

JAPANESE INDUSTRIAL STANDARD

JIS T 7201-1990

Anesthetic machines

ERRATA

Page	Position	Wrong	Correct
9	3.13	Oxygen supply pressure alarm device	Oxygen supply alarm device
9	3.13.1	Alarm device	Oxygen supply pressure alarm device
11	Line 1, Remarks, 3.14.4	- 1000 Pa corresponds to - 9.8 cmH ₂ O, and 10000 Pa to 98 cmH ₂ O, ...	To be exact, - 980 Pa corresponds to - 10 cmH ₂ O, and 9800 Pa to 100 cmH ₂ O, ...
25	Fig. 6	"※" denotes the position to be corrected. Weight resistant junction 22 M Weight resistant junction 22 F Junction nut	
26	Fig. 7	Nipple Elastic tube B C	

Remarks: This errata is for correcting the first edition of this Standard.

Japanese Standards Association

JIS

JAPANESE INDUSTRIAL STANDARD

Anesthetic machines

JIS T 7201—1990

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

J I S

Anesthetic machines

T 7201-1990

1. Scope

This Japanese Industrial Standard specifies, of those inhalation anesthetic machines used mainly for the human body, continuous flow anesthetic machines and related parts, including vaporizers, breathing tubes, breathing bags, etc. Intermittent flow (demand type) anesthetic machines, breathing circuits for babies and newborns and parts exclusively for lung ventilators are excluded.

Remarks 1. Applicable Standards and Corresponding International Standards to this Standard are shown in Attached Table 1.

2. The units and numerical values given in { } in this Standard are based on the traditional units and are currently the criteria in force.

2. Definitions

For the purposes of this Standard, the following definitions apply.

- (1) continuous flow anesthetic machine A machine which supplies anesthetic gas as a continuous flow to a breathing circuit.
- (2) intermittent flow (demand type) anesthetic machine A machine which supplies anesthetic gas as an intermittent flow adapting to the inspiratory phase of the patient.
- (3) respiratory circuit During pulmonary ventilation, the passage of gas directly connected with the airway of patient in which gas flows intermittently or continuously, and is a hallow circuit into which mixed gas is supplied from outside.
- (4) circulation type circuit A breathing circuit so constructed that gas flow circulation is divided into expiration passage and inspiration passage by a uni-directional valve, or the like. Usually, along the circuit a carbonic acid gas absorption apparatus is attached.
- (5) carbonic acid gas absorption device A device which absorbs and removes carbon dioxide (carbonic acid gas) by filling a carbonic acid gas absorbent in the breathing circuit, and passing the gas flow through it. The vessel which is filled with the carbonic acid gas absorbent is called the carbonic acid gas absorption case (canister).
- (6) expiration circuit The part of the respiratory circuit with transports the expired gas from the opening connected to the patient to the breathing bag.
- (7) inspiration circuit The part of the respiratory circuit which transports the inspired gas from the breathing bag to the opening connected to the patient.

