

JIS

JAPANESE INDUSTRIAL STANDARD

**Test methods of gas burning
appliances for domestic use**

JIS S 2093—1991

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

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JAPANESE INDUSTRIAL STANDARD

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Test methods of gas burning appliances
for domestic use

S 2093-1991

1. Scope

This Japanese Industrial Standard specifies the common test methods of gas burning appliances⁽²⁾ (hereafter referred to as appliance) for general domestic use, to use the liquefied petroleum gas or city gas⁽¹⁾ (hereafter referred to as gas) as the fuel.

Further, in the case where particularly specified in Japanese Industrial Standard classified by appliances (hereafter referred to as JIS), the specification applies.

Notes ⁽¹⁾ The liquefied petroleum gas means the gas described in "Standard of liquefied petroleum gas" of enforcement regulations (1968, Ordinance of Ministry of International Trade and Industry No. 14) based on the Law Concerning the Securing of Safety and the equity measure of Transaction of Liquefied Petroleum Gas (1967, Law No. 149).

The city gas means the gas of gas group described in 1971, (Ordinance of Ministry of International Trade and Industry No. 27) Ordinance concerning the verification of gas using products and the like based on the Gas Utility Industry Law (1954, Law No. 51).

⁽²⁾ In this Standard, the appliances are divided according to setting system and indoor appliance by vent and air-intake system as given in Attached Tables 2 and 3.

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

2. In this Standard the units and numerical values shown in { } are in accordance with the traditional units and are currently the criteria in force.

Further, as from January 1, 1995, the International System of Units (SI) applies and the traditional units and numeral values are appended for informative reference.

3. The pressures in this Standard other than those indicated as atmospheric pressure are all gauge pressures.

2. Test conditions

2.1 Conditions of test room The conditions of test room, unless particularly specified in each clause of this Standard or JIS classified by appliance, shall be in accordance with Table 1. However, according to the test item, in the case where it does not affect the test results, it may not be in accordance with this.

Table 1. Conditions of test room

Temperature of test room or the like	Conditions
Temperature of test room ⁽³⁾	The temperature of test room is "ordinary temperature" (standard temperature condition grade 15:20 + 15°C) specified in Table 1 of JIS Z 8703, and the fluctuation of temperature during test is to be ± 5 K.
Humidity of test room	The humidity of test room is to be "ordinary humidity" [standard humidity condition grade 20: (65 $\pm$ 20) %] specified in Table 2 of JIS Z 8703.
Atmosphere in room	The atmosphere in the room is not contained with carbon dioxide of not less than 0.2 % and carbon monoxide of not less than 0.002 %. Further, there must be no air current to affect gas-burning.

Note ⁽³⁾ For measurement of temperature in test room, as a rule, fix the mercury bulb of thermometer at approximately same height as the upper surface of appliance at the place apart approximately 1 m from appliance (if the height exceeds 1.5 m from the floor surface, it is to be 1.5 m in height from the floor surface.), measure at four points such as front, rear, right and left, and take the arithmetic mean as room temperature. However, make so as the mercury bulb of thermometer not to be directly affected by burning gas, radiated heat, etc. from the appliance.

2.2 Setting and using conditions of appliance The setting and using conditions of appliance, unless particularly specified in each clause of this Standard or in JIS classified by appliance, shall be the condition instructed by the manufacturer (the condition indicated in instructions or the like), and as for that to be used under air conditioning, the adjustment of air-conditioner shall be made to the respective test item at an adequate degree, and vent pipe for forced vent system's appliance and vent and air-intake pipe for forced vent and air-intake system's appliance shall be installed in the minimum length.

However, according to the test item, in the case where it does not affect the test results, it may not be in accordance with this.

2.3 Conditions of power source Conditions of power source, unless particularly specified in each clause of this Standard, shall be as follows. However, according to the test item, in the case where it does not affect the test results, it may not be in accordance with this.

- (1) Appliance using power source for domestic use The appliance using power source for domestic use is to be carried out applying the rated voltage of rated frequency.
- (2) Appliance using dry cell The appliance using dry cell is to be carried out by using the specified dry cell in the instructions and the like.

3. Test gas3.1 Test gas(1) In the case of appliance for liquefied petroleum gas

- (a) Propane: The component of propane (C_3H_8) is not less than 95 % in volume ratio.
- (b) Butane: The sum of components of n-butane (C_4H_{10}) and i-butane (C_4H_{10}) is not less than 95 % in volume ratio.

(2) In the case of appliance for city gas The test gas shall be of the same gas group's name as applied gas group's name marked in the nameplate of appliance (Refer to Attached Table 4).

3.2 Expression method of test gas conditions The test gas conditions to be used for this Standard and JIS classified by appliance shall be expressed with the kind and pressure of test gas, and in the case of appliance for liquefied petroleum gas, Table 2 is applied, and in the case of appliance for city gas, Table 3 applied (Refer to Attached Table 4).

Further, the test gas conditions in each clause of this Standard and in JIS classified by appliance shall be expressed by "symbol of kind of test gas - symbol of pressure of test gas".

Table 2. In the case of use for liquefied petroleum gas

(1) <u>Kind of test gas</u>		(2) <u>Pressure of test gas</u>	
		Unit: kPa{mmH ₂ O}	
Symbol	Kind of test gas	Symbol	Pressure of test gas
P	Propane	1 (Maximum pressure)	3.24 {330}
B	Butane	2 (Stand pressure)	2.75 {280}
S	Gas of either propane, butane or mixed gas of these	3 (Minimum pressure)	1.96 {200}

Table 3. In the case of city gas

(1) Kind of test gas

Symbol	Kind of test gas
0	Gas in the range of gas group
1	Gas likely to be in incomplete combustion
2	Gas likely to be in back fire
3	Gas likely to get blow off of flame
E	Gas to test the performance
S	Gas either 0, 1, 2, 3 or E

Table 3. (Continued)

(2) Pressure of test gasUnit: kPa { mmH₂O }

Symbol	Gas group to be applied		
	13A, 12A	6A	5A, 5AN, 4A 6B, 5B, 4B 7C, 6C, 5C, 4C
1 (Maximum pressure)	2.45 {250}	2.16 {220}	1.96 {200}
2 (Standard pressure)	1.96 {200}	1.47 {150}	0.981 {100}
3 (Minimum pressure)	0.981 {100}	0.686 {70}	0.490 {50}

Remarks: The pressure of test gas to be used for burning condition test of burner having device governor shall be as follows:

- (1) The pressure of test gas corresponding to symbol 1, shall be in the range 1 to 3 of symbols of test gas pressure shown in Table 2 for liquefied petroleum gas and in Table 3 for city gas, and shall be the highest in regulating pressure.
- (2) The pressure of test gas corresponding to symbol 3, shall be in the range 1 to 3 of symbols of test gas pressure shown in Table 2 for liquefied petroleum gas and in Table 3 for city gas, and shall be the lowest in regulating pressures.

