JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS T 8152 : 2012

(JSAA/JSA)

Gas respirators

ICS 13.340.30

Reference number : JIS T 8152 : 2012 (E)

Date of Establishment: 1972-02-28

Date of Revision: 2012-02-25

Date of Public Notice in Official Gazette: 2012-02-27

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Protective Equipment for Occupational Safety

---

JIS T 8152 : 2012, First English edition published in 2012-12

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

Printed in Japan

MT

Contents

Page

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Safety Appliances Association (JSAA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS T 8152** : 2002 is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, or utility model right. The relevant Ministers and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or the utility model right.

Gas respirators

Introduction

This Japanese Industrial Standard was established as **JIS B 9903** (Gas respirators) in 1955, and has gone through several revisions to this day. The last revision was performed in 2002. The revision at this time is to respond to the increasing types of toxic gas to be handled, the development of absorbents, the advance of testing technologies and necessity of appropriate expression, etc.

No corresponding International Standard has been published at this time.

1 Scope

This Standard specifies gas respirators for inhaling the air cleaned by removing toxic gases or vapours (hereafter referred to as "toxic gas") or particulate matters mixed with toxic gas in work area or other places (hereafter referred to as "respirators").

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards indicated below (including amendments) shall be applied.

JIS T 8001 *Glossary of terms for respiratory protective devices*

JIS Z 8102 *Names of non-luminous object colours*

JIS Z 8721 *Colour specification—Specification according to their three attributes*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions specified in **JIS T 8001** apply.

4 Classification

The respirators are classified into the types given in table 1.

The cartridges are as given in table 2 and, moreover, they are divided into those with particulate filter (combination filters) and those without particulate filter (gas filters).

The symbols for each class of combination filter classified in accordance with filtering efficiency are as given in table 3.

NOTE : The combination filters are intended as well to collect and remove particulate matters, and there are two types, built-in filter type and separable filter type.

Table 1 Classification of respirators

Respirators	Type of facepiece
Separation type	Full facepiece
	Half mask facepiece
Direct connection type	Full facepiece
	Half mask facepiece
Small size direct connection type	Full facepiece
	Half mask facepiece
Mouthpiece type	—

Table 2 Classification of cartridges

Cartridges	Types of applicable respirators			
	Separation type	Direct connection type	Small size direct connection type	Mouthpiece type
For halogen gases	○	○	○	○
For acid gases	○	○	○	○
For organic gases	○	○	○	—
For carbon monoxide	○	○	—	○
For carbon monoxide and organic gases	○	—	—	—
For ammonia	○	○	○	—
For sulfur dioxide (sulfurous acid gas)	○	○	○	○
For hydrogen cyanide	○	○	—	○
For hydrogen sulfide	○	○	○	—
For methyl bromide	○	○	○	—
For mercury	—	—	○	—
For formaldehyde	—	○	○	—
For hydrogen phosphide	○	○	○	—
For ethylene oxide	—	○	○	—
For methanol	—	○	○	—
NOTE : The meaning of the marks in the table is as follows. The mark ○ means the product specified in this Standard, and the mark — means those not to be specified in this Standard.				

Table 3 Symbols for each class of combination filters

Filtering efficiency	Symbols for each class	
%	Test using DOP particles	Test using NaCl particles
99.9 min.	L3	S3
95.0 min.	L2	S2
80.0 min.	L1	S1

5 Performance

5.1 Airtightness

The facepiece and the cartridges shall be those in which there is no air leakage when tested in accordance with **8.1**.

5.2 Airtightness of exhalation valve in normal operation

The exhalation valve shall immediately indicate the inside pressure reduction when tested in accordance with **8.2**. In addition, the time required for coming back to ordinary pressure after the reduction of pressure shall be 15 s or over.

5.3 Air-flow resistance of facepiece

The inhalation resistance and the exhalation resistance of the facepiece shall, at the most, be the values given in table 4 when tested in accordance with **8.3** and **8.4**, respectively.

Table 4 Air-flow resistance of facepiece

Unit : Pa

Item	Respirators		
	Separation type	Direct connection type	Small size direct connection type
Inhalation resistance	70	50	
Mean value of inhalation resistance peak values	165	120	
Exhalation resistance	80		
Mean value of exhalation resistance peak values	190		

5.4 Air-flow resistance of cartridge

The air-flow resistance of the cartridge shall, at the most, be the values given in table 5 when tested in accordance with **8.5**.

Table 5 Air-flow resistance of cartridge

Unit : Pa

Cartridges	Symbols for classes	Applicable respirators				
		Separation type		Direct connection type	Small size direct connection type	Mouthpiece type
		For carbon monoxide	For other than carbon monoxide			
With particulate filter	L3 or S3	400		370		
	L2 or S2	320		290		
	L1 or S1	310		280		
Without particulate filter	—	280	250	220		

5.5 Gas removing capacity of cartridge

The gas removing capacity of the cartridge shall be that, when tested in accordance with **8.6**, the break-through time thereof satisfies respective values given in tables 6 to 9.

Table 6 Gas removing capacity of cartridge for separation type respirator

Cartridges	Air containing test gas		Maximum allowable penetration ppm [a]	Breakthrough time min
	Test gas	Test density Volume fraction %		
For halogen gases	Chlorine	0.5	1	60 min.
For acid gases	Hydrogen chloride	0.5	5	100 min.
For organic gases	Cyclohexane	0.5	5	100 min.
For carbon monoxide	Carbon monoxide	1.0	50 [b]	180 min.
For carbon monoxide and organic gases	Carbon monoxide	1.0	50 [b]	60 min.
	Cyclohexane	0.5	5	30 min.
For ammonia	Ammonia	2.0	50	40 min.
For sulfur dioxide (sulfurous acid gases)	Sulfur dioxide	0.5	5	50 min.
For hydrogen cyanide	Hydrogen cyanide	0.5	5	50 min.
For hydrogen sulfide	Hydrogen sulfide	0.5	10	50 min.
For methyl bromide	Methyl bromide	0.5	1	50 min.
For hydrogen phosphide	Hydrogen phosphide	0.1	0.3	50 min.

Notes [a] 1 ppm = volume fraction 1×10^{-4} %

[b] So far as the first 5 min after starting the test are concerned, the concentration of transmitting gas is not considered to be breakthrough even when exceeding the maximum allowable penetration, if it is less than 100 ppm.

Table 7 Gas removing capacity of cartridge for direct connection type respirator

Cartridges	Air containing test gas		Maximum allowable penetration ppm [a]	Breakthrough time min
	Test gas	Test density Volume fraction %		
For halogen gases	Chlorine	0.3	1	15 min.
For acid gases	Hydrogen chloride	0.3	5	80 min.
For organic gases	Cyclohexane	0.3	5	30 min.
For carbon monoxide	Carbon monoxide	1.0	50 [b]	30 min.
For ammonia	Ammonia	1.0	50	10 min.
For sulfur dioxide (sulfurous acid gases)	Sulfur dioxide	0.3	5	15 min.
For hydrogen cyanide	Hydrogen cyanide	0.3	5	20 min.
For hydrogen sulfide	Hydrogen sulfide	0.3	10	20 min.
For methyl bromide	Methyl bromide	0.3	1	15 min.
For formaldehyde	Formaldehyde	0.02	0.1	45 min.
For hydrogen phosphide	Hydrogen phosphide	0.2	0.3	100 min.
For ethylene oxide	Ethylene oxide	0.02	1	10 min.
For methanol	Methanol	0.3	200	30 min.