- (8) breathing tube (corrugated tube) A flexible tube with a large opening diameter used for transporting the gas or anesthetic agent vapor by connecting the anesthetic machine with the patient. There are many tubes of bellows state (this is called corrugated tube).
- (9) respiratory bag (respiratory activity) A bag capable of scavenging by pressing to feed a patient with stored gas for ventilation in the inside for a certain time.
- (10) neck of respiratory bag The part which connects the breathing bag with the connecting opening of the breathing bag.
- (11) vaporizer A device which changes volatile anesthetic agent from a liquid into vapor (gas).
- (12) external circuit vaporizer A device forming part of the anesthetic machine (body), or attached to a part, used for vaporizing the volatile anesthetic agent by passing the flow of medical gas. External circuit vaporizers generally have a concentration scale.
- (13) internal circuit vaporizer An anesthetic vaporizer inserted along the anesthetic breathing circuit, forming one of its parts. Internal circuit inside vaporizers are generally draw-over vaporizers, the scale does not indicate the calibrated concentration, and in many cases it is only the target.
- (14) vaporizing tank (vaporizing chamber) A chamber to change the volatile anesthetic agent from a liquid phase to a gaseous phase inside of the vaporizer.
- (15) flow-control valve A device to control the flow rate of gas (manual type).
- (16) oxygen flush A manually actuated valve mechanism to directly feed a relatively large flow rate of oxygen to the common gas outlet without passing it through the flowmeter or vaporizer.
- (17) common gas outlet The outlet where the newly regulated and mixed gas flows out from the anesthetic machine. It is fed into the breathing circuit therefrom.
- (18) gas outlet for power The outlet for gas used as the power source for a device attached to the anesthetic machine or other device.
- (19) fresh-gas supply tube The flexible tube connecting from the common gas outlet to the fresh-gas inlet opening of the breathing circuit.
- (20) common-gas-outlet connector The connecting device from the common gas outlet to the fresh gas supply tube.
- (21) connector A gas connecting device which connects two or more parts.
- (22) fresh gas inlet opening The opening which connects the inlet tube of fresh gas to the breathing circuit (fresh gas supply tube) with the breathing circuit.

- (23) adaptor A connector which functionally connects parts not connected directly.
- (24) APL valve (pop-off valve, adjustable pressure limiting valve) A valve which prevents the pressure inside the circuit from increasing above a preset pressure by releasing gas to the outside of the circuit if the pressure inside the breathing circuit exceeds the preset level.
- (25) AGSS (anesthetic gas scavenging system) A gas passage system for collecting and disposing to the outside expired and anesthetic gas from the respiratory circuit.
- (26) DISS (diameter index safety system) A system for connecting different types of gas arranged by male and female connectors of different diameters.
- (27) NIST (non-interchangeable screw threaded) system A system connecting different types of gas by changing the diameter of the male and female connectors for each type of gas and also by changing direction of the screw threads.
- (28) internal circuit pressure gauge A pressure gauge which indicates the gas pressure (relative to atmospheric pressure) inside the respiratory circuit.
- (29) pressure regulator A device which lowers the high original pressure to the required stabilized pressure.
- (30) hose connector A connector which receives the medical gas from the medical gas piping equipment or high pressure vessel with an attached pressure regulator.
- (31) vessel connector A connector which receives medical gas from a high pressure gas vessel.
- (32) rated supply pressure The gas supply pressure to the piping in the anesthetic machine of each type of medical gas supplied from the medical gas piping equipment through the hose connector connected to the anesthetic machine of a gas pressure suitable to the design between a minimum of 294.2 kPa { 3 kgf/cm² } and a maximum of 490 kPa { 5 kgf/cm² }. For anesthetic machines without a hose connector, this refers to the gas supply pressure in the piping directly after the pressure regulator connected directly to the vessel connector.
- (33) compliance The change in the quantity of gas entering the vessel divided by the change in the gas pressure, expressed in ml/kPa { ml/cmH₂O }.
- (34) gas mixer A device capable of being adjusted to gas concentration within the design range of the mixed gas generated by the suitable mixing of multiple medical gases, including oxygen.

- (35) flowmeter or flow-rate indicator A device which measures and indicates the type of each medical gas or the flow of the mixed gas per unit time. In many cases, the gas flow rate which floats in opposition to gravity above a float in a transparent tube composed of taper tube is read by the height of the float.
- (36) Y piece A tube connector with three openings, which connects the inspiration and expiration circuits, with the other opening connecting with the patient.
- (37) one-way valve A valve which restricts gas flow to a specific direction.
- (38) expiration valve A one-way valve which actuates to allow the expiration from the patient to pass through the opening to the expiratory phase.
- (39) inspiration valve A one-way valve which actuates to allow the inspiration to the patient to pass through the opening to the inspiration phase.
- (40) Non-rebreathing valve A valve which actuates to prevent inspiration of expired air. A valve mechanism in which the expiration valve and inspiration valve functions are usually assembled in one unit.
- (41) check valve A valve capable of allowing gas to flow in only one direction, and which prevents the flow of gas in the other direction.
- (42) piping in an anesthetic machine The gas piping in an anesthetic machine from the check valve of hose connector or vessel connectors to the common gas outlet. This piping includes the piping connectors for connecting to the oxygen supply pressure alarm, the pressure gauge, the oxygen flush, etc.