3.3 Conditions of test gas The conditions of test gas, unless particularly specified in each clause of this Standard or JIS classified by appliance shall be "S-2". However, in the case where according to items of test, the influence is not caused on test results, it may not be in accordance with this.

4. Test device and test apparatus

4.1 Test device For the test device, that indicated in Attached Table 5 or that equivalent thereto shall be used.

4.2 Test apparatus For the test apparatus, that indicated in Attached Table 6 or that equivalent thereto shall be used.

5. Kind of tests

The kind of test shall be as given in Table 4.

Further, the application of test indicated in Table 4 is specified in JIS S 2092 and JIS classified by appliance.

Table 4. Kind of tests

Test	Number of table	Informative reference (relating Fig. No.)
Gas-Consumption test	Table 5	Fig. 1
Gas-tightness test of gas passage	Table 6	
Burning condition test under still air	Table 7	
Noise test	Table 9	Fig. 2
Temperature-rise test	Table 10	Fig. 3
Electric-ignition performance test	Table 11	
Performance test of flame failure safety apparatus and overheat preventive apparatus	Table 12	
Duty-cycle operation test	Table 13	
Heat resistance test of function parts	Table 14	
Structure test	Table 16	
Material test	Table 17	Fig. 4, Fig. 5, Fig. 6, Fig. 7
Electric relation test	Table 18	Fig. 8
Gas tightness test of gas tight construction part	Table 22	Fig. 9
Open type appliance test	Table 23	
Natural exhaust type (CF) appliance test	Table 24	Fig. 10, Fig. 11
Forced exhaust type (FE) appliance test	Table 25	Fig. 12
Balance outer wall type (BF-W) appliance test	Table 26	Fig. 13, Fig. 14, Fig. 15, Fig. 16
Balance chamber type (BF-C) appliance test	Table 28	Fig. 16, Fig. 17, Fig. 18, Fig. 19
Balance-duct type (BF-D) appliance test	Table 30	Fig. 16, Fig. 20, Fig. 21, Fig. 22
Forced vent and air intake type (FF) appliance test	Table 33	Fig. 13, Fig. 15, Fig. 23, Fig. 24
Out-door type (RF) appliance test	Table 35	Fig. 25, Fig. 26

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6. Gas-consumption test

The gas-consumption test shall be in accordance with Table 5.

Table 5. Gas consumption test

Item	Condition of appliance, test conditions and test method
1. Measurement of gas consumption	
(1) Condition of appliance	As for the appliance condition, the test appliance is connected as indicated in Fig. 1, and the appliance is under the condition specified in JIS classified by appliance by igniting the burner to be measured. Further, make the device plug, gas-quantity-regulator, etc. under the using condition at the maximum consumption of gas quantity.
(2) Test conditions	The test gas condition shall be P-2 in the case of appliance for liquefied petroleum gas and E-2 in the case of that for city gas (coincide the gas pressure of water-column meter (2) in Fig. 1 with the test-standard pressure).
(3) Test method	When the gas consumption has become nearly constant after igniting, start the measurement. One measurement shall be composed of the revolution of gas meter (integer revolution not less than one revolution), and the duration not less than 1 min. Carry out this measurement several times, obtain the actually measured gas quantity (V_a) from the value when the difference of values measured continuously has become not more than 2 %, and calculate the gas consumption under the temperature of 20°C, gas standard pressure, atmospheric pressure of 101.3 kPa {760 mmHg}, and dry condition according to the following formulae: $I_s(\text{kW}) = \frac{1}{3.6} \times W I_s \times \sqrt{d_a} \times V_a \times \frac{273}{293} \times \frac{101.3 + P_s}{101.3} \times \frac{B - P_m}{B + P_i}$ $\times \sqrt{\frac{293}{273 + t} \times \frac{B + P_m - \left(1 - \frac{0.622}{d_a}\right) S}{101.3 + P_s}}$

Table 5. (Continued)

Item	Condition of appliance, test conditions and test method
(3) Test method	$I_s(\text{MJ/h}) = W I_s \times \sqrt{d_a} \times V_a \times \frac{273}{293} \times \frac{101.3 + P_s}{101.3} \times \frac{B + P_m}{B + P_i}$ $\times \sqrt{\frac{293}{273 + t} \times \frac{B + P_m - \left(1 - \frac{0.622}{d_a}\right) S}{101.3 + P_s}}$ $\left\{ \begin{aligned} I_s(\text{kg/h}) &= 2.17 \times \sqrt{\frac{d_a}{1.68}} \times V_a \times \frac{273}{293} \times \frac{760 + \frac{P_s}{13.6}}{760} \\ &\times \frac{B + \frac{P_m}{13.6}}{B + \frac{P_i}{13.6}} \times \sqrt{\frac{293}{273 + t} \times \frac{B + \frac{P_m}{13.6} - \left(1 - \frac{0.622}{d_a}\right) S}{760 + \frac{P_s}{13.6}}} \end{aligned} \right\}$ $\left\{ \begin{aligned} I_s(\text{kcal/h}) &= W I_s \times \sqrt{d_a} \times V_a \times \frac{273}{293} \times \frac{760 + \frac{P_s}{13.6}}{760} \\ &\times \frac{B + \frac{P_m}{13.6}}{B + \frac{P_i}{13.6}} \times \sqrt{\frac{293}{273 + t} \times \frac{B + \frac{P_m}{13.6} - \left(1 - \frac{0.622}{d_a}\right) S}{760 + \frac{P_s}{13.6}}} \end{aligned} \right\}$ where I_s: In the case of appliance for liquefied petroleum gas The gas consumption at 20°C in temperature, gas pressure of standard pressure, atmospheric pressure of 101.3 kPa {760 mmHg}, 75 P gas (composed of propane 75 %, butane 25 %) and dry condition (kW, MJ/h, {kg/h}). In the case of appliance for city gas The gas consumption at 20°C in temperature, gas pressure of standard pressure, atmospheric pressure 101.3 kPa {760 mmHg}, standard Wobbe index of gas group to be applied and dry condition (kW, MJ/h, {kcal/h}) $W I_s$: In the case of appliance for liquefied petroleum gas Wobbe index of 75 P gas (MJ/m³_N) = 84.6 MJ/m³_N In the case of appliance for city gas Standard Wobbe index of gas group to be applied (MJ/m³_N {kcal/m³_N})

