed for use as respiratory protection during entry into and escape from vinyl chloride atmospheres containing adequate oxygen to support life, are described ac-

cording to their construction as follows:

- (a) Front-mounted or back-mounted gas masks;
- (b) Chin-style gas masks;
- (c) Chemical-cartridge respirators;
- (d) Powered air-purifying respirators; and
- (e) Other devices, including combination respirators.