INTERNATIONAL STANDARD

ISO 23551-3

First edition
2005-03-15

Safety and control devices for gas burners and gas-burning appliances — Particular requirements —

Part 3: Gas/air ratio controls, pneumatic type

Dispositifs de commande et de sécurité pour brûleurs à gaz et appareils à gaz — Exigences particulières —

Partie 3: Dispositifs de régulation du rapport air/gaz, type pneumatique

Reference number
ISO 23551-3:2005(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 23551-3 was prepared by Technical Committee ISO/TC 161, *Control and protective devices for gas and oil burners and gas and oil burning appliances*.

ISO 23551 consists of the following parts, under the general title *Safety and control devices for gas burners and gas-burning appliances — Particular requirements*:

— *Part 1: Automatic valves*

— *Part 2: Pressure governors*

— *Part 3: Gas air/ratio controls, pneumatic type*

The following parts are under preparation:

— *Part 4: Valve-proving systems for automatic shut-off valves*

Introduction

This part of ISO 23551 is intended to be used in conjunction with ISO 23550:2004. It makes reference to clauses and subclauses of ISO 23550:2004 or adapts them by indicating “Addition” or “Modification” in its corresponding clauses or subclauses.

Safety and control devices for gas burners and gas-burning appliances — Particular requirements —

Part 3:
Gas/air ratio controls, pneumatic type

1 Scope

This part of ISO 23551 specifies the safety, construction and performance requirements for gas/air ratio controls, pneumatic type (hereafter referred to as “ratio control”), for inlet pressures up to and including 50 kPa, of a nominal connection size up to and including DN 250, intended for use with gas appliances using fuel gases as natural gas, manufactured gas or liquefied petroleum gas (LPG). It also describes the test procedures for evaluating these requirements and specifies information necessary for installation and use.

This part of ISO 23551 is applicable to gas/air ratio controls for gas-burning appliances that can be tested independently of the appliance. It is applicable to gas/air ratio controls which function by controlling a gas pressure (or differential pressure) output in response to an air pressure (or differential pressure) and to a furnace back pressure signal input; but gas/air ratio controls which change the air pressure in response to the gas pressure are not excluded.

This part of ISO 23551 is not applicable to mechanically linked valves and electronic systems.

NOTE Sections of this part of ISO 23551 can be applied to the construction and performance of the ratio control function of multi-functional controls.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 23550:2004, *Safety and control devices for gas burners and gas-burning appliances — General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 23550 and the following apply.

3.1
gas/air ratio control, pneumatic type
control which supplies gas at specified pressures (absolute or relative) at its outlet in response to pneumatic signals

3.2
signal pressure
pressure input applied to the ratio control in order to provide the specified gas outlet pressure

3.3
gas/air ratio
slope of a straight line relationship between the outlet pressure and signal pressure applied to the ratio control

3.4
furnace back pressure
pressure of combustion gases from the combustion chamber applied to the gas/air ratio control

3.5
maximum flow rate
maximum rate, as a function of inlet and outlet pressures, declared by the manufacturer and expressed in cubic metres per hour of air at standard conditions

3.6
minimum flow rate
minimum rate, as a function of inlet and outlet pressures, declared by the manufacturer and expressed in cubic metres per hour of air at standard conditions

3.7
signal chamber
part of the ratio control to which the air, gas or furnace back pressure signal inputs are connected

3.8
signal tube
impulse line
pipe that is used to convey pressure from part of an installation to the signal chamber

3.9
response time
maximum time taken for the outlet pressure to reach stable conditions in the opening or closing direction in response to a step change in signal pressure

3.10
zero adjustment
offset shift
adjustment of the ratio control at zero point before setting into operation

4 Classification

4.1 General

Ratio controls shall be classified and grouped in accordance with 4.2 and 4.3.

4.2 Classes of control

See 7.6.1.

4.3 Groups of controls

ISO 23550:2004, 4.2 applies.

5 Test conditions

ISO 23550:2004, Clause 5 applies.

6 Construction

6.1 General

ISO 23550:2004, 6.1 applies.

6.2 Construction requirements

ISO 23550:2004, 6.2 applies.

6.3 Materials

6.3.1 General material requirements

ISO 23550:2004, 6.3.1 applies.

6.3.2 Housing

6.3.2.1 Housing design

ISO 23550:2004, 6.3.2.1 applies.

Addition:

When a diaphragm separates parts of the housing from the gas-carrying compartment or from atmosphere then this is considered to be indirectly separated. Those parts shall be made from metallic material.