Table 5. (Continued)

Item	Condition of appliance, test conditions and test method
	d_a : specific gravity of gas at the time of measurement (Take air as 1.) V_a : actually measured gas consumption (m^3/h) P_s : in the case of appliance for liquefied petroleum gas Standard pressure of test gas (kPa {mmH₂O} = 2.75{280})(kPa{mmH₂O}) In the case of appliance for city gas Standard pressure of test gas of gas group to be applied (kPa{mmH₂O}) P_m : gas pressure in the gas meter at the time of measurement (pressure of water column meter ①) (kPa {mmH₂O}) P_i : gas pressure at inlet of appliance at the time of measurement (Pressure of water column ②) (kPa {mmH₂O}) t : gas temperature in gas meter at the time of measurement (°C) B : atmospheric pressure at the time of measurement (kPa {mmHg}) S : saturated steam pressure at t °C in temperature (kPa {mmHg}) 0.622 : specific gravity of steam under ideal condition (Take air as 1.) 2.17 : density of 75 P gas under the dry condition 0°C atmospheric pressure 101.3 kPa {760 mmHg} (kg/m^3)
2. Accuracy of gas consumption against marked gas consumption	Calculate the accuracy of gas consumption against the marked gas consumption according to the following formula. $\Delta I_s = \frac{I_s - I_{s0}}{I_{s0}} \times 100$ where ΔI_s : accuracy of gas consumption against marked gas consumption (%) I_s : measured gas consumption (m^3/h) [kW, MJ/h, {kg/h}, {kcal/h}] I_{s0} : marked gas consumption (m^3/h) [kW, MJ/h, {kg/h}, {kcal/h}]

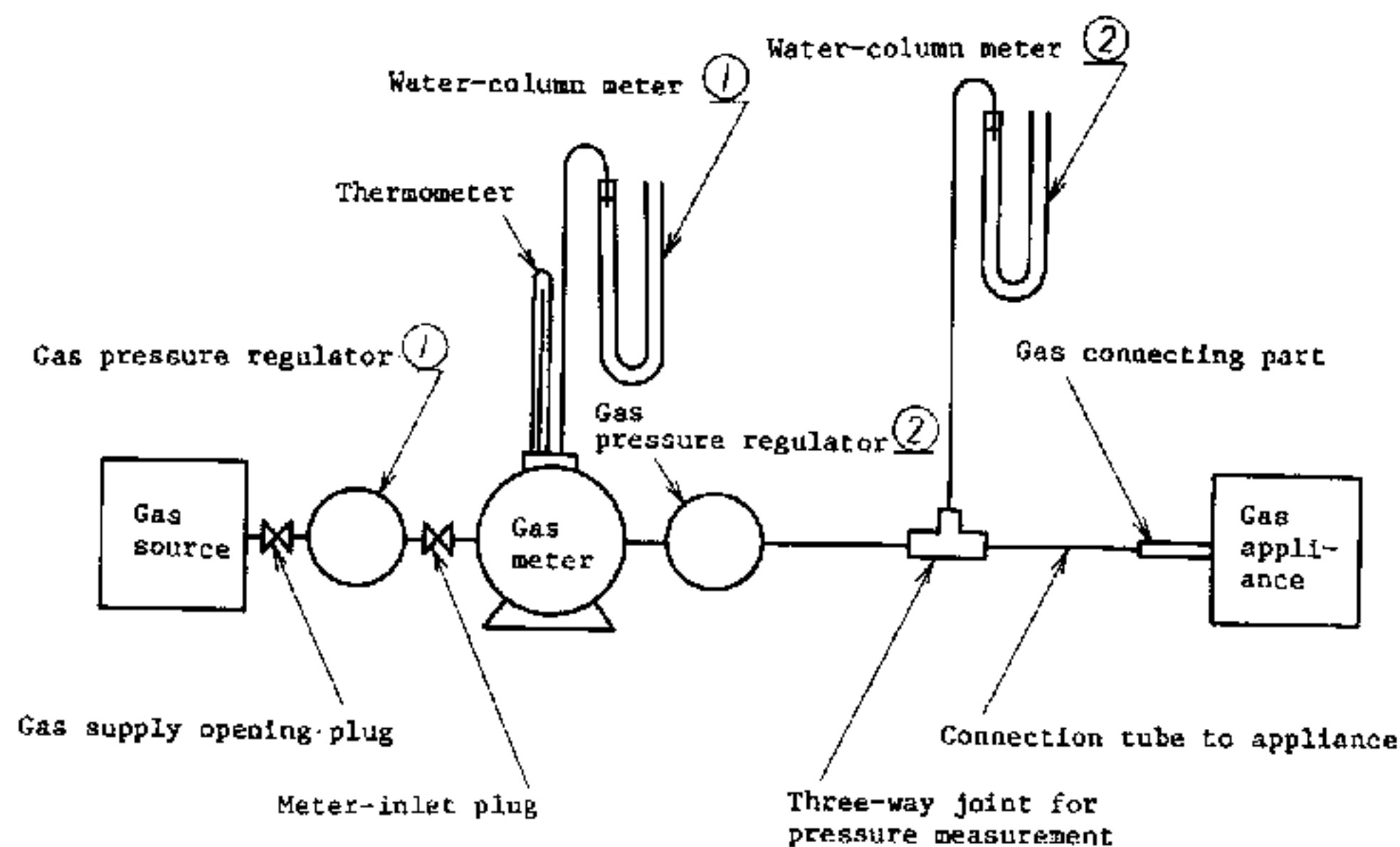
Informative reference: The relation formula between the temperature ($t^{\circ}\text{C}$) and the saturated steam pressure (S kPa {mmHg}) can be in accordance with the following. However, in the range from 0°C up to 100°C , make it significant to three numerals.

$$S = 10^{a_1} \{10^{a_2}\}$$

where,

$$a_1 = 7.203 - \frac{1735.74}{t + 234}, \quad a_2 = 8.078 - \frac{1735.74}{t + 234}$$

