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PROFESSIONAL STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

CJ/T 421-2013

Replace CJ/T 3074-1998

Electronic controller of household gas burning appliances

家用燃气燃烧器具电子控制器

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Foreword

This Standard was drafted according to the rules specified in GB/T 1.1-2009.

This Standard replaces CJ/T 3074-1998 *Electronic Controller of Household Gas Burning Appliances*.

This Standard is the revision of CJ/T 3074-1998 *Electronic Controller of Household Gas Burning Appliances*, and the main technical changes, compared with CJ/T 3074-1998, are as follows:

a) ADD the controller classification, DELETE the content of “model number” (see Chapter 4, Chapter 4 in 1998 version);

b) SUPPLEMENT the controller structure design requirements and circuit structure requirements for internal fault protection (see Chapter 5; 5.3 in 1998 version);

c) SUPPLEMENT the electrical safety and electromagnetic compatibility requirements (see 6.5, 6.6, Chapter 5 in 1998 version);

d) MODIFY the requirements for controller function and divided into different modules requirements according to function (see 6.1, 5.1, 5.2 in 1998 version);

e) MODIFY the requirements for thermal stress, continuous operating performance and internal fault protection (see 6.2, 6.3, 6.4; 5.1 in 1998 version);

f) MODIFY the special requirements for “battery-powered controller” (see Annex H, Chapter 5 in 1998 version);

g) DELETE the “salt fog test” and “vibration resistance test” (see 5.1 in 1998 version).

In order to maintain consistency with GB 16914-2012 *Technical Condition for Safety of Gas Burning Appliances*, this Standard provides corresponding table in Annex J to show those provisions in this Standard that support basic requirements of GB 16914-2012.

This Standard was proposed by Standard Rating Institute of Ministry of Housing and Urban-rural Development.

This Standard is under jurisdiction of Gas Technical Committee for Standardization of the Ministry of Housing and Urban-rural Development.

This Standard was drafted by organizations: Guangdong Vanward New Electric Co., Ltd., North China Municipal Engineering Design & Research Institute, Guangdong Macro Gas

Appliance Co., Ltd., Qingdao Economic & Technological Development Zone Haier Water Heater Co., Ltd., Sakura Bath & Kitchen Products (China) Co., Ltd., A.O. Smith (China) Water Heater Co., Ltd., Chengdu Qianfeng Electronic Co., Ltd., Zhejiang Dafeng Technology Co., Ltd., Guangdong Baiwei Electronics Co., Ltd., Beijing Viessmann Heating Technology Co., Ltd., Vaillant (Wuxi) Heating Equipment Co., Ltd., BSH Electrical Appliances (Jiangsu) Co., Ltd., Guangdong Huamei Junda Electric Appliances Co., Ltd., and Guangdong Midea Kitchen & Bathroom Appliance Manufacturing Co., Ltd.

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The previous version of the standard replaced by this Standard is as follows:

-- CJ/T 3074-1998.

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Electronic controller of household gas burning appliances

1 Scope

This Standard specifies terms and definitions, classification, structure, requirements, test methods, inspection rules, designation, installation and operation instructions, packaging, transportation and storage of electric controller (hereinafter referred as the controller) for household gas burning appliances that use urban gas specified in GB/T 13611.

This Standard applies to production and inspection of electric controller for household gas burning appliances.

2 Normative references

The articles contained in the following documents have become part of this Standard when they are quoted herein. For the dated documents so quoted, all the modifications (Including all corrections) or revisions made thereafter shall be applicable to this Standard.