Notes [a] 1 ppm = volume fraction 1×10^{-4} %

[b] So far as the first 5 min after starting the test are concerned, the concentration of transmitting gas is not considered to be breakthrough even when exceeding the maximum allowable penetration, if it is less than 400 ppm.

Table 8 Gas removing capacity of cartridge for small size direct connection type respirator

Cartridges	Air containing test gas			Maximum allowable penetration		Break-through time min
	Test gas	Test density		ppm [a]	mg/m³	
		Volume fraction %	mg/m³			
For halogen gases	Chlorine	0.02		1		40 min.
For acid gases	Hydrogen chloride	0.03		5		80 min.
For organic gases	Cyclohexane	0.03		5		50 min.
For ammonia	Ammonia	0.1		50		40 min.
For sulfur dioxide (sulfurous acid gases)	Sulfur dioxide	0.03		5		35 min.
For hydrogen sulfide	Hydrogen sulfide	0.02		10		35 min.
For methyl bromide	Methyl bromide	0.02		1		35 min.
For mercury	Mercury vapor		10		0.05	480 min.
For formaldehyde	Formaldehyde	0.002		0.1		85 min.
For hydrogen phosphide	Hydrogen phosphide	0.02		0.3		200 min.
For ethylene oxide	Ethylene oxide	0.002		1		15 min.
For methanol	Methanol	0.03		200		60 min.
Note [a] 1 ppm = volume fraction 1×10^{-4} %						

Table 9 Gas removing capacity of cartridge for mouthpiece type respirator

Cartridges	Air containing test gas		Maximum allowable penetration ppm [a]	Breakthrough time min
	Test gas	Test density Volume fraction %		
For halogen gases	Chlorine	0.02	1	40 min.
For acid gases	Hydrogen chloride	0.1	5	15 min.
For carbon monoxide	Carbon monoxide	1.0	50 [b]	30 min.
For sulfur dioxide (sulfurous acid gases)	Sulfur dioxide	0.03	5	35 min.
For hydrogen cyanide	Hydrogen cyanide	0.02	5	100 min.
Notes [a] 1 ppm = volume fraction 1×10^{-4} % [b] So far as the first 5 min after starting the test are concerned, the concentration of transmitting gas is not considered to be breakthrough even when exceeding the maximum allowable penetration, if it is less than 400 ppm.				

5.6 Filtering efficiency

When testing the combination filter in accordance with **8.7**, the minimum value of filtering efficiency shall conform to any one of the values given in table 3.

5.7 Rise value of carbon dioxide density in inhalation

When testing the facepiece in accordance with **8.8**, the rise value of carbon dioxide in inhalation shall be 1.0 % or less.

5.8 Breakage or uncoupling of breathing hose and breathing hose attaching parts

The portions from the facepiece to the cartridge connecting parts shall have no breakage or uncoupling when tested in accordance with **8.9**.

5.9 Extension rate of head harness

The extension rate of head harness shall be 50 % or less for full facepiece and 100 % or less for half mask facepiece when the head harness is tested in accordance with **8.10**.

5.10 Breakage or uncoupling of head harness

The head harness and the head-harness attaching part to a facepiece shall have no breakage or uncoupling when tested with the head harness and the facepiece being at both ends in accordance with **8.11**.

5.11 Airtightness of visor

The visor shall have no leakage of air when testing in accordance with **8.12**.

6 Construction

6.1 Construction in general

The construction of respirators shall be as follows.

Some examples of the construction of respirators are shown in Annex A.

a) Respirators shall be handled simply.

b) Respirators shall not be damaged easily.

c) Respirators shall be so constructed that abnormal oppressive pain is not felt when wearing.

d) Respirators shall be so constructed that the wearer himself is able to easily confirm anytime the good fitness of the face to the facepiece by closing the inhalation inlet or exhalation outlet.

e) Respirators shall be so constructed that the performance and wearing property of the respirator are not impaired, when the cartridge, head harness, inhalation valve, exhalation valve, etc. are exchanged.

f) Respirators shall be so constructed that they are ensured not to give hindrance to the human body by means, for example, of coating, filtration, etc., when using harmful material.

g) Respirators shall be so constructed that the visual field of the wearer is not remarkably hindered.

6.2 Construction according to types

6.2.1 Separation type respirators

The separation type respirators consist of the cartridge, breathing hose, inhalation valve, face blank, exhalation valve and head harness, and shall be so constructed as to be capable of inhaling the air purified by removing toxic gases, etc. through the cartridge and exhausting the exhalation into the open air through the exhalation valve.

6.2.2 Direct connection type respirators

The direct connection type respirators consist of the cartridge, inhalation valve, face blank, exhalation valve and head harness, and shall be so constructed as to be capable of inhaling the air purified by removing toxic gases through the cartridge and exhausting the exhalation into the open air through the exhalation valve.

6.2.3 Small size direct connection type respirators

The small size direct connection type respirators consist of the cartridge, inhalation valve, face blank, exhalation valve and head harness, and shall be so constructed as to be capable of inhaling the air purified by removing toxic gases through the cartridge and exhausting the exhalation into the open air through the exhalation valve.

6.2.4 Mouthpiece type respirators

The mouthpiece type respirators are intended to be used only for refuge in cases of gas leakage accidents etc., consist of cartridge, exhalation valve, mouthpiece, nose-clip, etc. and shall be so constructed as to be easy in handling and in quick and correct wearing and, so that at least the air passing part of the cartridge is so sealed as not to touch the open air until the time to be in service. In addition, they shall be so constructed that the air leakage from the mouth and nose is prevented by firmly closing the mouth and nipping the nose with a nose-clip after putting the mouthpiece between the lip and gum.

6.3 Construction of components

6.3.1 Facepiece, etc.

The facepiece, etc. are as follows.

a) In the full facepiece, the facepiece shall be constructed so as to cover the overall face without air leakage and to be capable of preventing the visor from getting fogged.

b) In the half mask facepiece, the facepiece shall be constructed so as to cover the nose and the surrounding of the mouth and so that there is no air leakage.

c) The mouthpiece shall be so constructed that the air leakage from the mouth and nose is prevented by firmly closing the mouth and nipping the nose with a nose-clip after putting the mouthpiece between the lip and gum.

6.3.2 Inhalation valve

The inhalation valve shall act sensitively corresponding to the usual breathing.

6.3.3 Exhalation valve

The exhalation valve is as follows.

a) It shall act correctly and sensitively corresponding to the usual breathing, regardless of the condition of valve and valve seat, either dry or wet.

b) It shall be kept in a closed state when the pressure is balanced between the inside and the outside, regardless of the direction of the facepiece.

c) It shall be protected by a covering from the damage caused by external forces.

6.3.4 Breathing hose and breathing hose attaching part

The breathing hose and its attaching part are as follows.

a) The breathing hose and its attaching part shall not disturb the wearer's motion and cause a disturbance against the airflow in a worn state even when bending in various states. In addition, even when pressurized by the jaw, arm, etc. the airflow shall not be disturbed.

b) The breathing hose shall be of a length not hindering the neck part in its movement.

6.3.5 Head harness

The head harness shall have an adequate length, sufficient resiliency and strength and, excluding the mouthpiece type, shall be of adjustable length.