Fig. 1. Measuring apparatus of gas consumption

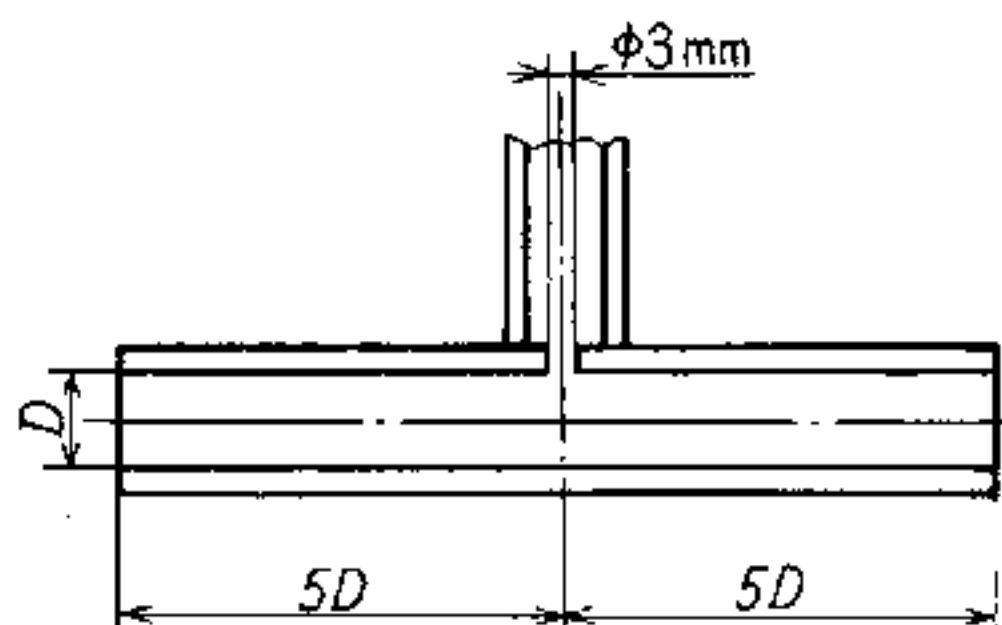


Remarks 1. Set the appliance at using condition.

2. For the connection tube, use the suitable tube to connection part of appliance, make the distance to three-way joint not more than 100 mm, and as short as possible.

Further, don't bend the tube or the like between them nor make the passing area smaller.

3. For the three-way joint for pressure measurement, as a rule, use the following.



Unit: mm

$$D = (1 \text{ to } 1.1) d$$

where, D : internal diameter of three-way joint

d : internal diameter of connection tube

4. The gas pressure regulator (2) is to be capable of regulating the pressure fluctuation at ± 19.6 Pa {2 mmH₂O} during the test.

Further, in the case where the abovementioned conditions are satisfied at gas meter inlet plug, it may not be used.

7. Gas-tightness test of gas passage

The gas-tightness test of gas passage shall be in accordance with Table 6.

Table 6. Gas-tightness test of gas passage

Item	Appliance condition, test conditions and test method
1. Gas closing valve (including appliance valve. Hereafter, the same in this Standard.)	Under the condition of gas closing valve closed, connect the precise gas flowmeter at the gas inlet part, apply the air pressure of 4.12 kPa {420 mmH ₂ O} from its inlet side, measure the leakage quantity and calculate the leakage quantity per 1 h from this.
2. From gas connection opening to flame hole	Make the conditions of test gas S-1, ignite respectively or simultaneously the burner ⁽⁴⁾ and ignition burner ⁽⁵⁾ and examine for the existence of outside leak from each part with the test fire or the like.

Notes ⁽⁴⁾ "Burner" means for that having pilot burner, the pilot burner and main burner, and for that without pilot burner means the main burner. Hereafter it is the same in this Standard. Further, the "pilot burner" means that which is used to ignite gas at main burner and burns simultaneously at least during burning of main burner.

⁽⁵⁾ "Ignition burner" means the burner which burns only when the burner light up. Hereafter, the same in this Standard.

8. Burning condition test under still air condition

Burning condition test under still air shall be in accordance with Table 7.

Table 7. Burning condition test under still air condition

Item	Appliance condition, test conditions and test method
1. Appliance condition	To be as given in Table 8.
2. Test conditions	To be as given in Table 8. Further, make the appliance valve whole open.
3. Test method (1) Flame establishment	(a) Examine whether all the flame establish safely after igniting the one end (flame hole) of main burner or not. As for the ignition method, in the case of the appliance to ignite directly with electric ignition device, ignite according to the device, and for that igniting according to ignition burner or pilot burner ignite with it, and for that neither of them ignite with match or induction flame. (b) Examine the potential of explosive flame establishment. (c) For the appliance having ignition burner or pilot burner, examine the easiness of light up of main burner from the burner.

Table 7. (Continued)

Item	Appliance condition, test conditions and test method
(2) Lifting	Ignite the burner, and after 15 s examine visually.
(3) Flame extinguishing	Ignite the burner, and after 15 s examine visually.
(4) Uniformity of flame	Ignite the burner, and after stabilizing the flame examine visually.
(5) Back fire	Until lapse of 30 min after igniting the burner examine visually.
(6) Continuous noise	Ignite all burners and examine the maximum continuous noise including the combustion noise according to 1. of Table 9.
(7) Flame extinguishing noise	30 min after igniting the burner, extinguish the flame and examine for the existence of explosive noise. Further, for operation of flame extinguishing close the individual appliance valve for burner manually as quickly as possible. For that having automatic flame extinguishing device, examine at the time of automatic closing.
(8) Concentration of CO (volume %) in theoretical dry combustion gas (Hereafter referred to as CO %)	15 min after igniting the burner, collect the combustion gas as evenly as possible over the whole surface of combustion gas exhaust part of appliance, measure the CO concentration and O₂ concentration in dry combustion gas and calculate according to the following formula. $CO = CO_a \times \frac{O_{2t}}{O_{2t} - O_{2a}}$ However, in the case where the composition of test gas are confirmed, CO concentration and CO₂ concentration in dry combustion gas are measured and may be calculated according to the following formula. $CO = CO_a \times \frac{CO_{2max}}{CO_{2a} - CO_{2t}}$

Table 7. (Continued)

Item	Appliance condition, test conditions and test method
(8) (Continued)	where, CO : CO concentration in theoretical dry combustion gas (volume %) CO_a : measured value of CO concentration in dry combustion gas (volume %) O_{2t} : measured value of O_2 concentration in air supply opening atmosphere (dry condition) (volume %) (In the case of fresh air, 21 %) O_{2a} : measured value of O_2 concentration in dry combustion gas (volume %) CO_{2max} : CO_2 concentration in theoretical dry combustion gas (volume %) CO_{2a} : measured value of CO_2 in dry combustion gas (volume %) CO_{2t} : measured value of CO_2 concentration in air supply opening atmosphere (dry condition) (volume %)
(9) Soot generation	Examine visually or the like.
(10) Contact with yellow flame	Electrode parts of ignition device and heat exchanger shall be examined visually.
(11) Overflow of flame	After ignition of burner examine visually.
(12) Stability of flame of pilot burner	(a) Examine for the existence of flame extinguishing and back fire in independent burning after ignition of pilot burner until the lapse of 15 min visually. (b) For existence of flame extinguishing and back fire at the time of igniting and extinguishing of main burner, examine visually by igniting the pilot burner and carrying out the flame establishing and extinguishing operation of the main burner.