GB/T 191 Packaging - Pictorial marking for handling of goods (GB/T 191-2008, ISO 780: 1997, MOD)

GB/T 2828 (All parts) Sampling procedures for inspection by attributes

GB 4706.1-2005 Household and similar electrical appliances-Safety - Part 1: General requirements (IEC 60335-1: 2004 (Ed4.1), IDT)

GB/T 13611 Classification and essential property of city gas

GB/T 14004 Fixed capacitors for use in electronic equipment - Part 6: Sectional specification fixed metallized polycarbonate film dielectric d.c. capacitors (GB/T 14004-1992, idt IEC 60384-6: 1987)

GB/T 14472 Fixed capacitors for use in electronic equipment - Part 14: Sectional specification Fixed capacitors for electromagnetic interference suppression and connection to the supply mains (GB/T 14472-1998, idt IEC 60384-14: 1993)

GB 14536.1-2008 Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1: 2003 (Ed3.1), IDT)

GB 14536.6-2008 Automatic electrical controls for household and similar use - Particular requirements for automatic electrical burner control systems (IEC 60730-2-5: 2004, IDT)

GB/T 17626.2 Electromagnetic compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test (GB/T 17626.2-2006, IEC 61000-4-2: 2001, IDT)

GB/T 17626.3 Electromagnetic compatibility - Testing and measurement techniques - Radiated radio-frequency electromagnetic field immunity test (GB/T 17626.3-2006, IEC 61000-4-3: 2002, IDT)

GB/T 17626.4 Electromagnetic compatibility - Testing and measurement techniques - Electrical fast transient/burst immunity test (GB/T 17626.4-2008, IEC 61000-4-4: 2004, IDT)

GB/T 17626.5 Electromagnetic compatibility - Testing and measurement techniques - Surge immunity test (GB/T 17626.5-2008, IEC 61000-4-5: 2005, IDT)

GB/T 17626.6 Electromagnetic compatibility - Testing and measurement techniques - Immunity to conducted disturbances induced by radio-frequency fields (GB/T 17626.6-2008, IEC 61000-4-6: 2006, IDT)

GB/T 17626.8 Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test (GB/T 17626.8-2006, IEC 61000-4-8: 2001, IDT)

GB/T 17626.11 Electromagnetic compatibility - Testing and measurement techniques - Voltage dips, short interruptions and voltage changes immunity tests (GB/T 17626.11-2008, IEC 61000-4-11: 2004, IDT)

GB/T 17626.28 Electromagnetic compatibility (EMC) - Testing and measurement techniques - Variation of power frequency immunity test (GB/T 17626.28-2006, IEC 61000-4-28: 2001, IDT)

GB 18802.1 Low-voltage surge protective devices - Part 1: Surge protective devices connected to low-voltage power distribution systems - Requirements and tests (GB 18802.1-2011, IEC 61643-1: 2005, MOD)

GB 19212.7 Safety of transformers, reactors, power supply units and similar products

for supply voltages up to 1 100 V - Part 7: Particular requirements and test for safety isolating transformers and power supply units incorporating safety isolating transformers (GB 19212.7-2012, IEC 61558-2-6: 2009, IDT)

GB/T 20438.2-2006 Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2: 2000, IDT)

GB/T 20438.7-2006 Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 7: Overview of techniques and measures (IEC 61508-7: 2000, IDT)

3 Terms and definitions

For the purpose of this Standard, those defined in GB/T 14536.1, GB 14536.6, GB/T 20438.4 and the following terms and definitions apply.

3.1 Terms and definitions related to burning control

3.1.1

Automatic burner control system

The control system consisted of components of programmable control device or un-programmable control device and flame detecting device, to enable the realization of control command issuance, start order control, burner operation monitoring and controlled shut-down generation; various functions of automatic burner control system may be designed within one or more control blocks.

3.1.2

Ignition safety time

Time interval from turn-on of gas valve to turn-off due to failure of flame signal detection.

3.1.3

Safety shut-down

Realize the gas cut-off through limiter, safety cut-off device or system internal fault inspection.

Note: Modified GB 14536.6-2008 and defined 2.3.122.

3.1.4

requirements:

a) Single channel with functional test;

b) Single channel with periodic self test;

c) Dual channel structure without comparison.

5.3.3 Circuit structure of Type C controller

Circuit structure of Type C controller shall at least meet one of the following structure requirements:

a) Single channel with periodic self test and monitoring;

b) Dual channel (homogeneous) with comparison;

c) Dual channel (diverse) with comparison.