6.3.6 Cartridge

The cartridge is to remove or detoxify the toxic gases, etc. in the ambient air passing by the inhalation caused by the wearer's pneumonic force through the sorbents, and its construction shall conform to the following requirements.

a) The combination filter shall have a particulate filter to collect the particulate matter.

In the case of those intended to collect the mist, etc. which may be generated after the collection, the particulate filter shall be provided outside the combination filter.

b) The cartridge shall be constructed so that the sorbent or other powder does not directly touch the skin or is not inhaled.

c) If the cartridge is filled with corrosive sorbent, its inside shall be of corrosion resistance or given sufficient corrosion-proof treatment.

6.3.7 Visor

The visor shall be firmly attached on the facepiece so as to make sure it airtight.

7 Materials

The materials used for each part of the respirators shall conform to the following requirements.

a) Strength, elasticity, etc. shall be suitable for service.

b) Materials used for portions in contact with the skin shall not give harmful influence to the skin and be able to be disinfected.

c) Metallic materials shall be of corrosion resistance or are given suitable corrosion-proof treatment.

8 Tests

8.1 Airtightness test

The airtightness test of the respirators shall be as follows.

a) Wear the facepiece of the respirator with a replaceable cartridge on a dummy head for testing (hereafter referred to as “dummy head”. See figure 1.) or a special holder with closing its exhalation valve seat and inhalation outlet, apply an air pressure of 1 kPa to the inside, and examine whether the air leaks or not.

NOTES : For detecting the air leakage, the following methods are typically used.

1) Let ammonia gas flow into the inside of the facepiece worn on the dummy head, cover the part where air leakage is examined with a cloth moistened with phenolphthalein alcohol aqueous solution and observe whether the colour of the cloth changes to red.

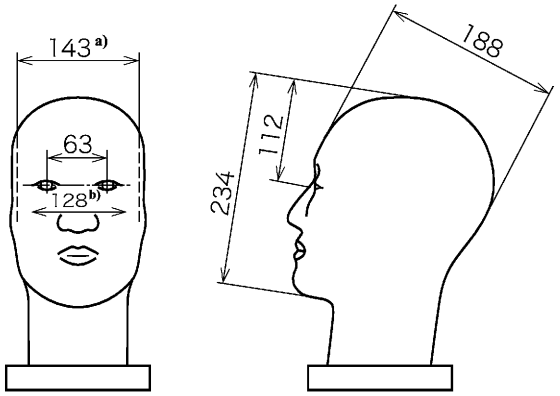
2) Let the air flow into the inside of the facepiece worn on the dummy head, coat the part where air leakage is examined with soapy water or the like and observe whether bubble of the soapy water is produced.

3) Sink the facepiece worn on the dummy head in water, let the air flow into the inside and observe whether air bubble is produced in the water.

b) In the case of the respirators provided with a replaceable cartridge, apply the air pressure of 1.5 kPa to the inside of the cartridge and examine whether air leakage occurs.

c) In the case of the respirators provided with an unchangeable cartridge, close the exhalation valve and the inlet of cartridge, remove the inhalation valve, apply the air pressure of 1.5 kPa to the inside and examine whether air leakage occurs.

Unit : mm



NOTE : The dimensions of this dummy head are based on the "Body measurement values of the members of the Japan Air Self-Defence Force—Ergonomic data for design of equipment" (1972) by Aeromedical Laboratory.

Notes a) It represents distance between tragi.

b) It represents width of the zygomatic arch.

Figure 1 Dummy head for test

8.2 Airtightness test of exhalation valve in operation

Mount the exhalation valve on the airtightness tester equipped with exhalation valve seat, examine a state of pressure reduction in the inside caused by the closure of the exhalation valve as a result of the suction of the air by a flow rate of 1 L/min, then lower the inside pressure by 1 470 Pa lower than the outside pressure and allow to stand, and measure the time required until the inside pressure comes to the ordinary pressure. In this case, the content volume of the airtightness tester shall be 50 ± 5 cm^3.

8.3 Test of inhalation resistance and exhalation resistance of facepiece

Mount the facepiece on a dummy head etc. and seal tightly the contacting part of the facepiece and the dummy head etc. using, for example, putty so as not to bring about a leakage therefrom. Then, carry out inhalation and exhalation at a rate of 40 L/min and measure the difference of the pressure between the inside and the outside of facepiece.

8.4 Test of inhalation resistance peak value and exhalation resistance peak value of facepiece

Mount the facepiece on a dummy head etc. and seal tightly the contacting part of the facepiece and the dummy head etc. using, for example, putty so as not to bring about a leakage therefrom. Connect a breathing machine to this dummy head etc., ventilate reciprocally at a rate of (2.0 ± 0.1 L/time) × (15 ± 1 times/min), measure the difference of the pressure between the outside and the inside of the facepiece for 1 min period starting from 30 s later than the beginning of the ventilation (in the case of full facepiece with inner mask, between the inside of inner mask and the outside of facepiece, hereafter the same) using a precision minute differential pressure gauge

(95 % response within 0.4 s including recording meter, hereafter the same) and obtain the average value of peak values during that period.

An example of the test apparatus is illustrated in figure 2.

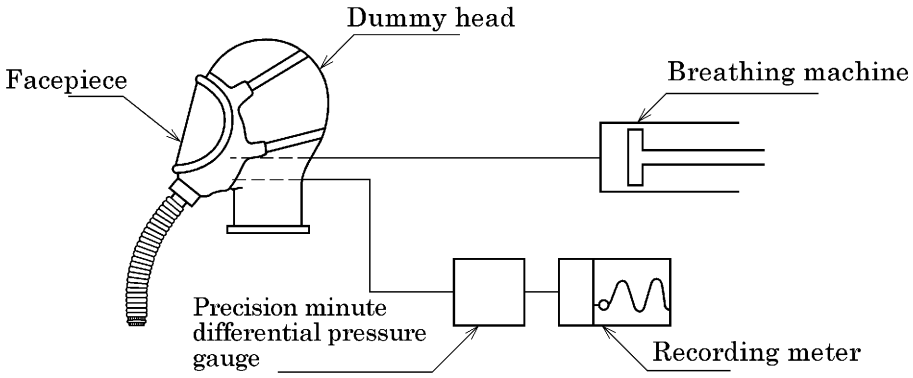


Figure 2 Example of the testing apparatus for inhalation resistance peak value and exhalation resistance peak value

8.5 Test of air-flow resistance of cartridge

Take a single cartridge as a test sample and pass the air, according to the number of cartridges to be mounted on the respirator, of 40 L/min (in the case of one cartridge), or 20 L/min (in the case of two cartridges) from the open air side to measure the difference of the pressure between the front side and back side of the cartridge.

The test of ventilation resistance of cartridge is carried out without carrying out a vibration test as specified in **a)** of **8.6**.

8.6 Test of gas removing capacity

For the test of gas removing capacity of cartridge, measure its breakthrough time after preconditioning of the cartridge.

a) **Preconditioning** Carry out a vibration test as preconditioning. Test apparatus and test procedures to be used for preconditioning shall be as follows.

1) **Test apparatus** The test apparatus shall be as follows.

— A vibration test apparatus consists of the steel case (K) which is fixed to the piston (S) which moves vertically, the rotating cam (N) which can go up by 20 mm, and the steel plate (P) which receives the fall (see figure 3).