Table 8. Conditions for combustion performance test

Test item	Condition of appliance				Test conditions		
	Condition of exhaust pipe of forced exhaust type (FE)	Condition of vent and air intake pipe of forced vent and air intake type (FF)	Adjusting condition of gas quantity		Voltage conditions(%)	Conditions of test gas	City gas
			Gas quantity adjusting type	Gas quantity change-over type			
(1) Flame establishment	Short	Short	Large and small	Whole	100	P-2	3-2
(2) Lifting	Short	Short	Large	Large	100	P-1	3-1
(3) Flame extinguishing	Short	Short	Large and small	Whole	90 and 110	P-1 and P-3	3-1 and 3-3
(4) Uniformity of flame	Short	Short	Large	Large	100	S-2	S-2
(5) Back fire	Short	Short	Large and small	Whole	90 and 110	P-3	2-3
(6) Continuous noise	Short	Short	Large	Large	100	P-1	2-1
(7) Flame extinguishing noise	Short	Short	Large	Large	100	P-2	2-2
(8) CO%	Long	Long	Large	Large	100	B-1	1-1
(9) Soot generation	Long	Long	Large	Large	100	B-1	1-1
(10) Contact with yellow flame	Long	Long	Large	Large	100	B-1	1-1
(11) Over-flow of flame	Long	Long	Large	Large	90 and 110	B-1	1-1
(12) Stability of flame of pilot burner	Long	Short	Large	Large	100	P-1 and P-3	3-1 and 3-3
	Long	Short	Large	Large	100	P-3	2-3
(13) Stability of flame of burner	Long	Short	Large and small	Whole	90 and 110	P-1 and P-3	3-1 and 3-3
	Long	Short	Large and small	whole	90 and 110	P-3	2-3
	Long	Long	Large	Whole	90 and 110	B-1	1-1
(14) Flowing-out of combustion gas from than ventilation opening	Long	Long	Large	Large	100	B-1	1-1

Note (⁶) The conditions of voltage indicate the percentage to the rated voltage of appliance using domestic power source.

Remarks 1. Gas quantity adjusting type means that to change the gas quantity to burner by operating the gas-quantity adjusting knob (hereafter including the lever and others), but does not mean to change the number of burners to pass the gas.

In this case, "large" means the condition where the gas quantity becomes the maximum. "Small" means the condition where the gas quantity adjusting knob or the like is so operated as to become the minimum using condition of gas quantity marked on the appliance body or described in the instructions.

Further, in the case where the indication of condition of "small" is absent in both marking and instructions, the condition to be gas quantity of 1/3 of the "large" condition is taken as the "small" condition.

2. The gas quantity change-over type means that to change the number of burners to pass gas by operating the knob and the like for gas quantity adjusting.

In this case the "large" means the condition to pass gas through all burners. The "small" means the condition to pass gas through burners of the minimum number. The "whole" means the condition to pass gas through the respective burners of each stage of number of burners capable of using with change-over.

3. The "short" or "long" of exhaust pipe of forced exhaust type (FE) and of vent and air intake pipe of forced vent and air intake type (FF) means the condition set at the minimum length or the maximum elongation to the exhaust pipe adequate to the appliance or the vent and air intake pipe according to the gist indicated in instructions.

4. The combustion condition test is, as a rule, to be carried out for each individual burner.

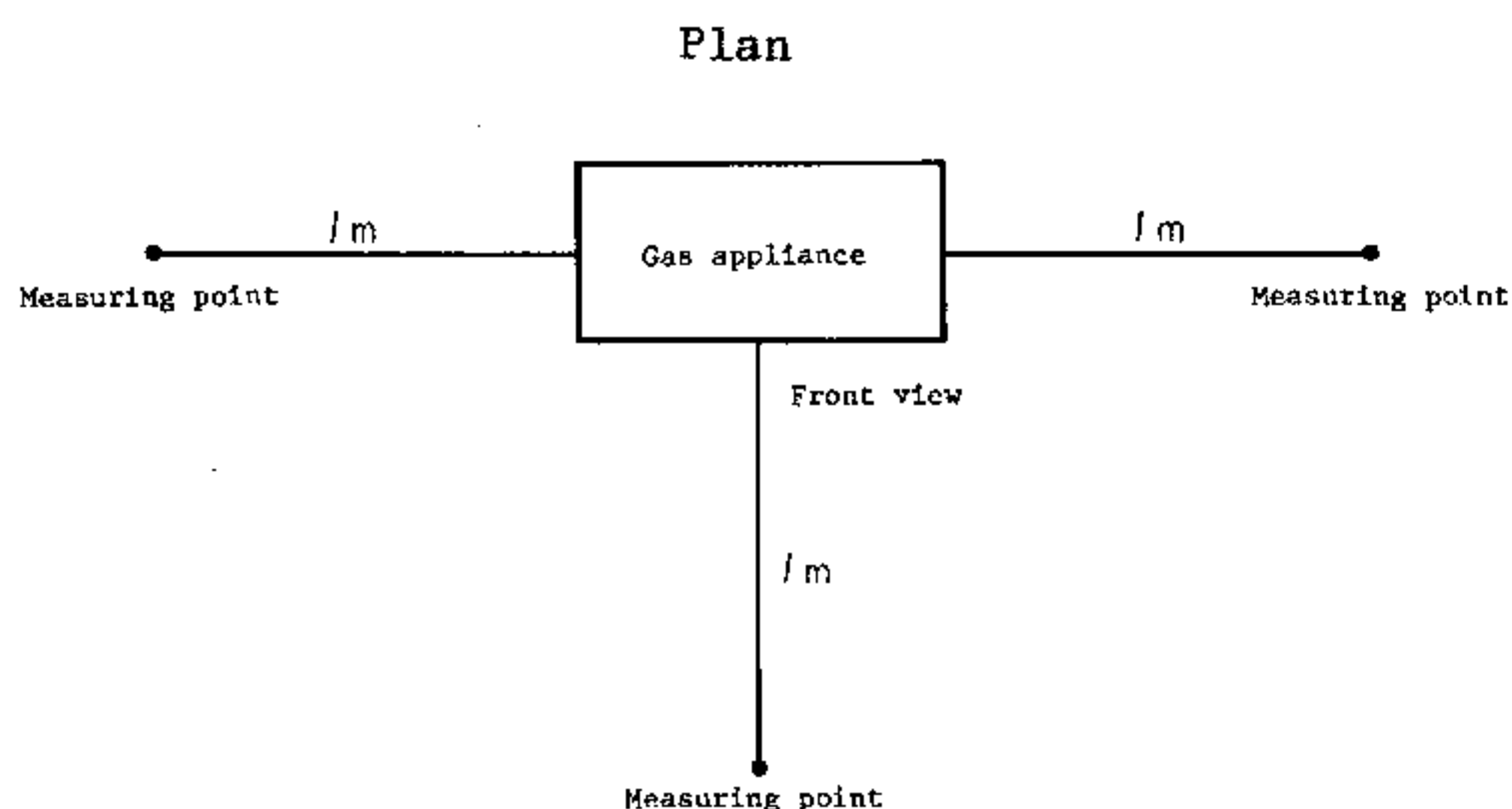
9. Noise test

The noise test shall be as given in Table 9.