Comparison between dual channel structures can be realized by the following methods:

-- By using of comparator;

-- By mutual comparison.

6 Requirements

6.1 Functional requirements

Various functions of the controller shall meet requirements specified under A. 3.1, B. 3.1, C. 3.1, D. 3.1, and E. 3.1.

6.2 Thermal stress requirements

6.2.1 Under normal use condition, electronic components of the controller shall be able to adapt to the cyclic change between the highest temperature and the lowest temperature.

Note: Temperature change may be generated due to environment temperature change, installation surface temperature change, supply voltage change, or the change from one operating state to another non-operating state, or from one non-operating sate to another operating state.

6.2.2 Under the load specified by manufacturer, perform the thermal stress test in accordance with test method specified in 7.3.

6.3 Requirements for continuous operating performance

6.3.1 The controller shall at least finish 250,000 times of cycle of normal start and

operation without fault.

6.3.2 For the controller components with uncertain operation cycle, select the shortest operation cycle and perform continuous operating performance test.

6.3.3 Under the load specified by manufacturer, perform continuous operating performance test in accordance with test method specified in 7.4.

6.4 Requirements for internal fault protection

For the controller with internal fault protection function, perform internal fault test in accordance with the following safety level requirements.

a) Type A controller

No requirement for internal fault safety protection for Type A controller.

b) Type B controller

Type B controller has self-protection function under single independent fault condition; carry out test in accordance with test method specified in 7.5.1, without considering the second independent fault. The controller failure shall be controlled in accordance with provisions in Annex F.

c) Type C controller

Type C controller has self-protection function under the first and the second independent fault condition; carry out test in accordance with test method specified in 7.5.2, without considering the third independent fault. The controller failure shall be controlled in accordance with provisions in Annex F.

6.5 The safety requirements for electrical components of the controller:

The controller shall meet the requirements specified in Chapter 8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, and 22 in GB 14536.6-2008, except for the requirements specified in 11.3.4, 11.3.103, 11.3.104, 11.3. 106-11.3.108, 11.4.101-11.4.106, 11.101, and 12.1.1

6.6 Electromagnetic compatibility of the controller

Electromagnetic compatibility of the controller shall meet the requirements specified in Annex G or H. 5.

7 Test methods

7.1 Test condition and allowable error

gases surrounding. Stacking height shall consider the endurable strength of packing box so as to prevent the damage of extrusion.

Annex A

(Normative)

Functional module of combustion control

A.1 Classification

The functional module of combustion control shall conform to Type B safety requirements; when cutting-off the valve, requirements of Annex D shall apply, and it shall conform to Type C safety requirements.

A.2 Structure

The structure of functional module of combustion control shall conform to the requirements of Chapter 5.

A.3 Requirements

A.3.1 Functional requirements

A.3.1.1 Requirement of safety time

A.3.1.1.1 Time adjustment

Clean time, waiting time, ignition safety time, response time for flame fault and delay time for accomplishing-locking are allowed to be adjusted, it requires the manufacturer to accomplish time adjustment.

A.3.1.1.2 Midway clean time and midway waiting time

For the systems with restart function, after an unsuccessful ignition, the midway clean time and midway waiting time before restarting shall conform to the statement made by manufacturer.

A.3.1.1.3 Before-clean time, after-clean time and waiting time

Before-clean time, after-clean time and waiting time shall be not less than that stated by manufacturer. When system having adjustable time, the measured value under 7.1 stipulations shall be regarded as reference value which shall be greater than the adjusted time.

A.3.1.1.4 Ignition safety time

Ignition safety time shall be no more than that stipulated by manufacturer. When system having adjustable time, the measured value under 7.1 stipulations shall be regarded as

reference value which shall be less than the adjusted time.

Note: This requirement is not applicable for the program-controlled devices without ignition safety time.