3. Performance

3.1 Operational parts and instruments The operational parts and instruments of anesthetic machines shall be visible by normal (rectified) vision ⁽¹⁾ from the front of the anesthetic machine from a distance of 1 m under 215 lx (lux).

The indicator and scale of the instruments shall be simple clear, and the connection association with the operational parts shall be easily confirmed.

Note ⁽¹⁾ Normal (rectified) vision in this Standard means that the naked eye or lens, when suitably rectified, shall have a visibility with both eyes of 1.0 or more.

3.2 Electrical mechanism If the anesthetic machine has an electrical mechanism, it shall comply with the specifications of JIS T 1001. Anesthetic machines with built-in monitor or alarm should be so constructed that, all are actuated when one main switch is turned on. All gas supply should be, controllable simultaneously by the actuation of the main switch, in which case the power source of the accessory oxygen concentration gauge must be controllable simultaneously.

3.3 Vessel connector (Refer to 4.3)

3.3.1 Filter The vessel connector to a high pressure gas vessel shall be provided with a dust-removing filter before the pressure regulator with fine pores of not more than 100 μm .

3.3.2 Check valve The check valve, when subjected to the test specified in 5.1, shall be free from clear gas leak to the inside of the room through another vessel connector.

3.4 Hose connector (Refer to 4.4)

3.4.1 Check valve The check valve, when subjected to the test specified in 5.2, shall be free from clear gas leak from a hose connector (anesthetic machine body side) not connected with the hose.

3.5 Pressure gauge or pressure indicator (Refer to 4.5)

3.5.1 Maximum scale value of a pressure gauge or pressure indicator for high pressure vessels The maximum scale value of a Bourdon tube pressure gauge or pressure indicator shall be not less than $4/3$ of the maximum filling pressure of the high pressure gas vessel with the gas at $20 \pm 3^\circ\text{C}$.

3.5.2 Maximum scale value of a pressure gauge or pressure indicator for supply gas from medical gas piping equipment or for reduced pressure gas from a high pressure gas vessel The maximum scale value of a Bourdon tube pressure gauge or pressure indicator shall be so graduated that it is capable of being read up to at least $4/3$ of the rated maximum supply pressure of the anesthetic machine concerned. The scale shall indicate clearly 100 kPa {kgf/cm²} units.

3.5.3 Indicating error The tolerance of the indicating error of a pressure gauge or pressure indicator and the indicating error at the time of pressure increase shall be Grade 3.0 as specified in JIS B 7505 or an accuracy equivalent or superior thereto.

3.5.4 Scale A scale of round type Bourdon tube pressure gauge equipped to anesthetic machines shall be as follows:

- (1) The span angle from the minimum scale value to the maximum scale value shall be 180 to 300°, and each pressure gauge shall be aligned to a span angle of $\pm 10^\circ$.
- (2) The minimum scale value of each instrument shall be positioned to align at the same part between the 6:00 and 9:00 positions on the dial.
- (3) The length of the span shall be not less than 50 mm.
- (4) The diameter of the scale plate shall be not less than 38 mm.

3.5.5 Safety device Safety devices shall be as follows:

- (1) Bourdon tube pressure gauges shall be so constructed that, with the pressure sensitive part detached, application of a pressure equal to the maximum scale value will not cause the inside parts to fly outside of the case.

For safety, a throttling device may be provided at the gas inlet passage. However, vent holes must be provided on the back of the pressure gauge case in order to prevent a rise in internal pressure.