Table 9. Noise test

Item	Appliance condition, test conditions and test method
1. Continuous noise test	Measure the noises at three points indicated in Fig. 2 by using a noise meter, according to characteristic A of weighing network in accordance JIS Z 8731, under the following conditions: (a) Place the microphone at the position apart by 1 m from the middle of outer surface of appliance, not being affected by combustion gas and the like. (b) The background noise should preferably be smaller by 10 dB or more than the noise of the appliance. (c) When using the appliance, the noise near the wall at the nearest to the appliance should preferably be smaller by 8 dB or more than the noise at the measuring position shown in Fig. 2. However, except the case of an anechoic room. (d) To be the maximum value of noise at three points indicated in Fig. 2.
2. Instantaneous noise test	Carry out the test of 1 at the first characteristic of noise meter, and take the value of read out numerical value added with 5 dB as the measured value.

Fig. 2. Measuring points of noise



10. Temperature rise test

The temperature rise test shall be as given in Table 10.

Table 10. Temperature rise test

Item	Appliance condition, test conditions and test method
1. Temperature rise test under the normal conditions	
(1) Condition of appliance	Set the appliance on the temperature measuring board of Fig. 3 or specified in JIS classified by appliance under the condition specified in the same JIS, and provide the using condition specified in the same JIS.
(2) Test conditions	Relating to the temperature rise test of each part of appliance, in the case of that for liquefied petroleum gas, P-2 is applied, and in the case of that for city gas, E-2 is applied. Further, relating to the temperature rise test of wooden wall, wooden base, etc. and exhaust gas temperature test around the appliance, in the case of that for liquefied petroleum gas, B-1 is applied, and in the case of that for city gas, 1-1 is applied.
(3) Test method	Ignite the burner, and measure the temperature and exhaust gas temperature of each part of appliance specified in JIS classified by appliance as well as of wooden wall and the like around the appliance for the time specified in JIS classified by appliance. However, carry out the temperature rise test of wooden wall and the like around the appliance and exhaust gas temperature test following to the temperature rise test of each part of appliance.
2. Temperature rise test under abnormal conditions	Set the appliance on the temperature measuring board of Fig. 3 or specified in JIS classified by appliance, under the condition specified in the same JIS and provide the using condition specified in the same JIS.
(1) Condition of appliance	Further, for that having such function to regulate the gas quantity or temperature as thermostat, provide the condition for its function not to actuate or the condition specified in JIS classified by appliance.

Table 10. (Continued)

Item	Appliance condition, test conditions and test method
(2) Test conditions	In the case of appliance for liquefied petroleum gas, B-1 is applied and in the case appliance for city gas, 1-1 is applied.
(3) Test method Temperature of wooden wall and the like around the appliance.	Ignite the burner, and measure the temperature of the wooden wall and the like around the appliance specified in JIS classified by appliance for the time specified in that JIS. However, in case where the overheat preventive apparatus actuates in midway and the gas passage of the main burner is closed, measure the attained maximum temperature.

Remarks 1. The temperature measuring parts of appliance means as follows:

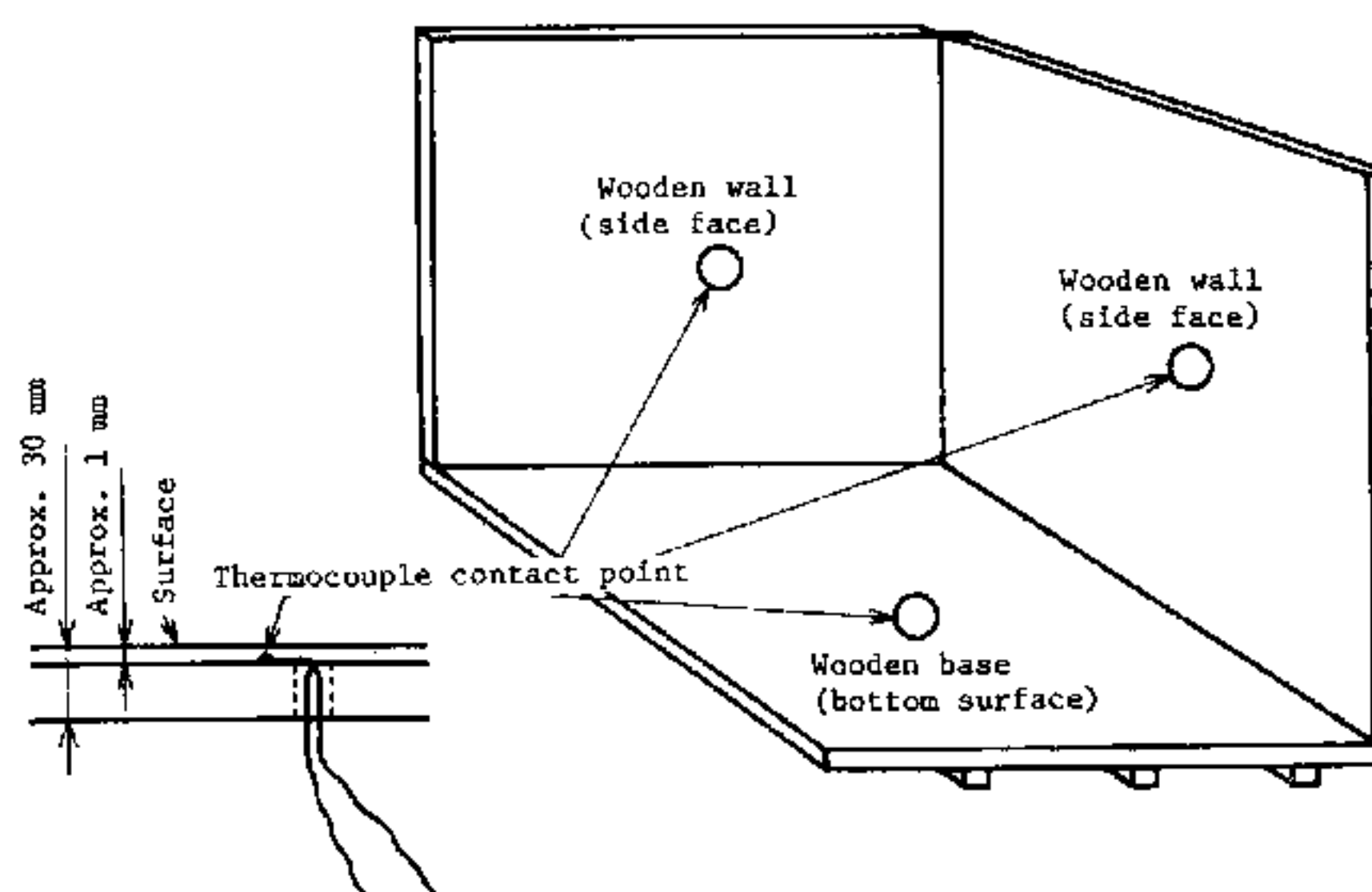
- (a) The parts to be touched by hand when carrying out the using operation of appliance valve knob, handles etc. for ignition, flame extinguishing, adjusting, etc.
- (b) The peripheral part adjacent to the part of (a) being apt to touch by hand at the time of carrying out the operation of (a).
- (c) The surface of gas connection opening (except the screw thread connecting opening).
- (d) The functional parts such as appliance valve, ignition equipment, appliance governor, etc.

