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TEST REPORT:

EN 137:2006

Self-contained open-circuit compressed air breathing apparatus with full face mask

Report No: 2014-W-124
Client: MSA (China) Safety Equipment Co., Ltd
Contact: Klaus.Xu
Model (s): AirXpress One
Date(s) of tests: 2014.02.28-2014.03.26

DESCRIPTION OF SAMPLES

	Model	Main Components
General Information	AirXpress One	Compressed air cylinder(10128734), Back plate, Full face mask(Ultra Elite)
Manufacturer	MSA (China) Safety Equipment Co., Ltd	
Manufacturer Address	8# Rui En Lane, Xingpu Road, Suzhou Industrial Park Suzhou Jiangsu 215126 China	
Information of Components¹:	Compressed air cylinder: MSA carbon fiber composite cylinder Back plate: One demand valve, mechanical pressure gauge and alarm whistle Full face mask: Ultra Elite with black head harness.	

Note 1. Material information provided by the manufacturer.

Signed:

Issued: 2014.04.01

杨文芬 Yang Wenfen
Authorized Signatory, Lab Director

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国家劳动保护用品质量监督检验中心(北京)



Test Results

6 Requirements

6.3 Design

Pass²

The diameter of pressurised parts with a pressure greater than 0,5 bar downstream of the shut-off valve(s) shall not exceed 32 mm.

The apparatus shall be sufficiently robust to withstand the rough usage it is likely to receive in service with respect to its classification.

The apparatus shall be designed so that there are no protruding parts or sharp edges likely to be caught on projections in narrow passages.

The surface of any part of the apparatus likely to be in contact with the wearer shall be free from sharp edges and burrs.

All parts requiring manipulation by the wearer shall be readily accessible and easily distinguishable from one another by touch. All adjustable parts and controls shall be constructed so that their adjustment is not liable to accidental alteration during use.

The apparatus shall be so designed that the wearer can remove it and, while still wearing the full face mask, continue to breathe from the apparatus.

The apparatus shall be designed to ensure its full function in any orientation

The main valve(s) of pressure vessel(s) shall be arranged so that the wearer can operate it (them) while wearing the apparatus.

If apparatus (of the same type) are designed for use with different sizes of pressure vessels, changing of pressure vessels shall be possible without the use of special tools. Where the manufacturer claims the apparatus can be used with a different range of pressure vessels then the worst case(s) shall be identified and tested.

Apparatus fitted with more than one pressure vessel may be fitted with individual valves on each pressure vessel.

It shall not be possible simultaneously to fit two or more pressure vessels of different rated filling pressures to the same apparatus.

It shall not be possible to fit an apparatus which is designed to operate with a lower rated working pressure to a pressure vessel with a higher rated filling pressure.

The apparatus shall continue to function satisfactorily after being submerged in water. Before immersion and after removal from the water the apparatus shall meet the requirements of 6.21.

Note 2. The laboratory deems that the samples submitted satisfy the requirements of this Clause based on the results obtained from the tests performed in accordance with this Specification.

6.4 Materials

Pass³

All materials used in the construction shall have adequate resistance to deterioration by heat and adequate mechanical strength.

Exposed parts, i.e. those which may be subjected to impact during use of the apparatus shall not be made of aluminium, magnesium, titanium or their alloys.

Materials which come into direct contact with the wearer's skin shall not be known to be likely to cause irritation or any other adverse effect to health.

Note 3. The laboratory received information from the manufacturer pertaining to the suitability of material used by the manufacturer.

6.5 Cleaning and disinfecting

Pass

All material shall be visibly unimpaired after cleaning and disinfection by the agents and procedures specified by the manufacturer.

6.6 Mass

Pass⁴

The mass of the apparatus as ready for use with full face mask and fully charged pressure vessel(s) shall not exceed 18 kg.

Note 4. Refer to Annex A for data.

6.7 Connections

6.7.1 General

Pass

Components of the apparatus shall be readily separated for cleaning, examining and testing. All demountable connections shall be readily connected and secured, where possible by hand. Any means for sealing used shall be retained in position when the joints and couplings are disconnected during normal use and maintenance.

