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**Universal test methods of gas burning appliances for
domestic use**

家用燃气用具通用试验方法

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Universal test methods of gas burning appliances for domestic use

1 Scope

This Standard specifies terms and definitions of gas burning appliances, test conditions, test gas and test methods for general performance.

This Standard is applicable to various gas water heaters, heaters, hot water heating stoves, cooking utensils, ovens, oven stoves and rice cookers for household use.

The gas referred to in this Standard is the gas specified in GB/T 13611. The domestic gas appliances that use gas types other than those specified in GB/T 13611 can refer to this Standard.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 1690-2006, *Rubber vulcanized or thermoplastic - Determination of the effect of liquids* (ISO 1817:2005, MOD)

GB/T 1740, *Determination of resistance to heat and humidity of paint films*

GB/T 1765, *Method of producing of paint films for testing heat and humidity resistance, salt-fog resistance and accelerated weathering*

GB/T 1771, *Paints and Varnishes - Determination of resistance to neutral salt spray*

GB/T 2421, *Environmental testing for electric and electronic products - Part 1: General and guidance* (GB/T 2421-1999, IEC 68-1:1988, IDT)

GB/T 2903, *Copper/Copper-Nickel (Constantan) thermocouple wires*

GB/T 3772, *Platinum-10% Rhodium/Platinum thermocouple wires*

GB 4706.1-2005, *Household and Similar Electrical Appliances - Safety - Part 1: General Requirements* (IEC 60335-1:2004 (Ed 4.1), IDT)

GB/T 12206-2006, *Testing method to determine the calorific values of town gas*

GB/T 13611, *Classification and basic characteristics of city gas*

GB/T 17626.4, *Electromagnetic compatibility - Testing and measurement techniques - Electrical fast transient/burst immunity test* (GB/T 17626.4-1998, IEC 61000-4-4:1995, IDT)

GB/T 17626.5, *Electromagnetic compatibility - Testing and measurement techniques - Surge immunity test* (GB/T 17626.5-1999, IEC 61000-4-5:1995, IDT)

GB/T 17626.11, *Electromagnetic compatibility - Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests* (GB/T 17626.11-1999, IEC 61000-4-11:1994, IDT)

GB/T 17799.1-1999, *Electromagnetic compatibility - Generic Standards - Immunity for residential, commercial and light-industrial environments* (IEC 61000-6-1:1997, IDT)

CJ/T 3075.2, *Laboratory of gas burning appliances - Test equipment and device*

CJ/T 3085-1999, *Terms of city gas*

QB/T 3826, *Corrosion-resistant testing method of the metal deposits and conversion coatings for the light industrial products - Neutral salt spraying test (NSS)*

QB/T 3832, *Evaluation of the corrosion test results of the metal deposits for the light industrial products*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 reference conditions

the dry gas state under the conditions that the temperature is 15°C and the absolute pressure is 101.3kPa

3.2 standard conditions

the dry gas state under the conditions that the temperature is 0°C and the absolute pressure is 101.3kPa

3.3 nominal heat flow rate; rated heat input

under the rated gas pressure, the heat released by the burning appliance using the reference gas per unit time

[CJ/T 3085-1999, definition 7.2.15]

3.4 converted actual heat rate

under the test conditions, the heat flow of the burner when using the test gas is converted to the value under the reference conditions

4 Test conditions

4.1 Laboratory conditions

When there are no special provisions for laboratory conditions for each inspection item or standard for burning appliances in this Standard, the following provisions shall be followed:

- a) Laboratory temperature: $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$;
- b) Atmospheric pressure: 86kPa~106kPa;
- c) Ambient air in the laboratory: the carbon monoxide content is less than 0.002%, and the carbon dioxide content is less than 0.2%. There shall be no airflow affecting combustion.

NOTE 1: The humidity requirements of the laboratory during the electrical test refer to the provisions of GB/T 2421.

