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


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

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


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
Defined state
The controller fault shall be in the state with one of the following characteristics:

a) The controller is forced to enter into a certain state in which the gas is cut off; when the cause that results in such safety state no longer exists, start it again only based on the specific requirement.

b) Within the specified time, the controller actively executes the protection action, safety shut-down or enters into locking state.

c) The controller operation shall meet all functional requirements relevant to safety.

3.1.5
Fault tolerating time
The maximum tolerating time from occurrence of burning appliances fault to shut-down of gas valve without causing damages.
Note: If the damages can be prevented, other safety actions may be accepted without turning off gas valve.

3.1.6
Fault response time
Within the fault tolerating time, the time from occurrence of the controller fault to entrance into defined state.

3.2 Terms and definitions related to circuit structure
3.2.1
Function block
The control system consisted of electrical/electronic devices with at least one input and one output, and with at least one special control function.

3.2.2
Single channel with functional test
One kind of single channel structure that guides the inspection data to the functional unit, before operation.

[GB 14536.1-2008, definition H. 2.16.5]

3.2.3
7.5 Internal fault protection test

7.5.1 Internal fault protection for Type B controller

7.5.1.1 First fault test

Import fault and carry out the test in accordance with requirements specified in Annex I and Table H. 11.12.7 in GB 14536.1-2008. The first fault that occurs in any component or any other fault caused by the first fault shall be in one of the following four states:

a) Operation of the controller is unachievable; all safety-related output terminals are cut off from power supply or switched to the defined state;

b) The controller performs safety shut-down or enters into locking state during the fault response time. If the controller is re-started from the locking state, it will re-enter into the locking state on the premise of existence of the same fault.

c) Continuous operation of the controller is performed, but the fault can be detected when it is re-started, and it enters into state a) or b);

d) The controller operation is performed normally; various functions shall meet requirements specified in this Standard.

Note 1: The fault is considered as the first fault that directly causes any other fault.

Note 2: The fault may occur in any stage of operation and program execution.

Note 3: Carry out inspection under the most unfavorable condition.

Note 4: Safety-related output terminal refers to the safety-related controlling output terminal in the safety shut-down state or locking state, such as gas valve drive.

7.5.1.2 Fault test during locking or safety shut-down period

Under the condition of without internal fault, make the controller in safety shut-down state or locking state, import internal fault and carry out the test in accordance with requirements specified in Annex I and Table H. 11.12.7 in GB 14536.1-2008. The first fault that occurs in any component or any other fault caused by the first fault shall be in one of the following four states:

a) The controller is maintained in the safety shut-down or locking state; all safety-related output terminals are maintained in the cut-off state.

b) The controller can not operate, and all power of the safety-related output terminals
shall cut off.
c) The controller re-starts operation, and enters into the state of a) or b), during which, the conduction time of safety-related output terminal shall not exceed the fault response time.
d) If cancelling the reasons causing the safety shut-down or locking state, the controller re-starts operation, then the safety of various functions shall comply with the requirements specified by this Standard.

7.5.2 Internal fault protection for Type C controller

7.5.2.1 First fault test
Import fault and carry out the test in accordance with requirements specified in Annex I and Table H.11.12.7 in GB 14536.1-2008. The first fault of any component or any other fault caused by the first fault shall meet the requirement of 7.5.1.1.

7.5.2.2 Second fault test
If the controller is in the state of 7.5.1.1 d) when testing the first fault, import the second fault and test it based on the requirements of Annex I and table H.11.12.7 of GB 14536.1-2008; usually, the second fault is any other independent fault related with the first fault. When testing, import the second fault when the first fault has been imported and the controller has been started; during the test of the second fault, the controller shall enter into one of the 4 states - a), b), c) or d) of 7.5.1.1.

7.5.2.3 Fault test during locking or safety shut-down period

7.5.2.3.1 Import the first fault during the locking or safety shut-down period
Under the condition of without internal fault, let the controller to be in safety shut-down or locking state, import internal fault and carry out the test in accordance with requirements specified in Annex I and Table H. 11.12.7 in GB 14536.1-2008. The first fault of any component or any other faults caused by the first fault shall meet the requirement of 7.5.1.2.

7.5.2.3.2 Import the second fault during the locking or safety shut-down period
If the controller is in the state of 7.5.1.2 d) when testing the first fault, import the second fault based on the requirements of Annex I and table H.11.12.7 in Annex H of GB
14536.1-2008 after the controller enters into the state of safety shut-down or locking again; during the test of the second fault, the controller shall enter into one of the four states, that is 7.5.1.2 a), b), c) or d).

8 Inspection rules

8.1 Exit-factory inspection

8.1.1 Exit-factory inspection items include the structure, safety project, function project, packaging and specification, etc.

8.1.2 When the products are in mass production, conduct the sample inspection according to the provisions of GB/T 2828 (all parts).

8.2 Type test

8.2.1 Type test items

The type test items of controller shall meet the requirements of chapter 5, 6, 7, and 8.