- (2) The vent holes for preventing the rise in internal pressure may be provided with a lid. However, the lid, except when so constructed that it will not detach from the case, shall be such that it will not detach easily when the internal case pressure rises, and shall use an elastic material posing little danger to man.

3.6 Pressure regulator (Hereafter referred to as the "regulator".) (Refer to 4.6)

3.6.1 Variation in flow rate and fluctuation of rated supply pressure
When operating one flow rate adjusting valve, the gas flow rates passing through other flow rate adjusting valves shall be free from fluctuation exceeding the flow rate scale value $\pm 10\%$ or ± 30 ml/min, whichever is larger. The fluctuation in supply pressure after reducing the flow rate from 10 l/min to the minimum scale value of the flowmeter shall be less than 10 % of the initial value.

3.6.2 Variation in supply pressure due to original-pressure variation of the high pressure gas vessel The fluctuation of supply pressure relative to the variation of the original pressure 98 kPa {1 kgf/cm²} shall be less than 0.69 kPa {0.007 kgf/cm²}.

3.6.3 Variation in supply pressure due to oxygen flush At the time of operation of oxygen flush, the gas flow rate passing through the oxygen-flow rate adjusting valve, when subjected to the test specified in 5.3, shall return to the flow rate of 2 ± 0.1 l/min within 2 s after stopping the flush each time.

3.6.4 Safety device The regulator shall be provided with the safety device specified in the following:

- (1) When the supply pressure has risen and exceeded the rated value, the safety device shall actuate at less than double the pressure.
- (2) Even if the regulator has failed, if the original pressure exceeds 150 % of the rated pressure maximum value, the supply pressure of the regulator shall not exceed three times the rated supply pressure.
- (3) If two or more regulators are assembled in series with the same type of gas, the safety device shall be attached to the first regulator.

- (4) If a regulator has an attached diaphragm which will burst under excessive pressure, the diaphragm shall burst between 3 to 6 times the rated supply pressure. This type of regulator must have such sufficient rigidity that when the diaphragm bursts, the body will be safely maintained.

3.7 Anesthetic machine inside piping (Hereafter referred to as the "piping".) (Refer to 4.7)

3.7.1 Strength of piping The piping shall be sufficiently durable so as not to burst until at least two times the maximum using (design) pressure at the respective locations.

3.7.2 Airtightness The maximum permissible gas leakage from piping, when subjected to the tests specified in (1) and (2) of 5.4, shall be as follows:

- (1) At the rated supply pressure, the gas leakage at the distance from the vessel connector and hose connector to the flow rate adjusting valve, when subjected to the test specified in 5.4 (1), shall not exceed 25 ml/min. Cases where the exhaust (vent) of oxygen or air from the fluid controller and the gas pressure actuating device are part of a mechanism are excepted.
- (2) The leakage from the piping between the flow rate adjusting valve and the gas common outlet and from parts for each type of gas attached thereto, when subjected to the test specified in 5.4 (2), shall not exceed 50 ml/min under the pressure of 3 kPa {30 cmH₂O} for each type gas. This applies even if an external circuit vaporizer is attached and turned on or off or when a vaporizer which can easily be detached daily is detached.

3.7.3 Draft resistance of piping The piping from the hose connector and the outlet of the pressure regulator to the flow rate adjusting valve, when subjected to a test similar to 5.3 at the rated minimum supply pressure and at the maximum value of the scale of each flowmeter, shall be capable of controlling to ± 0.5 l/min of the original flow rate.

3.7.4 Materials The piping shall be constructed of material sufficiently durable when used with each type of gas and agent used with the anesthetic machine.

3.8 Flow rate adjusting valve (Refer to 4.8)

3.8.1 Airtightness of the flow rate adjusting valve (Type test) The flow rate adjusting valve, when subjected to the test specified in 5.5, shall not generate leakage of 5 ml/min or more at $20 \pm 3^\circ\text{C}$ and a standard atmospheric pressure of 101.3 kPa {1013 mbar}.