6.3.2.2 Test for leakage of housing after removal of non-metallic parts

Carry out the test according to ISO 23550:2004, 6.3.2.2.

Addition:

Rupture the diaphragm and remove all non-metallic parts of the housing which separate a gas-carrying compartment from the atmosphere, excluding O-rings, seals, gaskets and diaphragms. Pressurize the inlet and outlet(s) of the control to the maximum working pressure and measure the leakage rate.

6.3.3 Springs

6.3.3.1 Closure springs

ISO 23550:2004, 6.3.3.1 applies.

6.3.3.2 Springs providing closing force and sealing force

ISO 23550:2004, 6.3.3.2 applies.

6.3.4 Resistance to corrosion and surface protection

ISO 23550:2004, 6.3.4 applies.

6.3.5 Impregnation

ISO 23550:2004, 6.3.5 applies.

6.3.6 Seals for glands for moving parts

ISO 23550:2004, 6.3.6 applies.

6.4 Gas connections

6.4.1 Making connections

ISO 23550:2004, 6.4.1 applies.

Addition:

Signal tube connections

Details of connections for gas, air or other (e.g. furnace back pressure) signal tubes shall be declared by the manufacturer. For gas connections standard gas connection size shall be used.

All requirements except those in 6.4.3 and 6.4.5 are applicable for air connections and others.

6.4.2 Connection sizes

ISO 23550:2004, 6.4.2 applies.

6.4.3 Threads

ISO 23550:2004, 6.4.3 applies.

6.4.4 Union joints

ISO 23550:2004, 6.4.4 applies.

6.4.5 Flanges

ISO 23550:2004, 6.4.5 applies.

6.4.6 Compression fittings

ISO 23550:2004, 6.4.6 applies.

6.4.7 Nipples for pressure tests

ISO 23550:2004, 6.4.7 applies.

6.4.8 Strainers

ISO 23550:2004, 6.4.8 applies.

Addition:

Class J valves shall incorporate an inlet strainer. The maximum strainer hole dimension shall not exceed 0,28 mm and shall prevent the passage of a 0,2 mm diameter pin gauge.

Strainers fitted to valves of DN 25 and above shall be accessible for cleaning or replacement without removing the valve body pipe connections from the pipe work.

7 Performance

7.1 General

ISO 23550:2004, 7.1 applies.

7.2 Leak-tightness

7.2.1 Criteria

ISO 23550:2004, 7.2.1 applies with modification of Table 2 as follows:

Internal leakage rates are not applicable.

Addition to 7.2.1 of ISO 23550:2004:

7.2.1.1 Signal chambers

When tested in accordance with 7.2.1.2, leakage from the signal chambers shall not exceed 1 500 cm^3/h at the maximum signal pressure declared by the manufacturer under the following conditions:

a) in new condition;

b) after the tests specified in 7.3, 7.5, 7.6.5, 7.6.7 and 7.7.

7.2.1.2 Test of signal chamber leakage

With any bleed port incorporated in the signal connections or signal chamber plugged, the air signal containing parts are pressurized to the test pressure and the leakage rate measured.

The maximum air leakage of the signal chamber (as declared by the manufacturer) shall not affect the safe functioning of the control.

7.2.2 Test for leak-tightness

7.2.2.1 General

Carry out the test according to ISO 23550:2004, 7.2.2.1, with the following modification:

The test shall be carried out using a pressure equal to 1,5 times the maximum inlet pressure, but at least 15 kPa.

7.2.2.2 External leak-tightness

Carry out the test according to ISO 23550:2004, 7.2.2.2.

7.3 Torsion and bending

ISO 23550:2004, 7.3 applies.

7.4 Rated flow rate

Flow rate shall be declared by the manufacturer [see 9.2 f)].

7.5 Durability

ISO 23550:2004, 7.5 applies.

7.6 Functional requirements

7.6.1 Control performance

When tested in accordance with 7.6.2, the control performance shall be such that the output (gas pressure or differential pressure) is maintained within

Class A: ± 5 %

Class B: ± 15 %

Class C: ± 25 %

of the value declared by the manufacturer or ± 1 mbar, whichever is the greater, at all signal inputs (air pressure or differential pressure) within the range declared by the manufacturer. Where the manufacturer declares tighter tolerances, these shall be verified during testing.

NOTE These classes will also be referred to under 7.6.3.

7.6.2 Performance test

7.6.2.1 Test apparatus

Install the ratio control in a test apparatus as specified by the manufacturer.

The pipe lengths connected to the inlet and outlet of the ratio control shall be of the same DN as the ratio control and five times DN in length unless the installation instructions specify some other minimum value.