NOTE 2: How to determine room temperature: In front of the burning appliance, 1m on the left and right, fix the temperature-sensing part of the thermometer at a position roughly the same height as the upper end of the burning appliance. Measure the temperature of the above three points. The average value is the room temperature.

4.2 Installation and test state of burning appliances

The installation of burning appliances shall be carried out in accordance with the inspection items of this Standard or the provisions of each standard of burning appliances.

Use a burner with adjustable air volume. At the beginning of the test, the air regulator shall be adjusted to an appropriate opening. And it shall not be adjusted again during the test.

4.3 Power supply conditions

The power supply conditions for the test shall meet the following requirements:

4.3.1 Burning appliances that use commercial power

appliance.

7.2 Open the first sealing valve at the gas inlet of the burning appliance. Close the second sealing valve at the gas inlet of the burning appliance. At the gas inlet of the burning appliance, use 4.2kPa air to test the air tightness of the second sealing valve in the burning appliance.

7.3 Use "0-1" gas to ignite all burning appliances. From the first sealing valve at the gas inlet of the burning appliance to the burning appliance port, use leak detection fluid to test the external air tightness.

8 Burning condition test

8.1 The state of the burning appliance and the condition of the test gas during the burning condition test of the burning appliance shall comply with the provisions in Table 2.

For burning appliances using commercial power, the voltage condition shall be 220V.

8.2 Test method for burning conditions

8.2.1 Flame pass: After igniting a fire hole of the main burning appliance, test the time for the flame to be transmitted to all the fire holes and whether there is detonation. The ignition method shall be carried out according to the regulations of each burning appliance standard.

8.2.2 From the flame: Observe after the main burner is ignited for 15s.

8.2.3 Extinguishing: Observe after igniting the main burning appliance for 15s.

8.2.4 Flame uniformity: Ignite the main burning appliance. Observe after the flame has stabilized.

8.2.5 Tempering: Observe within 30 minutes after the main burning appliance is ignited.

8.2.6 Burning noise: Ignite all burning appliances. Determine the maximum noise according to the provisions of 9.2.1 of this Standard.

8.2.7 Flameout noise: The flameout operation is carried out after the main burning appliance is ignited for 30 minutes. Determine flameout noise according to 9.2.2 of this Standard. Test whether there is a popping noise.

The gas valve shall be closed quickly during the flameout operation. For a burning appliance equipped with an automatic flameout protection device, its flameout noise shall be measured when it is automatically turned off.

8.2.8 Carbon monoxide content in dry flue gas: After the main burning appliance is

ignited for 15 minutes, the flue gas samples shall be collected as uniformly as possible at the exhaust site. The location and method of sampling shall be specified in accordance with the respective standards for burning appliances.

Determine carbon monoxide and oxygen content in flue gas. Calculate according to formula (4):

$$CO_{\alpha=1} = (CO)_m \times \frac{(O_2)_a}{(O_2)_a - (O_2)_m} \dots\dots\dots (4)$$

Determine carbon monoxide and carbon dioxide content in flue gas when the gas composition can be determined in the test. Calculate according to formula (5):

$$CO_{\alpha=1} = (CO)_m \times \frac{(CO_2)_N}{(CO_2)_m} \dots\dots\dots (5)$$

Where,

$CO_{\alpha=1}$ - When the excess air coefficient α is equal to 1, the value of carbon monoxide content in the dry flue gas sample, volume fraction (%);

$(CO)_m$ - The value of carbon monoxide content in the dry flue gas sample, volume fraction (%);

$(O_2)_a$ - The value of the oxygen content in the dry air around the air supply port, volume fraction (%);

$((O_2)_a=20.9\%$ in fresh air)

$(O_2)_m$ - The value of oxygen content in dry flue gas, volume fraction (%);

$(CO_2)_N$ - When the excess air coefficient α is equal to 1, the calculated value of the carbon dioxide content in the dry flue gas sample, volume fraction (%);

$(CO_2)_m$ - The measured value of carbon dioxide content in dry flue gas, volume fraction (%).