3.8.2 Safety of the flow rate adjusting valve Where the inlet pressure and the outlet pressure are constant and the peripheral temperature is constant the fluctuation width, when adjusted to an arbitrary flow rate and maintained for 10 min, shall be within ± 10 % of the scale value or ± 30 ml/min, whichever is larger.

Even when the flow rate adjusting valve is pushed or pulled by a force of 10 ± 2 N { 1 ± 0.2 kgf} in the axial direction, the fluctuation width shall remain in this range.

3.8.3 Adjustability of the flow rate adjusting valve When the inlet pressure to the flow rate adjusting valve in piping in an anesthetic machine shall be not less than 294.2 kPa { 3 kgf/cm² }, the rotary type adjusting valve shall be revolved at least 180° to adjust to 90 % of the maximum scale of the flowmeter.

3.8.4 Gas leakage of the flow rate adjusting valve and piping in upstream anesthetic machines With the adjusting valve closed, the leakage at the circumference and downstream (soap water test), at the design pressure at the inlet of the flow rate adjusting valve of the piping in anesthetic machines, when subjected to the test specified in 5.4 (1), shall be within the specification of 3.7.2 (1).

3.9 Flowmeter (Refer to 4.9)

3.9.1 Accuracy of the flowmeter The error range of the indication of the flowmeter, when subjected to the test specified in 5.6, and when calculated for the corresponding scales according to the following formula, shall be ± 10 % of the scale indicating value. If the error range of the part corresponding to 1/10 of the maximum scale value is not ± 10 %, the accuracy shall be noted on the instruction manual.

$$E = \frac{F - S}{S} \times 100$$

where, E : error of flowmeter indication (%)

F : reading of flowmeter to be tested

S : reading of reference flowmeter

3.9.2 Low oxygen prevention device At the time of using oxygen and nitrogen monoxide, the mechanism should ensure that the oxygen concentration in the mixed gas does not become less than 25 % (V/V). This mechanism shall be assembled between the flow rate adjusting valves of oxygen and nitrogen monoxide, or between the flowmeters (Refer to 4.10.2).

3.10 Gas mixer (Refer to 4.10)

3.10.1 Accuracy of the gas mixer At the maximum and minimum flow rate scales of the mixer, the oxygen concentration % (V/V) in the mixed gas shall be ± 5 % (V/V) of each indicating value.

3.10.2 Flow rate adjusting valve and flowmeter of gas mixer The performance of the mixer shall comply with the specifications of 3.7.2 and 3.8.1.

If there is a flowmeter attached for each gas, it shall comply with the specification of 3.9.1.

3.11 Vaporizer (Refer to 4.11)

3.11.1 External circuit vaporizer (Refer to 4.12) External circuit vaporizers shall be as follows:

- (1) If the medical liquid is filled up to the highest liquid surface level of the vaporizer and attached to the anesthetic machine, whether the vaporizer is on or off even with an overall gas flow rate of up to 20 l/min, and whether the oxygen flush is on or off, the medical liquid does not flow out from the vaporizer.

- (2) Accuracy of the vaporizer When gas is fed under normal use conditions with all graduations aligned to other than 0 of off or the same mechanism as off, the permissible range of concentration of anesthetic agent vapor at the outlet of the vaporizer, when subjected to the test specified in 5.7.1, shall be within $\pm 20\%$ of the scale value used or $\pm 5\%$ of the maximum scale value, whichever is larger.
- (3) Vaporizer off or 0 scale With off or 0 scale of a similar mechanism to off, when subjected to the test specified in 5.7.1, anesthetic agent vapor of greater than 0.1% (V/V) shall not go out. If there is a 0 scale in addition to off (2) applies.