2. The temperature measuring parts of wooden wall and the like around the appliance or the like mean the following parts:

- (a) Parts of wooden base surface underneath the lower surface of appliance and the parts of ceiling board surface overhead the upper surface of appliance.
- (b) Parts of wooden wall surfaces against the side face and the back side of appliance.
- (c) Surface of wooden frame of wall penetrating part of vent and air intake pipe of the hermetic type.
- (d) Surface of wooden frame peripheral to the exhaust pipe's top or vent and air intake pipe's top.

3. The measurement of marked exhaust gas temperature, as a rule, is carried out at the exhaust opening (For that to connect the exhaust pipe, the exhaust pipe's connecting opening).

Fig. 3. Temperature measuring apparatus of wooden base and wooden wall surfaces



- Remarks 1. For materials of wooden base and wooden wall, the special plywood in compliance with the Japanese Agricultural Standard (1969, Notification of Ministry of Agriculture and Forestry No. 1373) or that equivalent thereto, sufficiently dried 5 to 7 sheet plywood shall be used and the surface of wooden base, be varnish finished and the surface of wooden wall, be finished with flat black paint.
2. As for sizes of wooden wall and wooden base, the sufficiently large size for the appliance.
 3. Provide the number of thermocouples as many as possible, embed in checkered board state at equal interval and make them capable of measuring the temperature at optional portions.
 4. Embed the thermocouple by approximately 1 mm in depth from the surfaces of wooden base and wooden wall.
 5. Thermometer and thermocouple to be used shall be those specified in Attached Table 5 or those equivalent thereto in accuracy.

11. Electric-ignition performance test

The electric-ignition performance test shall be as given in Table 11.

Table 11. Electric ignition performance test

Item	Appliance condition, test conditions and test method
1. Condition of appliance	The using condition specified in JIS classified by appliance.
2. Test conditions	Provide the power-source conditions for that using a dry cell at the voltage of 70 % of nominal voltage (marked voltage), for that using the domestic power source at the voltage of 90 % of rated voltage at rated frequency, and as for the test gas conditions P-1 and P-3 shall be applied in the case of that for liquefied petroleum gas, 3-1 and 3-3 shall be applied in the case of that for city gas.
3. Test method	Carry out the ignition operation according to the ignition method indicated in the instructions and the like or to the undermentioned gist, continuously 10 times, and examine for the existence of explosive ignition caused by the number of times of ignition and overflowing of flame to the outside of casing, and others. (1) Preliminarily carry out the preparatory test several times. (2) At each ignition operation, provide the electric ignition apparatus and burner under the condition of approximate room temperature. (3) One time of ignition operation, and its speed, as a rule, according to the generating structure of ignition source, are as follows. (a) For the single generation type of piezoelectric-ignition system, one operation is counted as one time. Further, the speed of ignition operation of one time, as a rule, is approximately 0.5 to 1 s.

Table 11. (Continued)

Item	Appliance condition, test conditions and test method
	(b) For the continuous rotary type of piezoelectric-ignition system, take one rotation as once. Further the speed of the ignition operation of one time is the same as (a). (c) As for the continuous discharge ignition system using a dry cell or domestic power source and heater ignition system, holding up on operation position such as "ignition" position for 2 s is counted as once of the test.

Remarks: Relating to the flame failure safety device having function of automatic gas re-ignition system, examine for the potential of explosive ignition at the time of re-ignition.

12. Performance test of flame failure safety device and overheat preventive equipment

The performance test of flame failure safety device and overheat preventive equipment shall be as given in Table 12.

Table 12. Performance test of flame failure safety device and overheat preventive equipment

Item	Appliance condition, test conditions and test method
1. Flame failure safety device	
1.1 That of such structure that the gas passage is closed automatically	
(1) Opening-valve time at ignition time	
(a) Condition of appliance	Using condition specified in JIS classified by appliance.
(b) Test conditions	The conditions of test gas shall be P-3 in the case of appliance for liquefied petroleum gas, and 3-3 in the case of that for city gas.
(c) Test method	Measure the time after igniting with ordinary operation until the valve of safety device opens or the opening valve condition becomes the condition capable of continuing.

Table 12. (Continued)

Item	Appliance condition, test conditions and test method
(2) Valve closing time at the time of flame extinguishing	
(a) Condition of appliance	Using condition specified in JIS classified by appliance.
(b) Test conditions	The conditions of test gas shall be B-1 in the case of appliance for liquefied petroleum gas and 1-1 in the case of that for city gas.
(c) Test method	15 min after igniting the burner, extinguish the flame once, successively with the flame extinguished as it is continuously flow the gas or the air at pressure corresponding to pressure symbol 1 of test gas to pilot burner or the like. Carry out the operation and measure the time from the time when extinguished the fire until the valve of safety device is closed.
(3) Valve closing time when not ignited	
(a) Condition of appliance	The using condition specified in JIS classified by appliance.
(b) Test conditions	Instead of test gas, use the air at the pressure corresponding to test gas of Table 2 (2) pressure symbol 2 (standard pressure) of test gas.
(c) Test method	Carry out the ordinary ignition operation and measure the time between the ignition operation is carried out and the valve of safety device is closed.
1.2 The appliance of structure with automatic re-ignition	
(1) Valve opening time at igniting	To be in accordance with 1.1 (1) of this Table.
(2) Valve closing time at not igniting time	To be in accordance with 1.1 (3) of this table.
(3) Valve closing time in the case of not igniting at the time of re-igniting	To be in accordance with 1.1 (2) of this table.