8.2.2 Type test information

The Type test information provided by the manufacturer shall at least include the following contents:

a) The supply voltage and frequency, and operating current used by the controller;

b) The maximum and minimum environment temperature for normal operation of the controller, and the operating life (the cycle index of the normal operating mode shall be at least 250,000 times);

c) The level of protection and the installation site of the controller;

d) List of programming sequence, and the detailed information for regulating range of program time (if applicable);

e) The adopted type of flame sensor, and the response current value of the flame declared by the manufacturer;

f) The complete circuit diagram with component list which shall provide the parameters of electronic components and the electrical rated values;

g) The description of switch operation which can cause burner control system re-started from locking state, such as the description of the temperature controller or similar device;
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).
Annex E
(Normative)

Temperature control function block

E.1 Classification

Temperature control function block shall comply with the Class A safety requirement, or Class B safety requirement or Class C safety requirement, and its safety class shall be determined according to its practical application.

E.2 Structure

The structure of temperature control function block shall conform to the requirements of Chapter 5.

E.3 Requirements

E.3.1 Functional requirement

E.3.1.1 Procedure requirements

The procedure shall be consistent with the description in the Instruction.

E.3.1.2 Requirement of safety action

a) When the temperature detected exceeds the set temperature for the protection action of sensor, the temperature control functional module will perform safe shutdown, unless otherwise specified by the manufacturer;
b) If the action of an external safety protection device is detected, the controller shall perform safe shutdown.

E.3.1.3 Critical value

The manufacturer shall state the following critical value and error:

a) Manufacturing errors
b) The drifting value of set point;
c) The limiting temperature of the sensor;
d) Fault response time.

E.3.2 Thermal stress requirement

Thermal stress requirement shall comply with 6.2.

E.3.3 Requirements for continuous operating performance
test point shall be chosen according to the requirement of GB/T 17626.2

Table G.8 Electrostatic discharge test voltage

<table>
<thead>
<tr>
<th>Severe class:</th>
<th>Contact discharge: /kV</th>
<th>Air discharge: /kV</th>
</tr>
</thead>
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<tr>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

G.9.2 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.10 Power frequency magnetic field immunity

G.10.1 Frequency magnetic fields immunity test

a) The test conditions and instruments shall meet GB/T 17626.8 requirements;

b) Test method:

Devices with Hall effects and other controllers that are likely to be affected by the magnetic field can be applied to bear the influence of the power frequency magnetic field. Appliances shall be connected to the power with rated voltage, and the test shall be conducted under the stipulated test condition.

Table G.9 Continuous magnetic field test level

<table>
<thead>
<tr>
<th>Severe class:</th>
<th>Magnetic field intensity/(A/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

G.10.2 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.
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
temperature change rate shall be 1°C/min, and maintained at extreme temperature point for about 1h. Occurrence of condensation shall be avoided during the test.

-- Carry out cyclic operation of controller according to normal operation mode (standby, start, operation), and one-operation is considered as one cycle; cycle rate shall not exceed 6 times/min, with a total of 45,000 times of operation.

b) Under the highest environment temperature stated by manufacturer or 60°C (take the higher value) and 120% of rated voltage stated by manufacturer, carry out cyclic operation of controller according to normal operation mode (standby, start, operation), one-operation is considered as one cycle; cyclic operation shall be performed for 2,500 times for at least 24h.

c) Under the lowest environment temperature stated by manufacturer or 0°C (take the lower value) and 75% of rated voltage stated by manufacturer, carry out cyclic operation of controller according to normal operation mode (standby, start, operation), one-operation is considered as one cycle; cyclic operation shall be performed for 2,500 times for at least 24h.

d) If safety-related function of controller is realized through safety action of sensor or switch, then it shall simulate the sensor or switch to start such safety action under environment temperature and rated voltage condition; separately test each safety-related function for action for 5,000 times or carry out the test in accordance with test times specified in current dedicated product standards of our nation.

H.3.2 When conducting H.3.1 a), b), c) and d) tests, carry out cyclic operation of controller according to normal operation mode (standby, start, operation); the period in which controller is maintained in operating state and the interruption period for control loop before repeating cycle shall be determined by manufacturer and testing organization upon negotiation.

Note: Through the negotiation between the manufacturer and the test agent, it is decided that the shortest time shall be chosen to conduct the test among all the safety related time to avoid unnecessary prolonging thermal stress time.

H.3.3 After the completion of thermal stress test, repeat the function tests under the
## Annex J  
(Informative)

**The corresponding clauses of this Standard supporting basic requirements of GB 16914-2012**

Table J.1 shows the corresponding table of this Standard clauses supporting the basic requirements of GB 16914-2012.

**Table J. 1 The corresponding clauses of this Standard supporting basic requirements of GB 16914-2012**

<table>
<thead>
<tr>
<th>GB 16914-2012 clauses</th>
<th>Content of basic requirements</th>
<th>Corresponding clauses of this Standard</th>
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<td>Safety warnings (on the gas appliances and packages)</td>
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<tr>
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