A.3.1.1.5 Flame fault response time

Unless there is otherwise stipulation of the accepted standard, the response time, from the disappearance of flame signal to outage of safety valve, shall conform to the statement of manufacturer who shall state the minimum flame induced current value.

A.3.1.1.6 Delay time of accomplishing locking

The system needs to enter the lock-out state after the safety shut-down, in which the delay time shall be less than 30s.

A.3.1.2 Device requirements for flame detection

a) Flame ionization detector uses flame signal rectified current; the manufacturer shall state the minimum value of flame signal rectified current.

b) Open circuit of sensor or its connected cable shall cause disappearance of the flame signal.

A.3.1.3 Requirements for locking and reset device

A.3.1.3.1 Locking function

Systems with locking function shall be tested each time they are started; the circuit shall be analyzed according to the related failure mode in Table H.11.12.7 of Annex I and GB 14536.1-2008. Except for mechanical switch, the locking function controlled by mechanical execution unit needs only one test. When the locking function fails to work, the system shall execute safety shut-down.

A.3.1.3.2 Reset device

a) In non-volatile lock-out state, manual operation shall be used to restart, such as reset button in the operating device and remote-controller.

b) Misuse or damage of the reset-device, regardless of the reset-device is part of the equipment or it is remote control, such as continuous operation of manual reset button or internal fault of reset-device, or wire short-circuit of reset-device or wire-to-ground short circuit, shall not cause the problem that the system operation does not conform to the

requirements of this Standard, or prevent the system from operating safety shut-down or entering lock-out state.

A.3.2 Thermal stress requirement

Requirement for thermal stress shall comply with 6.2.

A.3.3 Requirements for continuous operating performance

Requirement for continuous operation performance shall comply with 6.3.

A.3.4 Requirements for internal fault protection

Requirement for internal fault protection shall comply with 6.4 b) or c).

A.4 Test methods

A.4.1 Functional test

A.4.1.1 The safety time test

According to instructions of the manufacturer, energize the controller according to the voltage conditions stipulated in 7.2.1, test whether it complies with the requirements of A.3.1.1.

A.4.1.2 Flame detection device test

According to instructions of the manufacturer, energize the controller according to the voltage conditions stipulated in 7.2.1, test whether the flame induced current of flame detection device complies with the manufacturer’s statement. The sensor used in the test or the opening of its connecting cable shall cause the flame signal disappear, test whether it complies with the requirements of A.3.1.2.

A.4.1.3 Locking and reset device test

A.4.1.3.1 Locking function test

According to instructions of the manufacturer, energize the controller according to the voltage conditions stipulated in 7.2.1, and perform locking function inspection for every start, and analyze it according to the fault modes described in Annex I and Table H.11.12.7 of GB 14536.1-2008, test whether it complies with the requirements of A.3.1.3.1.

A.4.1.3.2 Reset device test

According to instructions of the manufacturer, energize the controller according to the

complete the internal fault protection test according to the test method stipulated in 7.5.2, and 7.5.1.1 c) is not applicable, and after the test, it shall comply with the internal fault protection requirement of B.3.4.

B.5 Electromagnetic compatibility

Electromagnetic compatibility shall comply with the requirements of Annex G.

B.6 Designation, installation and operation instruction

Designation, installation and operation instruction shall comply with the requirements of Chapter 9, and the manufacturer shall state the following contents:

a) Safety grade of the controller;

b) The maximum response time;

c) The minimum waiting time;

d) Critical value (including the error);

e) The limiting temperature of the sensor;

f) Fault response time.

Annex C

(Normative)

Reset functional module

C.1 Classification

The reset functional module shall comply with the Type B safety requirements.

C.2 Structure

The structure of reset functional module shall conform to the requirements of Chapter 5.