Table 12. (Continued)

Item	Appliance condition, test conditions and test method
2. Performance of overheat preventive apparatus	Measure the temperature of the apparatus, wooden wall and the like around the appliance in operation on the temperature rise test under an abnormal conditions. Further, examine the gas passage if it automatically opens or not when the temperature returns to normal degree.

- Remarks 1. "Automatic gas passage shut-off structure" means the structure capable to shut-off the gas passage automatically at the time of igniting failure or at the time of flame extinguishing.
2. "Automatic gas re-ignition structure" means the structure capable to perform re-ignition operation immediately at the time of igniting failure or flame extinguishing, remaining the gas passage opened and in case where re-ignition is failure, the gas passage is closed automatically within a specified time.

13. Duty-cycle operation test

The duty-cycle operation test shall be as given in Table 13.

Table 13. Duty-cycle operation test

Item	Test method
1. Appliance valve	Provide the conditions of test gas by S-2 or the air at the same pressure as this, and after repeating by the number of times specified in JIS classified by appliance the opening-closing operation at the speed of 5 times/min or more and not more than 20 times/min, examine each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Examine for the existence of interference to use, easiness of opening-closing and existence of rupture, visually and manually or the like.
2. Electrical ignition apparatus	After repeating the operation of flashing at a rate of not less than 5 times/min and not more than 20 times/min by the number of times specified in JIS classified by appliance, examine the following each item. (1) Electrical ignition performance, examine according to Table 11. (2) Existence of interference in use Examine visually and manually or the like.

Table 13. (Continued)

Item	Test method
3. Appliance governor	Pass the test gas of conditions of S-2 or the air at the same pressure as this for 2 to 3 s, stop for 2 to 3 s, take such operation as once, and after repeating by the number of times specified in JIS classified by appliance, examine the following each item. (1) Gas tightness of gas passage Examine according to Table 6. (2) Change of regulating pressure Use the test gas of conditions of S-1 or the air at the same pressure as this, under the condition of flowing the gas of quantity equivalent to marked gas consumption quantity on the appliance or air, measure the regulated pressure (secondary pressure) before and after test and calculate the change of regulating pressure according to the following formula. $\Delta P = P_1 - P_2$ where ΔP: difference of regulating pressures between before and after test (Pa {mmH₂O}) P_1: regulating pressure after test (Pa {mmH₂O}) P_2: regulating pressure before test (Pa {mmH₂O})
4. Flame failure safety device	Provide the conditions of test gas by S-2, apply the flame to the flame detecting part of flame failure safety device for 2 min, after opening the valve of flame failure safety device, remove the flame, let it cool for 3 min and close the valve of flame failure safety device, take such operation as once, and after repeating by number of times specified in JIS classified by appliance, examine each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Performance Examine according to Table 12.

Table 13. (Continued)

Item	Test method
5. Solenoid valve	Use test gas of conditions of S-2 or the air at the same pressure as this, and after repeating the opening-closing operation at a rate of 10 times/min or more and not more than 30 times/min by the number of times specified in JIS classified by appliance, examine each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Existence of interference in use Examine the performance and existence of rupture visually and manually, or the like.
6. Timer (except the electron type) (1) The timer of such structure as to open-close the contact point of electric circuit mechanically to open-close solenoid valve (solenoid valve system)	After repeating the operation to open-close the contact point with timer operation knob and the like by the number of times specified in JIS classified by appliance, examine the change of working time after testing against that before testing concerning to the certainty of opening and closing functions of solenoid valve and the maximum working time can be set.
(2) The timer of such structure as to open-close directly the gas closing valve mechanically (direct working valve system)	Make the test gas conditions S-2 or by using the air of the same pressure as this, repeat the operation to open-close the gas closing valve by operating the operating knob and the like by the number of times specified in JIS classified by appliance, relating to the maximum operating time capable of setting, examine the change of working time after testing against the working time before testing and relating to gas tightness of gas passage according to Table 6.

Table 13. (Continued)

Item	Test method
7. Thermostat (except the electron type and proportional control type) (1) The thermostat of such structure as to open-close the contact point of electric circuit mechanically to open-close solenoid valve (solenoid valve system)	After repeating the heating and cooling of heat-sensitive part of thermostat by the number of times specified in JIS classified by appliance, examine for potential of failure in use.
(2) That of such structure as to open-close directly the gas closing valve mechanically (direct working valve system)	Make the conditions of test gas S-2 or by using the air of the same pressure as this, carry out the heating and cooling of heat sensitive part, and after repeating the working to open-close the gas closing valve by the number of times specified in JIS classified by appliance, examine for potential of interference to use and relating to gas tightness of gas passage according to Table 6.
8. Appliance receptacle	After repeating the attaching-detaching of plug or socket at a rate of 5 times/min or more and not more than 20 times/min by the number of times specified in JIS classified by appliance, examine for each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Existence of hindrance to use Examine smoothness of attaching-detaching, security and existence of rupture, visually and manually, or the like.

Table 13. (Continued)

Item	Test method
9. Universal rubber tube opening	After repeating the reciprocating motion at the maximum rotary angle at a rate of 5 times/min or more and not more than 20 times/min by the number of times specified in JIS classified by appliance, examine for each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Existence of hindrance to use Examine the smoothness of rotation and existence of rupture visually and manually, or the like.

14. Heat resistance test of functional parts

The heat resistance test of functional parts shall be as given in Table 14.

Further, the test temperature shall be the temperature corresponding to the classification of heat resistance grade indicated in Table 15.

Table 14. Heat resistance test of functional parts

Item	Test method
1. Gas closing valve	Put the specimen into the constant temperature tank at the temperature corresponding to heat resistance grade of Table 15, take out, after leaving as it is for 24 h, and when the temperature has become approximately same as room temperature, examine for each of following items. (1) Gas tightness of gas passage Examine according to Table 6. (2) Existence of hindrance to use Examine by carrying out opening-closing operation.
2. Ignition unit (including the piezoelectric elements)	Put into the constant temperature tank at the temperature corresponding to heat resistance grade of Table 15, take out, after leaving for 24 h, and after becoming the same temperature as room temperature, examine for the existence of hindrance to use manually or the like.