Remarks: There are external circuit vaporizers which raise the scale with making at 0 from off and those in which the 0 scale is equal to off and directly from which starts the minimum effective scale. In the former, between off and 0, and in the latter between 0 and the minimum effective scale, the off/on switch occurs, and therefore the concentration is not guaranteed.

- (4) Degree of stability by back pressure of the vaporizer The concentration of the volatile anesthetic agent vapor in gas passing through the vaporizer, when subjected to the back pressure test according to 5.7.2, shall not exceed $+30$ to -20% of the scale indicating value of the vaporizer or $+7.5$ to -5% of the maximum scale value, whichever is larger.

3.11.2 Internal circuit vaporizer (Refer to 4.13) When subjected to the test specified in 5.7.2 at the closed position of the internal circuit vaporizer, anesthetic agent vapor of a concentration exceeding 0.1% (V/V) shall not go out.

3.12 Common gas outlet (Refer to 4.14)

3.12.1 Strength of the conical junction If on its axis a bending power factor (moment of power) of 3 Nm $\{0.3\text{ kgfm}\}$ and around the axis a rotary torque of 3 Nm $\{0.3\text{ kgfm}\}$ are applied at the same time, there shall be no permanent elongation at the mount of the common gas outlet.

3.12.2 Strength of the weight resistant junction If on its axis a bending factor of 10 Nm $\{1\text{ kgfm}\}$ and around the axis a rotary torque of 24 Nm $\{2.4\text{ kgfm}\}$ are applied at the same time, there shall be no permanent elongation on the mount of the common gas outlet (Refer to Fig. 6).

3.13 Oxygen supply pressure alarm device

3.13.1 Alarm device The alarm device shall be as follows:

- (1) Anesthetic machines shall be provided with an audio alarm system to indicate incomplete oxygen supply. At the same time, a visible alarm may be provided.
- (2) The audio alarm system, at a background white noise of 55 dB (A), shall generate sound with a pressure difference of not less than 2 dB (A) for 7 s or more.

- (3) Medical gas or electricity can be used as the power source to actuate the audio alarm system. However, it must satisfy the specifications of (4), (5) and (8).
- (4) The alarm shall actuate when the oxygen supply pressure drops to the level instructed by the manufacturer (if there is no special instruction, it shall be 150 kPa {1.5 kgf/cm²}).
- (5) It shall not be of such structure that before the oxygen supply pressure returns to the alarm starting point, it is capable of stopping the alarm or of resetting the alarm.
- (6) If medical gas is to be used as the power source, it shall depend only upon the rated oxygen supply pressure of the piping from the bomb attached to the anesthetic machine or the hose connector to the oxygen flowmeter.

If a commercial power source is used as the power source, a battery power source shall be provided to ensure activation even during a power suspension (if the commercial power source is cut, it shall also generate a red color lamp and an emergency audio alarm).

- (7) The visible alarm of (1) shall actuate as a red signal or red color lamp, and shall be set at a position clearly visible by the operator during use of the anesthetic machine under ordinary conditions.
- (8) A label describing type of alarm device shall be provided on the anesthetic machine, in a clear and indelible method.

3.13.2 Gas-isolation safety device The gas-isolation safety device shall be as follows:

- (1) Anesthetic machines shall be provided with another gas-isolation safety device for incomplete oxygen supply.
- (2) The safety device when the oxygen supply pressure has dropped to the other level instructed by the manufacture, lower than that specified in 3.13.1 (4), shall actuate and perform either of the following functions (a) or (b).
 - (a) Stop the supply of all gases other than oxygen from reaching the common gas outlet. However, with anesthetic machines with piping of air, it may be capable of reopening the supply of air.
 - (b) While gradually stopping the flow rate of the gases other than oxygen, it shall be capable of maintaining the flow rate or concentration of oxygen at the preset level until the gases other than oxygen stops (with anesthetic machines with piping for air, it may be so made that it is able to be utilized by reopening the supply of air).
- (3) Its structure shall be such that if the oxygen supply pressure does not recover to the pressure specified in 3.13.2 (2), releasing of the isolation safety device is impossible.