— The mass of the steel case shall be larger than 10 kg.

— The steel plate which receives the fall of the steel case shall have the mass 10 or more times of the mass of the steel case. Alternatively, the plate shall be bolted securely to the rigid floor.

— The steel case shall be so constructed as to prevent cartridges from touching each other during a test, and to be capable of moving 6 mm in a horizontal direction (when the side of cartridge was faced downward), and freely in a vertical direction.

2) **Test procedure** The test procedure shall be as follows.

i) Unpack the cartridge.

ii) Orient the side of the cartridge downward, and insert it into the steel case of test apparatus.

iii) Vibrate it with about 100 times/min and for about 20 min ($2\,000^{+20}_{-0}$ times).

iv) Take out the cartridge from a steel case and measure breakthrough time within 2 h.

In addition, if it takes 30 min or more for the breakthrough time measurement to start, keep the cartridge in the airtight container, and store it in the room of 16 °C to 32 °C and (50 ± 30) % RH.

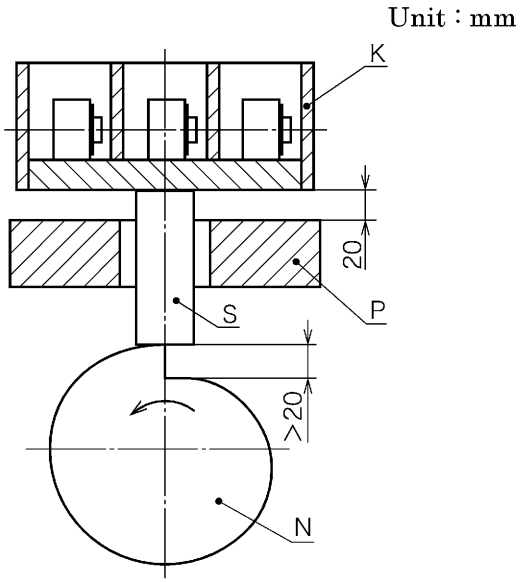


Figure 3 Example of vibration test apparatus

b) **Breakthrough time measurement** Take a single cartridge as a test sample and pass the air including the test gas of the concentration as given in the tables 6 to 9, under the condition as given in table 10, according to the kinds of gas and obtain its breakthrough time.

During the test, the test sample shall be oriented in the direction of horizontal flow of the air including the test gas.

For the measurement, the method by which it is possible to measure constantly the gases of the similar concentration to the maximum allowable penetration shall be used.

Table 10 Condition for gas removing capacity test

Number of cartridges to be mounted on respirator Unit	1	2
Flow rate L/min	30	15
Temperature °C	20 ± 2	
Relative humidity %	50 ± 5	

8.7 Test of filtering efficiency

Take a combination filter or a unit of detachable filter as a test sample and pass the test particles given in table 11. The passing flow rate shall, according to the number of the cartridges to be mounted on the respirator, be 85 L/min (in the case of one filter) or 42.5 L/min (in the case of two filters). In the course of the time until the amount of the test particles supplied as the test sample comes to the values given in table 11, measure continuously the concentration of the test particles before and after the passage of the test sample using a particle concentration meter based on scattered light system and obtain the minimum value from among the values of the filtering efficiency calculated by the following formula.

$$E=\frac{C_1-C_2}{C_1}\times 100$$

where, E : filtering efficiency (%)

C_1 : concentration of test particle before the passage of test sample (mg/m^3)

C_2 : concentration of test particle after the passage of test sample (mg/m^3)

Table 11 Test particle

Kind	DOP particle [a]	NaCl particle [b]
Concentration mg/m^3	100 max.	50 max.
Width of variation to the mean value of concentration	± 15 % max.	± 15 % max.
Median of distribution of particles μm	0.15 to 0.25	0.06 to 0.1
Geometrical standard deviation of distribution of particles	1.6 max.	1.8 max.
Quantity to be supplied to respirator mg	200	100
Notes [a] The liquid particles which were produced by spraying dioctyl phthalate (DOP). [b] The solid particles which were produced by spraying sodium chloride (NaCl) solution and by drying them.		

8.8 Test of density rise value of carbon dioxide in inhalation

Connect the dummy head with dummy respiration equipment and operate under the condition given in table 12. In each state that the respirator is mounted on dummy head and not done so, measure the density of the carbon dioxide in the inhalation at the time when making the density of the carbon dioxide in the exhalation 5 % (ordinary temperature) and obtain the density rise value of the carbon dioxide in the inhalation by the following formula.

Apparatus for test of density rise value of carbon dioxide in inhalation is illustrated in figure 4.

$$D = C_3 - C_4$$

where, D : density rise value of carbon dioxide in inhalation caused by respirator (%)
C_3 : density of carbon dioxide in inhalation in a state of respirator mounted on dummy head (%)
C_4 : density of carbon dioxide in inhalation in a state of respirator not mounted on dummy head (%)

Table 12 Conditions for test of density rise value of carbon dioxide in inhalation caused by respirator

Temperature in test ambient atmosphere °C	20 ± 5
Respiration wave	Sinusoidal wave
Amount of ventilation at one time L	2.0 ± 01
Number of times of ventilation at every minute	15 ± 1

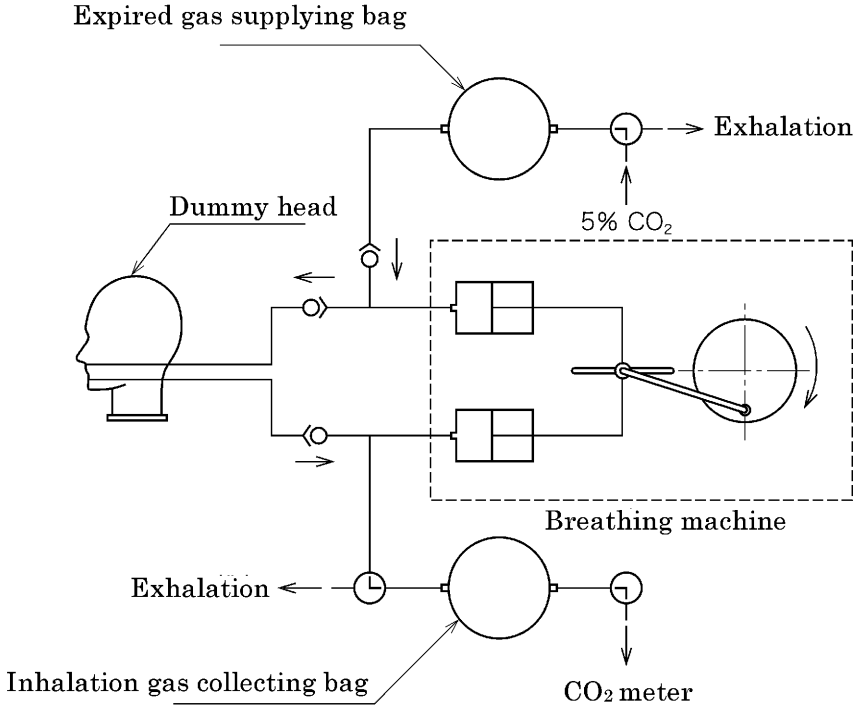


Figure 4 Example of apparatus for testing of density rise value of carbon dioxide in inhalation

8.9 Strength test of the part between facepiece and cartridge attaching part

Mount a separation type respirator on a dummy head fixed firmly on a solid table and, when applying a tensile load of 98 N to the cartridge at the end of breathing hose, examine all over the parts from the facepiece to the cartridge attaching part as to whether breakage or separation arises.