6.7.2 Couplings(if fitted)

Pass

The apparatus shall be constructed so that any twisting of the hoses and tubes does not affect the fit or performance of the apparatus, or cause the hoses and or tubes to become disconnected. The design of the couplings shall be such as to prevent unintentional interruption of the air supply.

6.7.3 Strength of connections to full face mask, demand valve and breathing hose (if fitted) **Pass⁵**

Connections of the breathing hose (if fitted) to the full face mask connector and to the demand valve or between the full face mask connector and the demand valve shall withstand a force of 250 N.

Note 5. Refer to Annex A for data.

6.7.4 Connection between apparatus and full face mask

Pass⁶

The connection between the apparatus and the full face mask may be achieved by a permanent, special or thread type connector. If a thread connector is used, either it shall comply with the requirements of one of the following two European Standards:

EN 148-1 for breathing apparatus without positive pressure;

EN 148-3 for breathing apparatus with positive pressure;

or, if any other thread type connector is used, it shall not be possible to connect it with the above mentioned threads.

The thread according to EN 148-2 shall not be used with the equipment covered by this European Standard.

If a thread connector in accordance with EN 148-3 is used then the requirements of Annex C shall be met, when tested in accordance with Annex C.

For standardised threads a thread gauge shall be used to check dimensions.

For all equipment connectors of the full face mask a pull test as described in 7.12.4.3 and 8.9 of EN 136:1998 shall be applied and no separation shall occur.

After temperature pre-conditioning in accordance with 6.24 and return to ambient temperature the connectors between apparatus and full face mask shall be examined and the performance requirements of the threads shall be satisfied.

Note 6. Refer to Annex A for data.

6.7.5 High, medium and low pressure connections

Pass

High, medium and low pressure connections shall not be interchangeable.

No interchangeable connections between high, medium and low pressure connections.

6.8 Full face mask

Pass

Type 1 self-contained open-circuit compressed air breathing apparatus shall have at least a full face mask class 2 according to EN 136:1998.

6.9 Body harness

Pass⁷

The body harness shall be designed to allow the user to don and doff the apparatus quickly and easily without assistance and shall be adjustable. All adjusting devices shall be so constructed that once adjusted they will not slip inadvertently.

The body harness shall be constructed such that when tested in practical performance tests the apparatus shall be worn without avoidable discomfort, the wearer shall show no undue sign of strain attributable to wearing the apparatus, and that the apparatus shall impede the wearer as little as possible when in a crouched position or when working in any space with restricted access or limited movement.

The body harness shall be considered satisfactory if during the practical performance test it does not slip and continues to hold the apparatus securely to the wearer's body throughout the duration of test.

Note 7. The lab deems the samples to have passed the practical performance test.

6.10 Practical performance

Pass⁸

The complete apparatus shall undergo practical performance tests under realistic conditions. These general tests serve the purpose of checking the apparatus for imperfections that cannot be determined by the tests described elsewhere in this European Standard.

If during any activity, by any test subject the test subject fails to finalise the selected activity due to the apparatus being not fit for the purpose for which it has been designed, the apparatus shall be deemed to have failed.

After completion of the activities the test subjects are asked to answer the questions in 6.6 of EN 13274-2:2001. These answers will be used by the test house to determine if the apparatus passes or fails.

The test house shall provide full details of those parts of the practical performance tests which revealed these imperfections.

Note 8. Refer to Annex A for data.

6.11 Resistance to temperature and flammability

6.11.1 Temperature performance

6.11.1.1 General

Pass

The apparatus shall operate trouble-free over the temperature range of -30 °C to 60 °C.

Apparatus specifically designed for temperatures beyond these limits shall be tested and the temperature(s) shall be marked on the apparatus.

6.11.1.2 General

Pass⁹

For breathing apparatus with positive pressure a positive pressure shall be maintained in the cavity of the mask adjacent to the face seal.

The components shall remain leak-tight, fulfil the breathing resistance requirements and the air supply shall not be interrupted after the test although they may be deformed.

Note 9. Refer to Annex A for data.

6.11.1.3 Breathing resistance at high temperatures

Pass¹⁰

For breathing apparatus with positive pressure a positive pressure shall be maintained in the cavity of the mask adjacent to the face seal.

The exhalation resistance shall not exceed 10 mbar.

Note 10. Refer to Annex A for data.