3.13.3 Oxygen densitometer The oxygen densitometer shall be as follows:

- (1) Anesthetic machines shall be provided with an oxygen densitometer in order to continuously measure the oxygen concentration in the inspiration circuit.
- (2) The oxygen densitometer shall be in accordance with JIS T 7203. It shall at least be provided with an audio-minimum concentration alarm.

3.14 Respiratory circuit (Refer to 4.17)

3.14.1 The leakage of whole body of breathing circuit, when subjected to the test specified in 5.8.1, shall not exceed 175 ml/min.

3.14.2 The expiratory draft resistance of the breathing circuit, when subjected to the test specified in 5.8.2 shall not exceed 0.6 kPa {6 cmH₂O}.

3.14.3 The inspiratory draft resistance of the breathing circuit, when subjected to the test specified in 5.8.3, shall not exceed - 0.6 kPa {- 6 cmH₂O}.

3.14.4 The breathing circuit shall be provided with a circuit inside pressure gauge with a scale indicated in 100 Pa {cmH₂O}, graduated at least in the range of - 10 × 100 Pa {- 10 cmH₂O} to 60 × 100 Pa {60 cmH₂O}. If required, the 0 point can be regulated, and the reading shall not exceed the error range of ± (the sum of 2 % of the full scale and 4 % of the read-out value).

Remarks: - 1000 Pa corresponds to - 9.8 cmH₂O, and 10000 Pa to 98 cmH₂O, but as usually the scales of both the units are indicated in duplication, these are correctly graduated in the ranges of - 1 kPa to 10 kPa and - 10 cmH₂O to 100 cmH₂O.

3.14.5 The draft resistance and reverse flow of the APL valve shall be as follows:

- (1) The draft resistance of the APL valve, when subjected to the test specified in 5.8.4, at the time of full opening, at the flow rate of 3.0 l/min, shall be 0.05 kPa {0.5 cmH₂O} to 0.3 kPa {3 cmH₂O}, and at the flow rate of 30 l/min, 0.1 kPa {1 cmH₂O} to 0.5 kPa {5 cmH₂O}.
- (2) The reverse flow of the APL valve attached with a scavenging device of anesthetic gas, when subjected to the test specified in 5.8.6, shall not exceed 60 ml/min.

3.14.6 The breathing circuit may be provided with a safety valve which fully opens automatically at the internal pressure of 5 kPa {50 cmH₂O}, in addition to the APL valve.

3.14.7 The draft resistances of the inspiration valve and expiration valve, when subjected to the respective test specified in 5.8.5 (2), shall not exceed 0.15 kPa {1.5 cmH₂O}.

When subjected to the test specified in 5.8.5 (3), the opening valve pressure shall not exceed 0.12 kPa {1.2 cmH₂O}.

3.14.8 The reverse flows of the inspiration valve and the expiration valve, when subjected to the respective test specified in 5.8.6, shall not exceed 5 min for rising to 0.5 kPa {5 cmH₂O} at 60 ml/min, and the valves shall not drop from the valve seat.

3.15 Breathing tube

3.15.1 shape The shape of the breathing tube shall be as follows:

- (1) Both end opening parts of the breathing tube shall be cylindrical or in such shape as to be suitable for the junction of the cone. Usually, the opening parts should be of such material quality and shape to fit both.
- (2) If cylinder, it shall be able to be joined securely to the nominal 22 mm cone junction.
- (3) If a conical opening part, it shall be suitable for the 15 mm cone junction specified in Fig. 1 or for the 22 mm cone junction specified in Fig. 2.

For single use breathing tubes integrated with a Y piece, the patient end of the Y piece shall be a 22 mm/15 mm male/female coaxial cone junction.

Fig. 1. 15 mm Cone junction
[Abbreviation: 15 M (male) T and 15 F (female)]

Unit: mm