8.10 Test of elongation of head harness

Prepare a test piece of head harness of at least 1 cm in distance between bench marks (limited only to extensible part), measure the lengths between the bench marks when applying a tensile load of 0.98 N and 9.8 N in that order, and calculate the elongation by the following formula.

$$e=\frac{L_1-L_2}{L_1}\times 100$$

where, e : elongation percentage (%)
L_1 : length between bench marks when applying a tensile load of 9.8 N (cm)
L_2 : length between bench marks when applying a tensile load of 0.98 N (cm)

8.11 Strength test of head harness and its attaching part

To head harness attaching part and head harness itself, respectively, apply a tensile load of 50 N in the case of the respirator with full facepiece and 25 N in the case of the respirator with half mask facepiece and examine whether breakage or separation arises.

8.12 Visor part shock test

Put a visor in a state of being mounted on the facepiece into thermostat of − 10 °C and 40 °C reciprocally five times for 30 min each, mount it on a dummy head, keep the middle part of the visor horizontal, drop freely a steel ball of 22 mm diameter and approximately 45 g mass onto the middle surface of the visor from a height of 1.3 m and examine, in accordance with **8.1**, whether any defect of airtightness due to a damage of visor part arises or not.

In this case, the steel ball may be dropped through a pipe allowing dropping naturally (pipe of an internal diameter approximately twice the diameter of the steel ball).

9 Inspection

In the inspection, the tests specified in clause **8** are carried out and the results shall conform to the specifications in clause **5**.

In addition, the sampling inspection shall be based on a reasonable sampling inspection plan.

10 Designation

The designation of products shall be as follows.

a) The respirators shall be designated based on the classification, title of Standard, type of cartridge for each kind of gas and type with or without particulate filter.

Example : Separation type full facepiece gas respirator for halogen gas (with particulate filter)

b) The cartridges shall be designated based on the classification of relevant respirator, kind of gas for use and type with or without particulate filter.

Example : Cartridge for direct connection type gas respirator, for organic gas (combination filter)

11 Marking

The marking shall be as follows.

a) The following information shall be marked on a conspicuous place of the container of respirator.

1) Classification and title of Standard

Example 1 Separation type full facepiece gas respirator
Example 2 Small direct connection type half mask facepiece gas respirator

2) Manufacturer's name or its abbreviation

3) Year and month of manufacture or their abbreviation

b) The following information shall be marked on a conspicuous place on the cartridge.

1) Classification and colour of cartridges given in table 13

2) Manufacturer's name or its abbreviation

3) Year and month of manufacture or their abbreviation

4) Indication of two cartridges used (limited to the case where two cartridges are necessary to be used at the same time)

5) If one kind of cartridge is usable for plural kinds of gas, all these kinds may be marked.

6) In the case of combination filter, symbols for each class of filters given in table 3.

c) As for the respirator with separable particulate filter, the following information shall be marked on a conspicuous place of the filter. However, if the marking on the body is impossible, the marking on the package is permitted.

1) Name of cartridge fitted for

2) Symbols for each class given in table 3

d) The colour of the side surface of cartridge shall be as follows.

1) The cartridges shall be coated with the colour given in table 13 according to the classification over almost the entire side surface. Other colouring shall not be misconceived.

Besides, it is allowed to stick a colour paper unlikely to fall off or discolour, or to colour the can itself of the cartridge.

Table 13 Colours of cartridges

Classification of cartridges	Name of colour [a]	Colour [b]
For halogen gases	Grey [c]	N6
	Black [c]	N1.0
For acid gases	Grey	N6
For organic gases	Black	N1.0
For carbon monoxide	Red	7.5R 4.5/14
For ammonia	Green	5G 5.5/6
For sulfur dioxide (sulfurous acid gas)	Yellow-red	2.5YR 6/13
For hydrogen cyanide	Blue	2.5PB 3.5/10
For hydrogen sulfide	Yellow	2.5Y 8/16
For methyl bromide	Brown	5YR 3/2
For mercury	Olive	7.5Y 3.5/4
For formaldehyde	Olive	7.5Y 3.5/4
For ethylene oxide	Olive	7.5Y 3.5/4
For methanol	Olive	7.5Y 3.5/4
For hydrogen phosphide	Olive	7.5Y 3.5/4

Note [a] In accordance with **JIS Z 8102.**
[b] In accordance with **JIS Z 8721.**
[c] Two kinds of colours are displayed in the two layers in the direction perpendicular to that of ventilation (see figure 5).

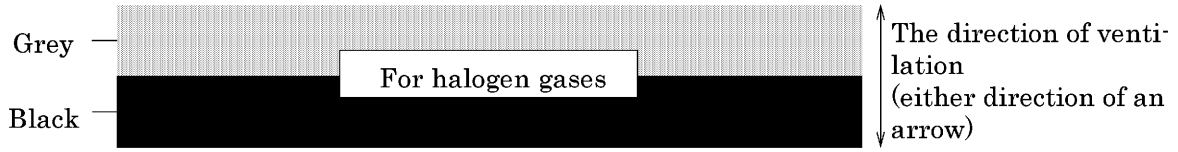


Figure 5 Marking example of colour of cartridges for halogen gases

2) If the cartridge is used for plural kinds of gases, overall kinds shall be indicated, the colours on the side face shall be displayed in stripes perpendicular to the direction of ventilation, and, if necessary, letters shall be used for indicating the kind (see figure 6).

If one of the gases is halogen gas, the combination of two colours as shown in figure 5 shall be displayed in stripes with the colour which indicates other gas perpendicular to the direction of ventilation.

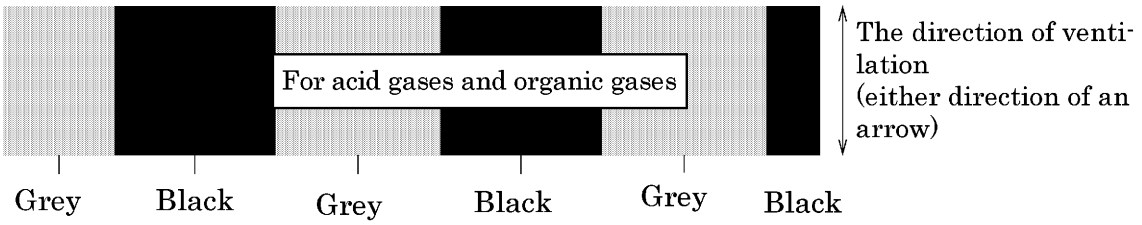


Figure 6 Marking example of cartridges for plural gases used

3) The cartridges with particulate filter shall, as shown in figure 7, be marked with the white line indicating the part where the filter is placed.