6.11.2 Flammability

6.11.2.1 Components

Pass¹¹

The material of the straps and buckles shall not burn or continue to burn for more than 5 s after removal from the flame.

The breathing hose(s) (leading to full face mask), medium pressure tube(s) and lung governed demand valve shall prove to be "self-extinguishing", i.e. the material shall not be of highly flammable nature and the parts shall not continue to burn for more than 5 s after removal from the flame.

The components shall remain leak-tight, fulfil the breathing resistance requirements and the air supply shall not be interrupted after the test although they may be deformed.

Note 11. Refer to Annex A for data.

6.12 Protection against particulate matter

Pass

The piece parts of the apparatus supplying compressed air shall be reliably protected against particulate matter that may be contained in the compressed air.

6.13 High and medium pressure parts

Pass

Metallic high pressure tubes, valves and couplings shall be tested to prove that they are capable of withstanding a pressure of 50 % above the maximum filling pressure of the pressure vessel without damage.

Non-metallic parts shall be tested to prove that they are capable of withstanding a pressure of twice the maximum filling pressure of the pressure vessel without damage.

All medium pressure parts downstream of the pressure reducer shall be capable of withstanding twice their maximum attainable working pressure without damage.

6.14 Pressure vessel(s)

Pass

The pressure vessel(s) shall be designed in accordance with national regulations.

Any pressure vessel outlet connection shall comply with EN 144-1.

6.15 Pressure valve(s)

Pass

The pressure vessel valve(s) shall comply with EN 144-1 and EN 144-2.

The inlet and outlet connections on the pressure vessel valve(s) shall comply with the requirements given in EN 144-1 for the thread connection for the inlet connection and EN 144-2 for the outlet connection.

The pressure vessel valve(s) shall be protected against blockage and transmission of particulate matter that may be contained in the compressed air.

The valve(s) shall be so designed that the valve spindle cannot be completely unscrewed from the assembly during normal operation.

The valve(s) shall be designed or so located that it cannot be closed inadvertently.

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6.16 Pressure reducer

6.16.1 Pressure valve(s)

Pass

If the apparatus is designed with a pressure reducer, any adjustable medium pressure stage shall be reliably secured against accidental alteration and adequately sealed so that any unauthorised adjustment can be detected.

A pressure reducer relief valve shall be provided if the down stream parts of the apparatus cannot withstand the full pressure vessel pressure.

6.16.2 Apparatus with a pressure reducer relief valve

Pass¹²

The pressure reducer relief valve shall be designed to pass an air flow of 400 l/min at a medium pressure not exceeding 30 bar.

With the pressure reducer relief valve activated the inhalation and exhalation breathing resistance shall not exceed 25 mbar.

Note 12. Refer to Annex A for data.

6.16.3 Apparatus without a pressure reducer relief valve

Pass

Where a pressure reducer relief valve is not provided the inhalation and exhalation breathing resistance shall not exceed 25 mbar.

6.17 Pressure indicator and tube

6.17.1 General

Pass¹³

The information given by the pressure indicator and the warning device (see 6.18.1) shall be complementary in every case.

The apparatus shall be equipped with a reliable pressure indicator which will read the pressure in the pressure vessel(s) on opening the valve(s) to ensure that the individual or equilibrated pressure is measured respectively.

The pressure indicator shall be positioned to enable the pressure to be read conveniently by the wearer.

The pressure indicator tube shall be sufficiently robust to withstand rough usage which it is likely to receive in service with respect to its classification. Where the tube is protected by a cover the enclosed space shall be vented to the atmosphere.

The pressure indicator shall be resistant to water and shall withstand immersion in water at a depth of 1 m for 24 h. After the test no water shall be visible in the device.

The pressure indicator shall have accuracy class 1.6 as defined in Clause 6 of EN 837-1:1996.

It shall be possible to read the gauge marking in poor light.

The design of the gauge shall enable the wearer to estimate the pressure to within 10 bar.

When pressure indicator and connecting hose are removed from the apparatus then the flow shall not exceed 25 l/min at 200 bar.

Note 13. Refer to Annex A for data.

6.17.2 Pressure indicator of the pointer type**Pass**

The pressure indicator shall be provided with a blow out release which protects the wearer against injuries.