NOTE 1: The use condition of formula (4) is that the oxygen content in the flue gas is less than 14%.

NOTE 2: The value of $(CO_2)_N$ shall be calculated according to the theoretical flue gas volume of the actual gas or refer to GB/T 13611.

8.2.9 Yellow flame and contact yellow flame: Ignite the main burning appliance. Check for yellow flames. In any 1min, when the electrode or the heat exchanger is in continuous contact with the yellow flame for more than 30s, the electrode or the heat

11 Ignition device performance test

11.1 State of burning appliances: According to the state specified by the standards of various burning appliances.

Ignition devices using dry batteries shall adjust the power supply voltage to 70% of the rated voltage. Ignition devices using AC power shall be regulated to 90% of the rated voltage.

11.2 Test gas conditions: Use "3-1" and "3-3" test gases.

11.3 Test method: It shall be ignited according to the operation specified in each burning appliance standard. Repeat the ignition 10 times according to the following procedure. Check the number of fires and whether there is a detonation phenomenon. The operating procedure is to carry out several preparatory ignitions in advance. Each ignition shall be performed when the ignition device is approximately near room temperature. The ignition operation mode and ignition speed, according to different ignition devices, are specified as follows:

- a) Single-shot piezoelectric ignition device operates once for one time. Each time the speed is controlled within the time of 0.5s~1s.
- b) Rotary ignition device takes one rotation as one turn. Its speed is the same as a).
- c) For continuous discharge type or heating wire ignition devices using alternating current or direct current power supply, the time of staying in the "ignition" position for 2s is one time.

12 Operation performance test of flameout protection device and anti-overheating device

12.1 Flameout protection device

12.1.1 Structure that the gas passage can be automatically closed

12.1.1.1 Valve opening time at ignition

- a) Appliance state: According to the state specified by each burning appliance standard.
- b) Test gas conditions: Use "3-3" test gas.
- c) Test method: Measure the time from the start of the ignition operation to the time when the flameout protection device is in the valve-open state, which shall comply with the time specified in the standards for various burning appliances.

12.1.1.2 Flameout valve closing time

- a) State of burning appliances: According to the state of each burning appliance standard.
- b) Test gas conditions: Use "1-1" test gas.
- c) Test method: Immediately after the main burner is ignited for 15 minutes, pass the same pressure air into the ignition burner and the main burner to force the flame out. Record the time from the flameout to the time when the flameout protection device is turned off, which shall comply with the time specified in the standards of each burning appliance.

12.1.1.3 Closing time for auto-ignition operation that cannot be ignited

- a) Appliance state: According to the state specified by each burning appliance standard.
- b) Test gas conditions: Use air equivalent to the rated gas pressure instead of the test gas.
- c) Test method: Carry out the usual ignition operation. Measure the time it takes for the flameout protection device to open to close the valve.

12.1.2 Structure that can automatically re-ignite

12.1.2.1 Valve opening time during re-ignition: the same as item 12.1.1.1.

12.1.2.2 Valve closing time during re-ignition: the same as item 12.1.1.2.

12.1.2.3 Valve closing time when re-ignition cannot be ignited: the same as item 12.1.1.3.

12.2 Action performance of anti-overheating device: When the anti-overheating device operates, check that the gas passage to the burner is closed. When the temperature returns to normal temperature, check whether the gas passage to the burner is automatically opened.

NOTE 1: "The structure of the gas passage can be automatically closed" refers to the structure that the gas passage can be automatically closed when the ignition is not ignited or the flame is extinguished.

NOTE 2: The "automatic re-ignition structure" refers to a structure in which the gas passage is not closed when the ignition is not ignited or extinguished but is re-ignited immediately. After the re-ignition is completed, the gas passage is automatically closed within a certain period of time.

Test method: According to the corresponding heat resistance level temperature specified in each burning appliance standard, put the sample in an incubator for 24h. Cool to room temperature after taking out. The air tightness test shall be carried out in accordance with Chapter 7 of this Standard. Perform switch operation to check for obstructions in use.