C.3 Requirements

C.3.1 Functional requirements

a) The system shall not accept the restart generated by automatic equipment, for example, timer, unless there is a special purpose;

b) The reset function can be performed by manual action, when using remote-controller to reset, the reset function shall be activated by at least two manual actions;

c) The fault of reset function shall not cause abnormal operation of the system, and the fault shall be detected prior to next reboot, and the faults shall not affect the system’s implementation of safe shutdown or entrance into the locking state;

d) The reboot action can be conducted for no more than 5 times within 15 min, and the reboot action for more than 5 times will not be executed;

e) If the reset function is activated by a manually-controlled thermostat or a device with similar function, its final purpose shall be declared by the manufacturer.

Note: Not all forms of reset functions are applicable, and these functions shall be selected based on their final purposes and the manufacturer's declaration.

C.3.2 Thermal stress requirement

Requirement for thermal stress shall comply with 6.2.

C3.3 Requirements for continuous operating performance

Requirements for continuous operating performance shall comply with 6.3.

C.3.4 Requirements for internal fault protection

Requirements for internal fault protection shall comply with 6.4b).

C.4 Test methods

C.4.1 Function test

According to the manufacturer's instruction, supply power to the controller according to the voltage conditions stipulated in 7.2.1, test whether it complies with the requirements of C.3.1.

C.4.2 Thermal stress test

The thermal stress test completed following the test method in 7.3 shall meet the thermal stress requirements of C. 3.2.

C.4.3 Continuous operating performance test

Complete the continuous operating performance test according to the test method stipulated in 7.4, and it shall comply with requirements for continuous operating performance of C.3.3.

C.4.4 Internal fault protection test

Reset function block shall complete the internal fault protection test according to the test method stipulated in 7.5.1, and it shall comply with the internal fault protection requirement of C.3.4.

C.5 Electromagnetic compatibility

Electromagnetic compatibility shall comply with the requirements of Annex G.

C.6 Designation, installation and operation instruction

Designation, installation and operation instruction shall comply with the requirements of Chapter 9, and the manufacturer shall state the following contents:

a) The response time of fault and the applicability of 7.5.1.1 c);

b) The reset function of manually-controlled thermostat (if applicable).

Annex D

(Normative)

The gas shutoff functional module

D.1 Classification

The gas shutoff functional module shall comply with the Class C safety requirements.

D.2 Structure

The structure of gas shutoff functional module shall comply with the requirements of Chapter 5.

D.3 Requirements

D.3.1 Functional requirements

The procedure shall be in compliance with the requirements of the specification.

D.3.2 Thermal stress requirement

Thermal stress requirement shall comply with 6.2.

D.3.3 Requirements for continuous operating performance

Requirements for continuous operating performance shall comply with 6.3.

D.3.4 Requirements for internal fault protection

Requirements for internal fault protection shall comply with 6.4.c).

D.4 Test method

D.4.1 Function test

According to the manufacturer’s instruction, supply power the controller according to the voltage conditions stipulated in 7.2.1, test whether it complies with the requirements of D.3.1

D.4.2 Thermal stress test

The thermal stress test completed following the test method in 7.3 shall meet the thermal stress requirements of D.3.2.

D.4.3 Continuous operating performance test

Complete the continuous operating performance test according to the test method stipulated in 7.4, and it shall comply with the requirements for continuous operating performance of D.3.3.

D.4.4 Internal fault protection test

Gas shutoff function block shall complete the internal fault protection test according to the test method stipulated in 7.5.2, 7.5.1.1c) is not applicable, and it shall comply with the internal fault protection requirement of D.3.4.

D.5. Electromagnetic compatibility

Electromagnetic compatibility shall comply with the requirements of Annex G.

D.6 Designation, installation and operation instruction

Designation, installation and operation instruction shall comply with the requirements of Chapter 9, and the manufacturer shall state the following contents:

a) The connection method and output characteristics;

b) Fault response time.

Designation, installation and operation instruction shall comply with the requirements of Chapter 9, and the manufacturer shall state the following contents:

a) Manufacturing errors;

b) The drifting value of set point;

c) The limiting temperature of the sensor;

d) Fault response time.