The gauge window shall be made of a material being non-splintering when breaking.

6.18 Warning device**6.18.1 General****Pass¹⁴**

The information given by the warning device and the pressure indicator (see 6.17.1) shall be complementary in every case.

The apparatus shall have a suitable warning device that operates when the pressure vessel pressure drops to a predetermined level to warn the wearer.

The warning device shall either be activated automatically when the pressure vessel valve(s) is (are) opened or if manually activated it shall not be possible to use the apparatus before the device is activated.

The warning device shall activate at a pressure of (55 ± 5) bar or at such higher pressure as will ensure that at least 200 l of air remain within the pressure vessel.

If there is an audible warning device the sound pressure level shall be at least 90 dB(A) measured at the ear nearest to the device.

The signal may be continuous or intermittent. When activated, the duration of the warning at 90 dB(A) shall be at least 15 s for a continuous signal and 60 s for an intermittent signal and thereafter shall continue to sound down to 10 bar.

In case of an intermittent warning device the peak sound pressure level shall be at least 90 dB(A).

The frequency range shall be between 2 000 Hz and 4 000 Hz.

After response of the warning device the wearer shall be able to continue breathing without difficulty.

Note 14. Refer to Annex A for data.

6.18.2 Pneumatic warning device**Pass¹⁵**

The air loss that might be caused by the warning signal shall not exceed an average of 5 l/min from response of signal to a pressure of 10 bar.

The warning device shall continue to operate in a temperature range of 0 °C to 10 °C at a relative humidity of 90 %.

Note 15. Refer to Annex A for data.

6.19 Flexible hoses and tubes**6.19.1 Resistance to collapse of breathing hose****Pass¹⁶**

The air flow shall not be reduced by more than 10 % at the specified test air flow rate. There shall be no visible distortion 5 min after completion of the test.

Note 16. Refer to Annex A for data.

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6.19.2 Medium pressure connecting tube **Pass¹⁷**

Tubes to the demand valve (connections included) shall withstand for 15 min twice the operating pressure of the pressure reducer relief valve or at least 30 bar whichever is the higher.

Note 17. Refer to Annex A for data.

6.20 Lung governed demand valve**6.20.1 General** **Pass¹⁸**

The breathable air supply shall be sufficient for a sinusoidal flow of 40 x 2,5 l/min at all pressure vessel pressures above 20 bar and of 25 x 2 l/min at a pressure vessel pressure of 10 bar.

Note 18. Refer to Annex A for data.

6.20.3 Apparatus with positive pressure **Pass**

The lung governed demand valve for positive pressure apparatus shall be fitted with a manual or an automatic change-over switch.

6.21 Breathing resistance**6.21.1 Inhalation resistance****6.21.1.2 Apparatus with positive pressure** **Pass¹⁹**

The apparatus shall be designed such that positive pressure is maintained in the cavity of the mask adjacent to the face seal. The pressure shall be positive but not exceed 5 mbar.

At a sinusoidal flow of 40 x 2,5 l/min this requirement shall be met at all pressure vessel pressures above 20 bar and at a sinusoidal flow of 25 x 2 l/min the requirement shall be met down to a pressure vessel pressure of 10 bar.

Note 19. Refer to Annex A for data.

6.21.2 Exhalation resistance**6.21.2.3 Apparatus with positive pressure** **Pass²⁰**

The exhalation resistance shall not exceed 6 mbar at a continuous flow of 10l/min, 7 mbar at a sinusoidal flow of 25 x 2 l/min and 10 mbar at a sinusoidal flow of 40 x 2,5 l/min.

Note 20. Refer to Annex A for data.

6.22 Static pressure **Pass²¹**

For apparatus with positive pressure, the static pressure in the mask cavity under conditions of equilibrium shall not exceed 5 mbar.

Note 21. Refer to Annex A for data.

6.23 Leak-tightness**6.23.1 General** **Pass**

The assembled apparatus shall satisfy the following requirements for leak-tightness, at both low and high pressures. Any leakage of the full face mask (if fitted) at the dummy head is prevented by sealing the facepiece to the dummy head.