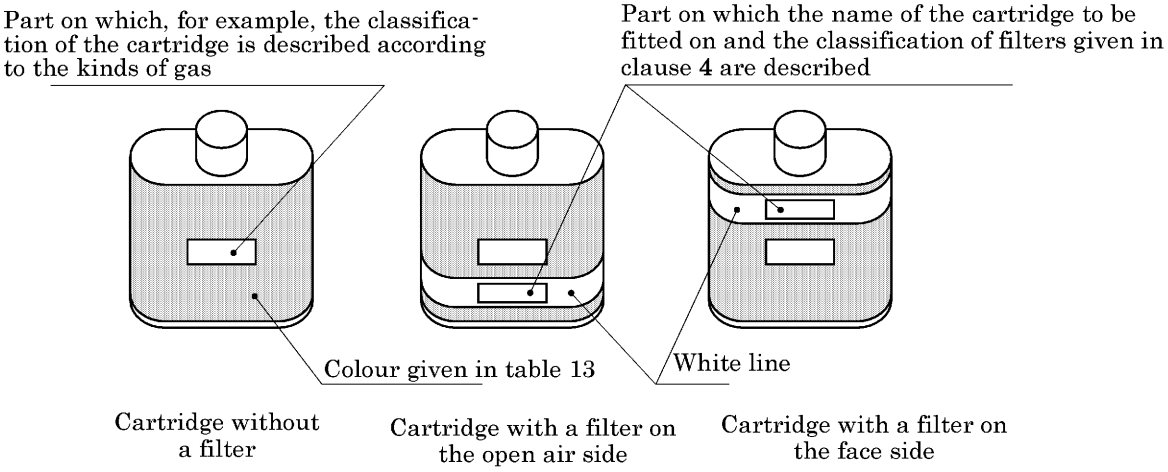
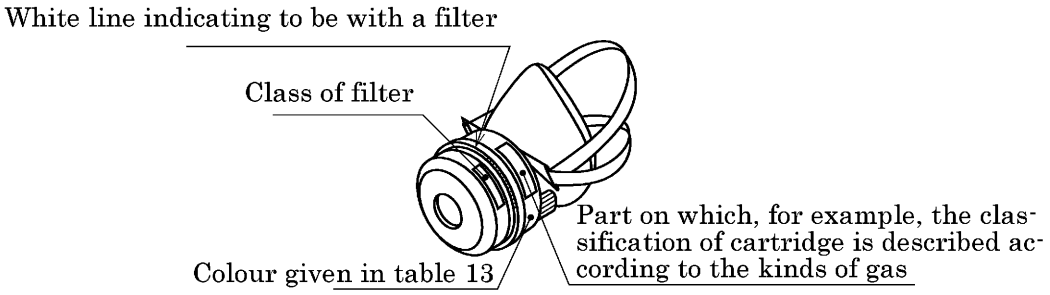
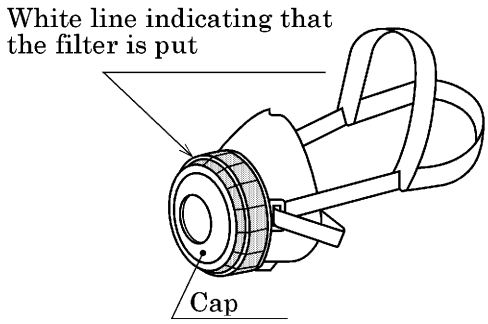


Figure 7 Examples of colouring cartridges

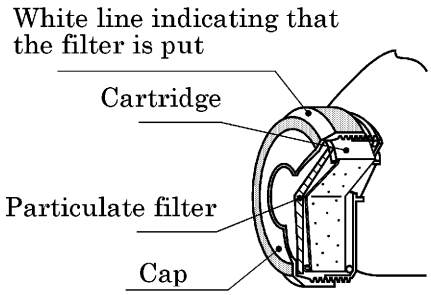
4) a), b) and c) in figure 8 show respectively an example of separable particulate filter and colouring of the cartridges to which the filter is attached.



a) Example of marking in the case of fixing a particulate filter and cartridge together on a facepiece by a cap



b) Example of marking in the case of attaching a particulate filter to a cartridge by a cap



c) Example of marking in the case of attaching a particulate filter to a cartridge by a screw, etc.

Figure 8 Examples of colouring of separable particulate filter and cartridge to which it is attachable

e) The expiry date of cartridges shall be described on the packages.

12 Attached documents

12.1 Instruction manual

The instruction manual described with the following information shall be attached to each respirator and cartridge.

a) **Respirators** The information described in the instruction manual attached to respirators shall be as follows.

1) Environmental condition under which respirators can be used

2) Environmental condition under which respirators shall not be used (places where oxygen concentration is likely to come less than 18 % and places where toxic gas, particulate matter and radioactive material are likely to exist exceeding a limit) and the countermeasures to be taken against them

3) Attachment and detachment of cartridges

4) Selection of cartridge and standard for its exchange

5) Care to be taken for check, maintenance and storage

6) Method for disinfection of facepiece and cautions

7) Disposable procedure of respirators

b) **Cartridges** The information described in the instruction manual attached to cartridges shall be as follows.

1) Attention to be paid to careful reading of the instruction manual for respirators

2) Standard for its exchange

3) Disposable procedure of cartridges

12.2 Other attached documents

The breakthrough curve and service recording card or the substitutes for them shall be attached to cartridges.

Annex A (informative)
Examples of the construction of gas respirators

A.1 Gas respirators

Examples of the construction of gas respirators are shown in figures A.1 to A.4.