Annex F

(Normative)

The failure control technologies and measures of the functional safety-related systems

F.1 The technologies and measures for controlling hardware failure

The fault and failure of controlling hardware failure detected by the technologies and measures shall be in accordance with the provisions of Table A. 1 in GB/T 20438.2-2006, and the diagnostic techniques/measures of hardware shall be in accordance with the provisions of Table A.2~Table A.15 in GB/T 20438.2-2006. The specific content of the technologies and measures for controlling hardware failure shall be in accordance with the appropriate provisions of Appendix A in GB/T 20438.7-2006.

F.2 The technologies and measures for controlling system failure

The integrity of system safety shall be in accordance with the provisions of A.3 in GB/T 20438.2-2006, the technologies and measures for controlling system failure shall be in accordance with the provisions of Tables A.16- A.18 in GB/T 20438.2-2006, and the effectiveness of the technologies and measures for controlling system failure shall be in accordance with the provisions of Table A.19 in GB/T 20438.2-2006. The specific content of the technologies and measures for controlling system failure shall be in accordance with the corresponding provisions of Appendix A Appendix B and Appendix C in GB/T 20438.7-2006.

b) Test method:

The power frequency changing test shall be carried on the controller that is adopted the power frequency as synchronizing or comparative clock.

The appliance shall be connected to the power of the rated voltage, and the main power frequency rated value is 50 Hz. The controller implements a whole operating progress from starting to off, with the percentage of power frequency changing consistent with the regulations of G.3, and each power frequency point shall be carried on at least 3 times. The percentage of time changing related to safety in the controlling process shall not be over the percentage of the power frequency changing.

Table G.3 Supply frequency variation

Severe class:	The percentage of the power frequency changing				
	± 1%	± 2%	± 3%	± 4%	± 5%
2	√	√	--	--	--
3	--	--	√	√	√

G.4.2 Determination

-- When test is conducted according to the severe class 2, the controller shall be according to the requirements of Judgment Criterion I.

-- When test is conducted according to the severe class 3, the controller shall be according to the requirements of Judgment Criterion II.

G.5 Surge (shock) immunity

G.5.1 Surge immunity test

a) The test conditions and instruments shall meet the requirements of GB/T 17626.5.

b) Test method:

The appliance shall be connected to the power of the rated voltage, with both poles of the power connecting one pulse generator. When the voltage fluctuation mentioned in G.4 happens on the power end and related signal end of the appliance, 5 pulses shall be respectively imposed on the positive and negative poles of the appliance power within not less than 60s, with the pulses consistent with the requirement of G.4.

5 pulses respectively imposing on the positive and negative poles shall be provided in the following orders:

Annex H

(Normative)

Battery power controller

H.1 Scope

According to the provisions of Chapter 1, supplement the requirements of the applied battery supplying power to the controller. The quiescent current and stand-by power consumption of the battery power controller shall comply with the statements of the manufacturer.

H.2 Under environment temperature

According to the statement of manufacturer, complete the function test respectively in accordance with A.4.1, B.4.1, C.4.1, D.4.1, E.4.1 under requirements specified in 7.1 and under the following specified voltage condition:

a) Under rated voltage stated by manufacturer;

b) Under 75% of stated rated voltage;

c) Under 120% of stated rated voltage;

H.3 Thermal stress test

H.3.1 At output terminal, impose the load and rated power stated by manufacturer and carry out thermal stress test in accordance with the following requirements:

a) Carry out continuous operation under the following conditions:

-- Impose load according to the rated value stated by manufacturer, and then increase voltage to 110% of the rated voltage stated by manufacturer; during each 24h-test cycle, reduce the voltage to 90% of the rated voltage stated by manufacturer, and continue for 30min under this voltage. Voltage change shall not be synchronous with temperature change. Each 24h-test cycle shall at least contain one supply voltage interruption period of 30s.

-- Environment temperature changes within the range between the highest environment temperature stated by manufacturer or 60ºC (take the higher value) and the lowest environment or 0ºC (take the lower value), operating temperature for electrical components circulates between these two extreme temperatures. Environment

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