The accuracy of measurements of pressure, differential pressure and temperature shall be at least ± 2 % at minimum values of inlet pressure or differential pressure.

7.6.2.2 Control performance

Perform the test by recording the outlet pressure as the signal pressure is varied between maximum and minimum and back from minimum to maximum, at minimum inlet pressure and maximum flow rate as declared by the manufacturer, and with the zero adjustment as set by the manufacturer.

Then repeat the test at the maximum inlet pressure as declared by the manufacturer.

Conformity with 7.6.1 and 7.6.3 shall be checked.

7.6.3 Stability

For classes B and C, any continuous oscillation or hunting of the output (gas pressure or differential pressure) shall not exceed ± 10 % of the controlled output value at any point within the declared working range of the ratio control or ± 1 mbar, whichever is the greater, and shall not cause the output to fall outside the tolerance defined in 7.6.1.

7.6.4 Response time

When tested in accordance with 7.6.5, the response time value shall not exceed the value declared by the manufacturer.

7.6.5 Response time test

Increase the signal pressure from minimum to maximum over a period of 0,9 times the declared response time. Measure the time taken for the outlet pressure to reach stable conditions (within ± 5 %) from the instant the signal pressure reaches maximum.

Repeat the test with the signal pressure decreasing from maximum to minimum. Measure the time taken for the outlet pressure to reach stable conditions from the instant the signal pressure reaches minimum.

Perform the tests at minimum inlet pressure, with the ratio control set to maximum flow. Conformity with 7.6.4 shall be checked.

7.6.6 Gas/air pressure ratio adjustment

If the gas/air pressure ratio is adjustable, the ratio control shall function when the adjustment is at its extreme limits and the range of pressure ratios achieved shall cover the declared adjustment range when tested in accordance with 7.6.7.

7.6.7 Gas/air pressure ratio adjustment test

If the ratio control has an adjustable gas/air pressure ratio, additional tests shall be carried out in accordance with 7.6.6 at the maximum and minimum gas/air pressure ratio settings and conformity to 7.6.1, 7.6.3 and 7.6.4 shall be checked.

7.6.8 Zero adjustment (offset shift)

When tested in accordance with 7.6.9, the zero adjustment range shall cover that declared by the manufacturer.

7.6.9 Effect of zero adjustment

If zero adjustment is declared, its effect is checked for conformity to 7.6.8 in accordance with the manufacturer's instructions.

7.7 Endurance

7.7.1 Endurance requirement

After testing in accordance with 7.7.2, the leak-tightness and control performance shall meet the requirements of 7.2 and 7.6.1.

7.7.2 Test of endurance

Position the ratio control in a temperature-controlled cabinet with air supplies connected to the inlet and outlet connections as appropriate. A switched arrangement of valves shall be used, as appropriate to the function of the ratio control under test to operate the ratio control over its full range.

The test consists of 100 000 cycles: 50 000 at room temperature, 25 000 at the maximum declared ambient temperature and 25 000 at the minimum declared ambient temperature. Carry out the test under the worst conditions of inlet pressure and flow rate to ensure that the ratio control is working over its whole range.

A cycle shall consist of varying the signal pressure from minimum to maximum and back to minimum.

Provided that the ratio control operates over its full range it is not necessary for the cycle time to be equal to the response time.

In addition, where the ratio control incorporates an electric motor which could be required to run continuously, the motor shall be run continuously for a period of 1 000 h at the maximum declared ambient temperature.

8 EMC/electrical requirements

Ratio controls shall comply with ISO 23550:2004, 8.11.

ISO 23550:2004, 8.1 to 8.10 are not applicable.

9 Marking, installation and operating instructions

9.1 Marking

Ratio controls shall comply with ISO 23550:2004, Clause 9, with the following modification.

The following information, at least, shall be durably marked on the ratio control in a clearly visible position:

a) manufacturer and/or trade mark;

b) model designation;

c) date-code;

d) maximum inlet pressure;

e) direction of gas flow, by an arrow (e.g. cast or embossed);

f) identification of signal ports;

g) electrical supply details (where applicable).

9.2 Installation and operating instructions

The instructions provided with the control shall include the following relevant information:

a) gas/air pressure ratio — nominal value or adjustment range if variable;

b) zero adjustment range;

c) minimum and maximum signal pressure;

d) minimum and maximum outlet pressure;

e) minimum and maximum inlet pressure;

f) minimum and maximum flow rate;

g) response time(s);

h) ambient temperature range;

i) recommendations for inlet pressure regulation (if any);

j) recommendations for size/length/position of signal tubes;