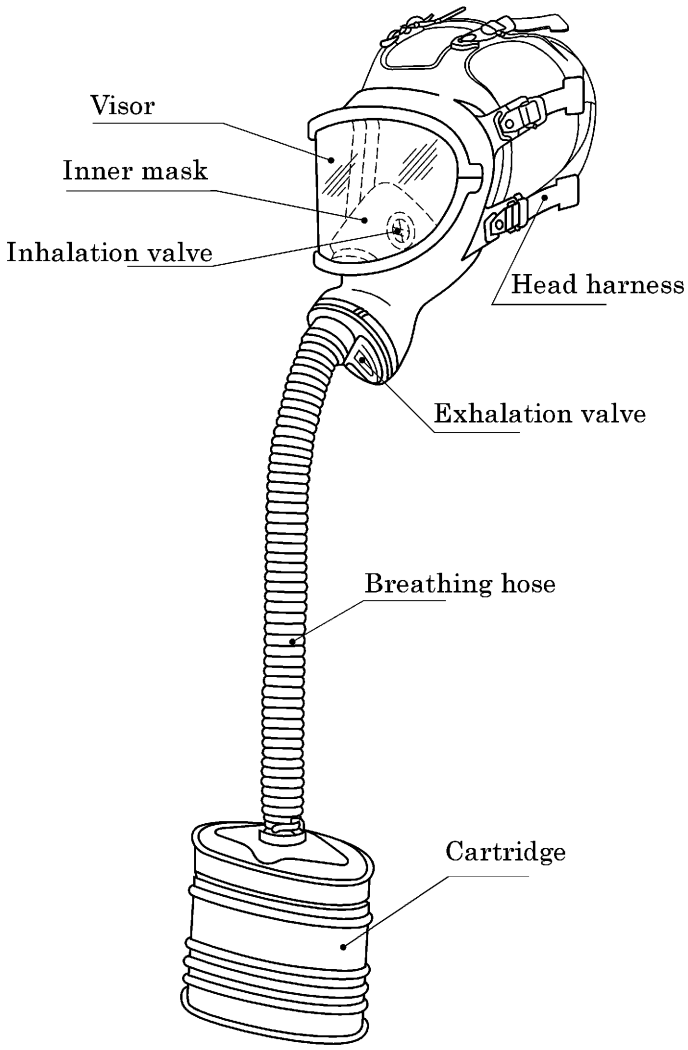


Figure A.1 Example of separation type full facepiece gas respirator

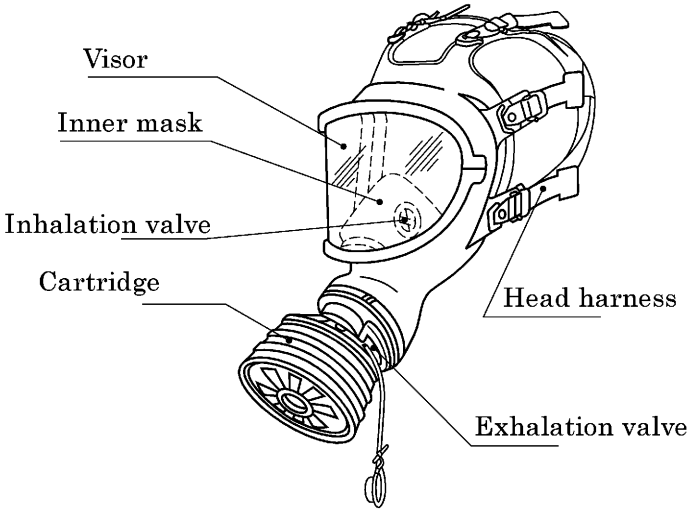


Figure A.2 Example of direct connection type full facepiece gas respirator

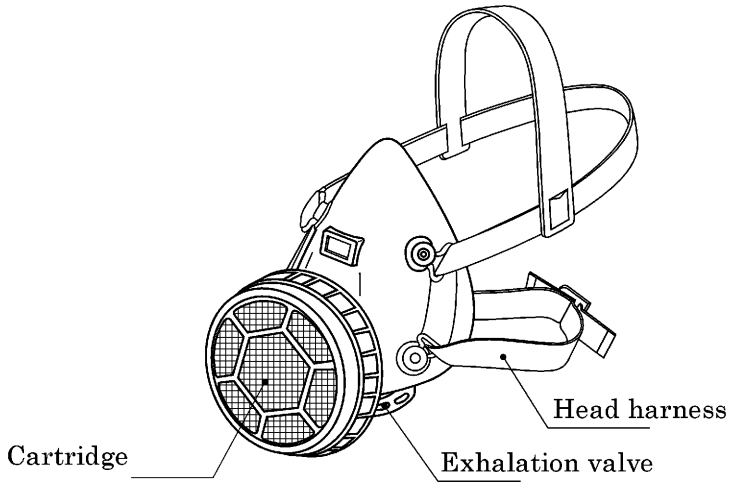


Figure A.3 Example of small size direct connection type half mask facepiece gas respirator

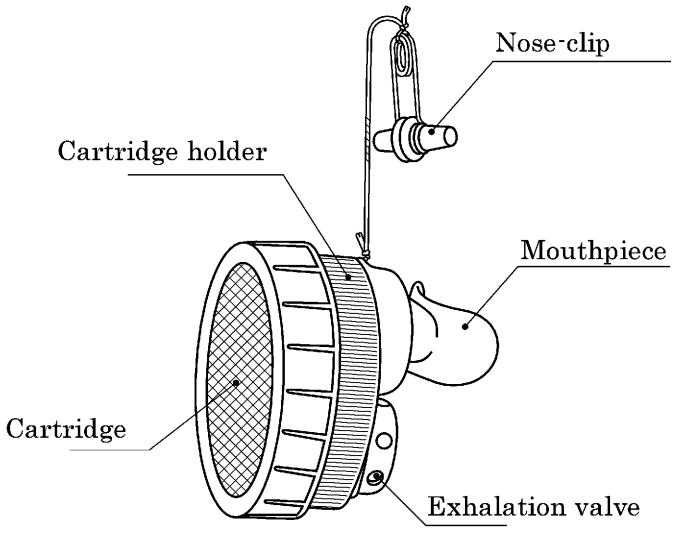
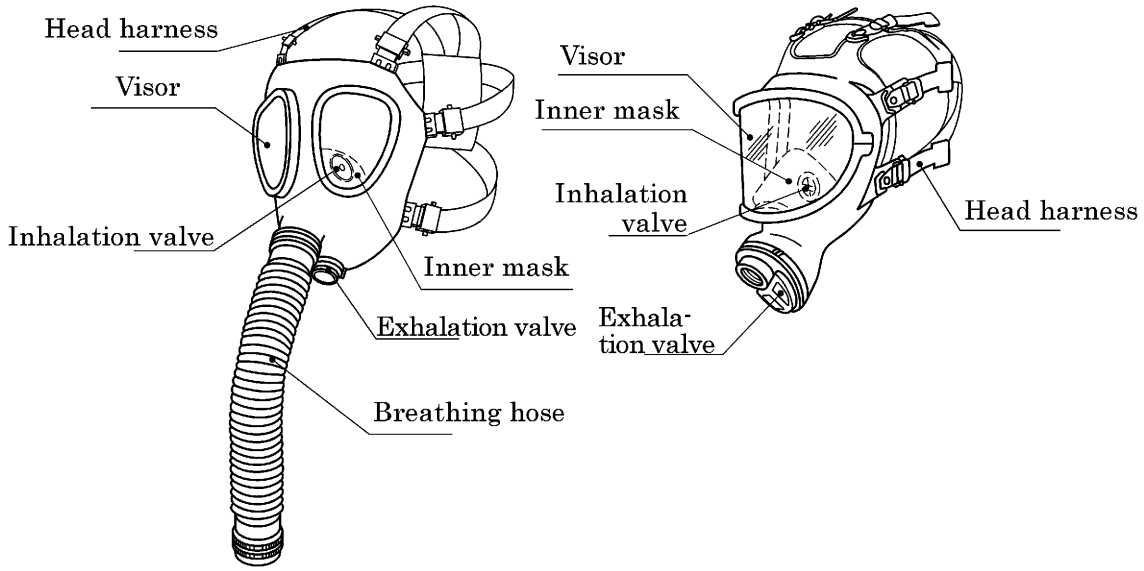


Figure A.4 Example of mouthpiece type gas respirator

A.2 Facepiece and accessories of gas respirator

Examples of the construction of a facepiece and accessories of a gas respirator are shown in figures A.5 and A.6.