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6.23.2 Low pressure

Pass²²

The assembled apparatus without full face mask fitted shall be tested for leak-tightness at a negative and a positive pressure of 7,5 mbar. After the pressure has stabilised the pressure change shall not be greater than 0,3 mbar in 1 min.

Note 22. Refer to Annex A for data.

6.23.3 High pressure

6.23.3.2 Apparatus with positive pressure

Pass²³

When tested in accordance with 7.7.2, the pressure change shall not exceed 20 bar in 1 min.

Note 23. Refer to Annex A for data.

8 Marking

Pass²⁴

The apparatus shall be marked as follows:

8.1 The manufacturer, supplier or importer shall be identified by name, trademark, or other means of identification.

8.2 Manufacturers model designation.

8.3 The number and year of this European Standard and classification.

8.4 Serial number.

8.5 Year of manufacture or equivalent.

8.6 Where the apparatus meets temperature requirements outside those specified in 6.11.1.1 it shall be marked with the range.

8.7 Where the apparatus meets the requirements of 6.11.2.2 the full face mask shall be marked with "cl 3+".

8.8 Where the recommendations of Annex C have been adopted, the demand valve shall be marked with "A".

8.9 Where the reliable performance of piece parts may be affected by ageing, means of identifying the date (at least the year) of manufacture shall be given.

8.10 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified.

If sub-assemblies with considerable bearing on safety are too small to be marked, the information shall be given in the information supplied by the manufacturer.

8.11 The pressure reducer shall be durably marked with a serial number. The marking shall be such that the year of production can be ascertained. In addition, provision shall be made to mark the date (year and month) and test marks of the last testing performed.

8.12 The marking shall be as clearly visible and as durable as possible.

Note 24. Refer to Annex B for details.

9 Information supplied by the manufacturer**Pass²⁵**

9.1 On delivery information supplied by the manufacturer shall accompany every apparatus enabling trained and qualified persons to use it.

9.2 Information supplied by the manufacturer shall be in the official language(s) of the country of destination.

9.3 The information supplied by the manufacturer shall contain all information necessary for trained and qualified persons on:

- application/limitation;
 - checks prior to use;
 - donning and fitting;
 - use;
 - maintenance (preferably separately printed instructions, these shall include reference to relevant standards or for the periodic inspection and testing of the pressure vessels);
 - storage;
- of the equipment.

9.4 The information supplied by the manufacturer shall include that the air supply shall meet the requirements for breathable air according to EN 12021.

NOTE The figures given in EN 12021 are valid if measured at normal conditions (atmospheric pressure, room temperature).

9.5 The information supplied by the manufacturer shall be unambiguous.

NOTE If helpful, illustrations, part numbers, marking etc. may be added.

9.6 Any other information the manufacturer may wish to supply.

9.7 Information on spare parts (if appropriate).

9.8 Markings required by Clause 8 shall be explained.

9.9 To avoid undesirable effects associated with expansion of gases at different filling pressures, a warning shall be given that for devices using more than one valved pressure vessel each of those shall be filled to their rated filling pressure prior to use. This warning shall include the information that after the correct connection of those valved pressure vessels all shut-off valves shall be in the "OPEN" position prior to and during use.

Note 25. Refer to Annex B for details.