14.2 Ignition device

Test method: According to the corresponding heat resistance level temperature specified in each burning appliance standard, put the sample in an incubator for 24h. Cool to room temperature after taking out. The ignition performance test shall be carried out in accordance with Chapter 11 of this Standard.

14.3 Pressure regulator of burning appliance

Test method: According to the corresponding heat resistance level temperature specified in each burning appliance standard, put the regulator in an incubator for 24h. Cool to room temperature after taking out. Test according to 13.3a) and 13.3b).

15 Structure test

15.1 Vibration

Test method: Place the burning appliance horizontally on the vibrator according to the transport state. At a frequency of 10Hz, the full amplitude of 5mm is vibrated up and down, left and right for 30 minutes. The air tightness test shall be carried out in accordance with Chapter 7 of this Standard.

15.2 Tip over

Test method: Place the burning appliance horizontally on the test bench. It shall be gradually poured to the angle specified by each burning appliance standard. Visually check whether it is overturned; whether the parts that pose a fire hazard move or fall off.

16 Material property test

16.1 Heat resistance

Test method: Put the specimen into the heating furnace. Slowly raise the temperature to the temperature specified in the standard of each burning appliance within 30 minutes. Keep 1h at this temperature. Visually inspect the material for melting.

16.2 Corrosion resistance

16.2.1 Salt spray resistance test of electroplating specimen

Test method: Place the electroplating specimen in the specified saltwater spray equipment. Spray with 5% sodium chloride solution at a temperature of $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The sedimentation amount of sodium chloride is $1\text{ mL}/80\text{cm}^2 \cdot \text{h} \sim 2\text{ mL}/80\text{cm}^2 \cdot \text{h}$. The atomizing air pressure is $70\text{ kPa} \sim 100\text{ kPa}$. The time is stipulated by the standard of each burning appliance. After taking out the specimen, check the degree of corrosion. The test method shall be carried out according to QB/T 3826. Quality assessment shall be carried out in accordance with QB/T 3832.

16.2.2 Salt spray resistance test of painted specimen

Test method: Prepare the template according to the requirements of GB/T 1765. Place the template in the prescribed salt spray equipment. Spray with 5% sodium chloride solution at a temperature of $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The sedimentation amount of sodium chloride is $1\text{ mL}/80\text{cm}^2 \cdot \text{h} \sim 2\text{ mL}/80\text{cm}^2 \cdot \text{h}$. Time is according to the standard of each appliance. The test method is carried out according to the provisions of GB/T 1771. Evaluate the degree of corrosion according to GB/T 1740.

16.3 Gas resistance

16.3.1 Diaphragms, gas gaskets, washers

- a) Test method: Immerse the three specimens with pre-measured mass in n-pentane at a temperature of $5^{\circ}\text{C} \sim 25^{\circ}\text{C}$ for 72 h. Take it out and put it in the air for 24 hours. The mass change shall be tested according to GB/T 1690-2006. Artificial gas burning appliances shall be tested with solution "B" specified in GB/T 1690-2006.
- b) Specimen production: Diaphragms are standard with $10\text{ mm} \times 10\text{ mm}$. Small sealing gaskets and gaskets use integral immersion. For large sealing gaskets and washers, refer to the size of the diaphragm. The thickness is not limited.

16.3.2 Slurry, grease sealing material

Test method: Weigh about 1g of sealing material and apply it to the aluminum sheet. After being placed at room temperature for 24h, place it in the test equipment shown in Figure 3. Open cocks A and B. Replace the internal air with butane gas. Close cock B. Keep the gas pressure in the U-shaped pipe at 5kPa. Under the conditions of $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and $4^{\circ}\text{C} \pm 1^{\circ}\text{C}$, respectively place for 1 h. Then calculate the change rate of sealant quality, which shall be less than the specified value in each burning appliance standard.

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