a) With a breathing hose b) Without a breathing hose

Figure A.5 Examples of full facepiece

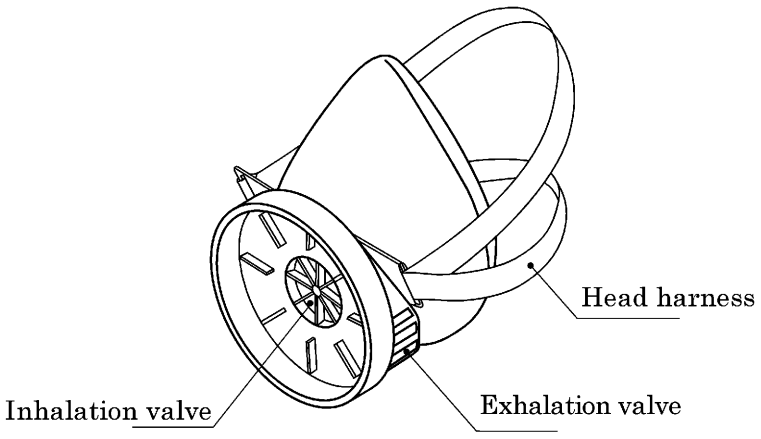
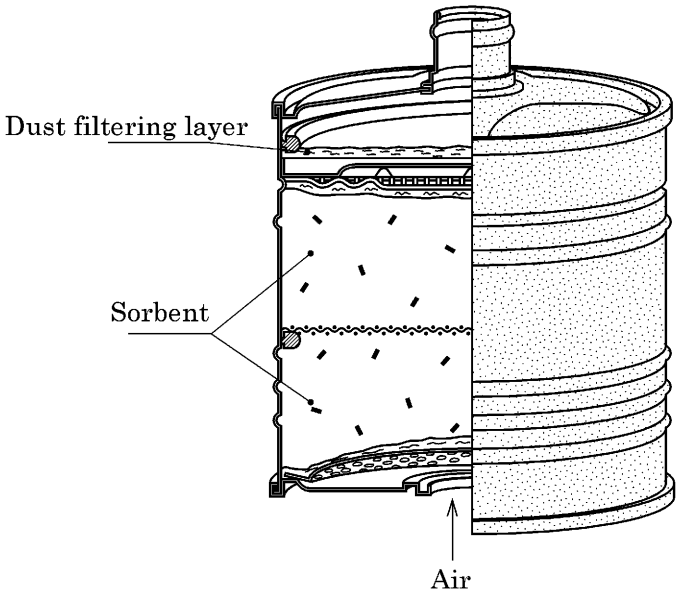


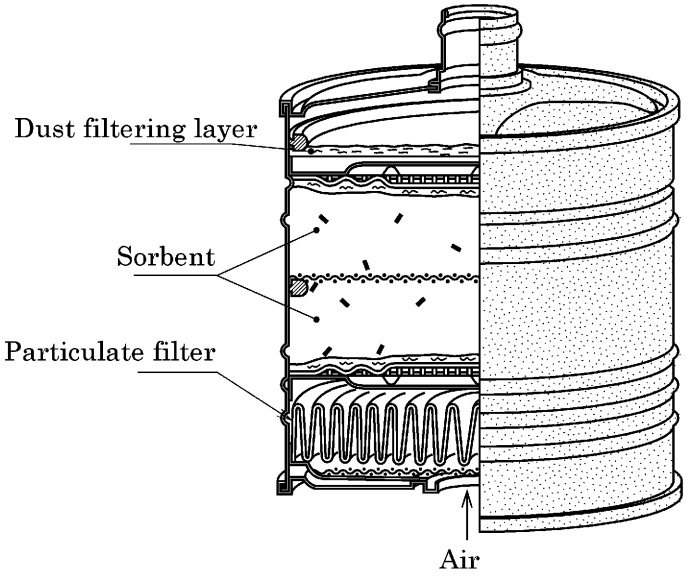
Figure A.6 Example of half mask facepiece

A.3 Cartridge of gas respirator

Examples of the construction of cartridges of gas respirators are shown in figures A.7 to A.9.

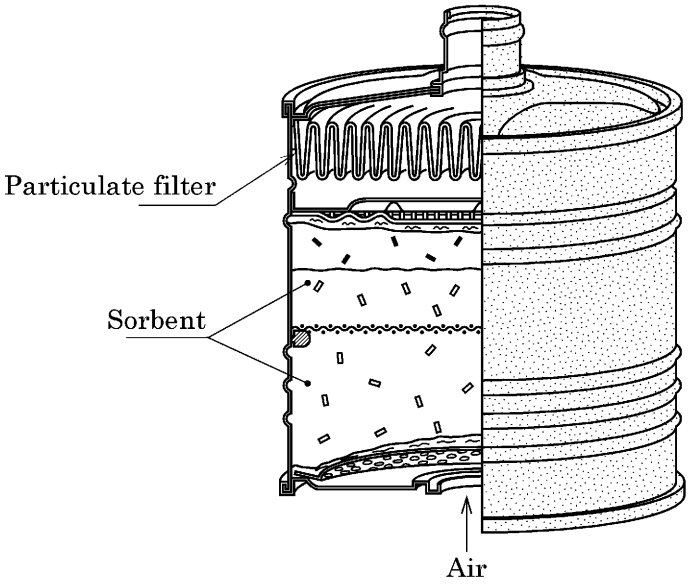


a) Without particulate filter



b) With dust proofing function (in the case of cartridges with a filter on the open air side)

Figure A.7 Examples of separation cartridges



c) With particulate filter (in the case of cartridges with a filter on the face side)

Figure A.7 (concluded)

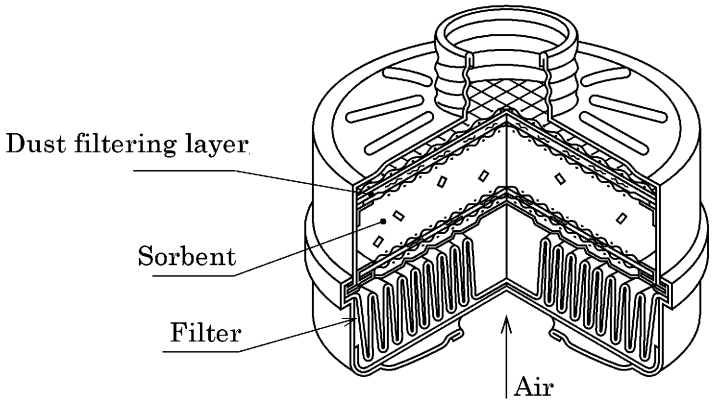
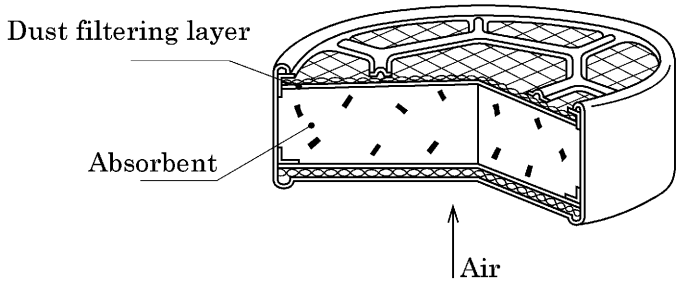
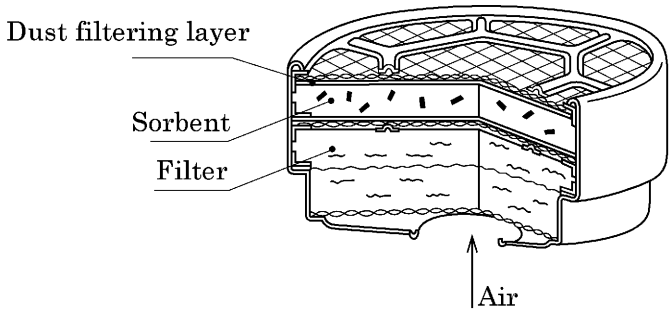


Figure A.8 Example of direct connection type cartridge (with particulate filter)



a) Without particulate filter



b) With particulate filter (in the case of cartridge with a filter on the open air side)

Figure A.9 Examples of small size direct connection type cartridges

Errata for JIS (English edition) are printed in *Standardization and Quality Control*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

Errata will be provided upon request, please contact:

Standards Publishing Department, Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN
TEL. 03-3583-8002 FAX. 03-3583-0462