End of Test Results

Annex A: Summarization of Test Data**Ambient temperature at time of test: 22°C**

Clause	Result						Assessment
6.6	Mass of the whole respirator:10kg						Pass
6.7.3	No breaking of connections after tested with a force of 250N.						Pass
6.7.4	No separation occurred after a pull test of 500N to connectors of the full face mask.						Pass
6.10	Activity test	Sample No.	Subject 1	Subject 2	Subject 3	Subject 4	Pass
		1	Pass	Pass	Pass	Pass	
		2	Pass	Pass	Pass	Pass	
	Questionnaire test	Sample No.	Subject 1	Subject 2	Subject 3	Subject 4	
		1	Pass	Pass	Pass	Pass	
		2	Pass	Pass	Pass	Pass	
	Note: All subjects was able to finalise the selected activity, The test house deems the questionnaire to indicate the samples satisfy the requirements.						Pass
6.11.1.2	During the low temperature breathing test, the cavity of the mask adjacent to the face seal maintains a positive pressure.						Pass
	Exhalation resistance: 7.68 mbar						
6.11.1.3	During the high temperature breathing test, the cavity of the mask adjacent to the face seal maintains a positive pressure.						Pass
	Inhalation resistance: 4.87 mbar						
6.11.2.1	Burning behavior of straps		Continue to burn for 1 s				Pass
	Burning behavior of buckles		Continue to burn for 1 s				
	Burning behavior of breathing hose		Did not burn				
	Burning behavior of Medium pressure tube		Did not burn				
	Burning behavior of lung governed demand valve		Did not burn				
	Leak-tightness after flammability test		Leak-tight after flammability test				
	Breathing resistance after flammability test	Inhalation resistance	5.51 mbar				
		Exhalation resistance	2.10 mbar				
Interruption of air supply		No					
6.16.2	Air flow of pressure reducer relief valve		>400l/min				Pass
	Breathing resistance when pressure reducer relief valve is activated	Inhalation resistance	3.32 mbar				
		Exhalation resistance	5.08 mbar				
6.17.1	24h water immersion		No water in the pressure indicator after 24h water immersion				Pass
	Graduated range of pressure indicator		The pressure indicator is graduated from 0 up to 400bar Pressure vessel maximum filling pressure: 300bar Difference: 100bar				
	Accuracy class of pressure indicator		Accuracy class 1.6				
	Poor light readability		Back light illuminated				
	Air flow when pressure indicator is removed		14L/min				

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Clause	Result		Assessment
6.18.1	Automatic activation of the warning device	The warning device is automatically-activated	
	Activation pressure of warning device	54 bar	
	Sound pressure level	91 dB(A)	
	Signal of warning device	Continuous signal The duration of the warning signal above 90 dB(A)>16s	
	Frequency range of the warning device	2000-4000Hz	
	Breathing when warning device is activated	The wearer is able to continue breathing without difficulty	
6.18.2	Average air loss caused by the warning signal	4.2l/min	
	Temperature and humidity range	The warning device can continue to operate in a temperature range of 0 °C-10°C, 90% relative humidity.	
6.19.1	Air flow at collapsing test	Air flow reduction	
		0%	
	Distortion of breathing hose after collapsing test	No visible distortion	
6.19.2	Medium pressure connecting tube	The tubes could withstand a pressure of 30bar.	
6.20.1	Lung governed demand valve-general	Pressure vessel pressure>20bar	Sinusoidal flow of 40*2.5l/min ok
		Pressure vessel pressure at 10bar	Sinusoidal flow of 25*2l/min ok
6.21.1.2	Pressure in the cavity of the mask		Positive, <5mbar
	Pressure inside the mask at 40*2.5l/min sinusoidal flow		1.98mbar
	Pressure inside the mask at 25*2l/min sinusoidal flow		2.12mbar
6.21.2.3	Exhalation resistance at 10l/min continuous flow		3.71 mbar
	Exhalation resistance at 25*2l/min sinusoidal flow		5.21 mbar
	Exhalation resistance at 40*2.5l/min sinusoidal flow		5.68 mbar
6.22	Static pressure in the mask cavity		2.81mbar
6.23.2	Leak-tightness-low pressure	Pressure change at -7.5mbar	0.1mbar
		Pressure change at 7.5mbar	0.1mbar
6.23.3.2	Leak-tightness-high pressure		Pressure change in 1 min: 11bar

End of Report

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ANNEX B: Summarization of markings

Components/sub-assemblies	Part-marking	Date of manufacture
Pressure reducer	Yes	Yes
Lung demand valve	Yes	—
Lung demand valve diaphragm	Yes	Yes
Breathing hose (if fitted)	Yes	Yes
Inhalation valve disc (if fitted to the lung demand valve)	Information supplied in user manual	Information supplied in user manual
Exhalation valve disc (if fitted to the lung demand valve)	Information supplied in user manual	Information supplied in user manual
Full face mask	Yes	Yes
Carrying harness	—	—
Carrying frame	Yes	Yes
Pressure indicator	Yes	—
Medium pressure connecting tube	—	Yes
High pressure connecting tube	—	Yes
Warning device (if separate from other function parts)	Yes	—
Pressure vessel	Yes	Yes
Pressure vessel valve	Yes	Yes
Note: “—”: Not a necessary requirement in the standard.		

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