BS EN 16678:2015

BSI Standards Publication

Safety and control devices for gas burners and gas burning appliances — Automatic shut-off valves for operating pressure of above 500 kPa up to and including 6 300 kPa

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee GSE/22, Safety and control devices for gas and oil burners and gas burning appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Safety and control devices for gas burners and gas burning appliances - Automatic shut-off valves for operating pressure of above 500 kPa up to and including 6 300 kPa

Équipements auxiliaires pour brûleurs à gaz et appareils à gaz - Robinets automatiques de sectionnement pour pression de service supérieure à 500 kPa et inférieure ou égale à 6 300 kPa

Sicherheits- und Regeleinrichtungen für Gasbrenner und Gasbrennstoffgeräte - Automatische Absperrventile für einen Betriebsdruck über 500 kPa bis einschließlich 6 300 kPa

This European Standard was approved by CEN on 19 September 2015.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 16678:2015) has been prepared by Technical Committee CEN/TC 58 “Safety and control devices for burners and appliances burning gaseous or liquid fuels”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives 2009/142/EC and 97/23/EC.

For relationship with EU Directives, see informative Annexes ZA and ZB, which are an integral part of this document.

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1 Scope

This European Standard specifies the safety, design, construction and performance requirements and testing for automatic shut-off valves with or without modulating control functions (hereafter referred to as 'valves') for burners and appliances burning one or more gaseous fuels according to EN 437:2003+A1:2009.

This European Standard is applicable to valves with declared maximum inlet pressures of more than 500 kPa (5 bar) and up to and including 6 300 kPa (63 bar).

This European Standard is applicable to

— electrically operated valves and to valves actuated by fluids including the pilot valves for these fluids if actuated electrically and including release valves, but not to any external electrical devices for switching the actuating energy;

— automatic shut-off valves where the flow rate is controlled by external electrical signals proportional to the applied signal.

This European Standard is not applicable to valves specifically designed for use in transmission and distribution networks.

NOTE Provisions for final product inspection and testing by the manufacturer are not specified.

2 Normative references

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

EN 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*

EN 549:1994, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 682:2002, *Elastomeric Seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 1092-1:2007+A1:2013, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1092-2:1997, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1092-3:2003, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges*

EN 1092-4:2002, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 4: Aluminium alloy flanges*

EN 1759-1:2004, *Flanges and their joint — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 1759-3:2003, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 3: Copper alloy flanges*

EN 1759-4:2003, *Flanges and their joint — Circular flanges for pipes, valves, fittings and accessories, class designated — Part 4: Aluminium alloy flanges*

EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads — Part 1: Taper external threads and parallel internal threads — Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads — Part 2: Taper external threads and taper internal threads — Dimensions, tolerances and designation*

EN 12516-1:2014, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*

EN 12516-2:2014, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*

EN 12516-3:2002, *Valves — Shell design strength — Part 3: Experimental method*

EN 12516-4:2014, *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured in metallic materials other than steel*

EN 12627:1999, *Industrial valves — Butt welding ends for steel valves*

EN 12760:1999, *Valves — Socket welding ends for steel valves*

EN 13611:2007+A2:2011, *Safety and control devices for gas burners and gas burning appliances — General requirements*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60730-1:2011, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:2010)*

EN 61058-1:2002, *Switches for appliances — Part 1: General requirements (IEC 61058-1:2000)*

EN 175301-803:2006, *Detail Specification: Rectangular connectors — Flat contacts, 0,8 mm thickness, locking screw not detachable*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 8573-1:2010, *Compressed air — Part 1: Contaminants and purity classes*

3 Terms and definitions

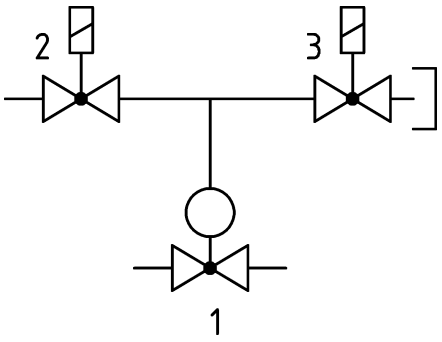
For the purposes of this document, the terms and definitions given in EN 13611:2007+A2:2011, EN 161:2011+A3:2013, and the following apply.

3.101
pilot valve
valve which controls the fluid (e.g. compressed air) supplied to the actuating mechanism

Note 1 to entry: A typical pilot and release valve application is shown in Figure 1.

3.102
release valve
valve in the line from the pilot valve to the actuating mechanism which closes the vent automatically when the actuating fluid is released by the pilot valve and opens it automatically when the pilot valve is closed

Note 1 to entry: A typical pilot and release valve application is shown in Figure 1.



Key

1 control under test

2 pilot valve (normally closed)

3 release valve, normally open

Figure 1 — Typical pilot and release valve application

3.103
maximum allowable pressure
PS
maximum pressure for which the body, its inner metallic partition walls and some other pressure containing parts are designed

3.104
specific maximum allowable pressure
PS_d
differential pressure between pressure containing parts with different maximum allowable pressures

4 Classification

4.1 Classes of control

EN 13611:2007+A2:2011, 4.1 is replaced by the following:

— Class A valves

Valves where the sealing force is not decreased by the gas inlet pressure. They are classified A according to the sealing force requirements of 7.105. Balanced valves according to this standard are Class A valves.

— Class D valves

Valves which are not subject to the requirements for the sealing force and fixed closing time.

4.2 Groups of control

Shall be according to EN 13611:2007+A2:2011, 4.2.

4.3 Classes of control functions

EN 13611:2007+A2:2011, 4.3 is not applicable.

5 Units of measurement and test conditions

Shall be according to EN 13611:2007+A2:2011, Clause 5.

6 Construction requirements

6.1 General

Shall be according to EN 13611:2007+A2:2011, 6.1 with the following addition:

If an automatic shut-off valve requires a release and/or a pilot valve to fulfil the requirements of this standard, these are considered to be part of the automatic shut-off valve and shall be specified in the installation and operating instructions. The combination of automatic shut-off valve and release and/or pilot valve shall conform to all requirements of this standard.

The interaction of all valves participating in the closing mechanism shall be evaluated. An appropriate risk assessment shall be carried out.

For each pressurized compartment the local maximum pressure shall be considered for the strength design and for the selection of the material. It shall be ensured by mechanical means that parts for different pressures are separated. A diaphragm shall not be used for this purpose.

6.2 Mechanical parts of the control

6.2.1 Appearance

Shall be according to EN 13611:2007+A2:2011, 6.2.1.

6.2.2 Holes

Shall be according to EN 13611:2007+A2:2011, 6.2.2.

6.2.3 Breather holes

EN 13611:2007+A2:2011, 6.2.3 is not applicable.

6.2.4 Test for leakage of breather holes

EN 13611:2007+A2:2011, 6.2.4 is not applicable.

6.2.5 Screwed fastenings

EN 13611:2007+A2:2011, 6.2.5 is replaced by the following:

Screwed fastenings shall be specified in the installations and operating instructions.

Self-tapping screws which cut a thread and produce swarf shall not be used for connecting gas-carrying parts or parts which can be removed for service.

Self-tapping screws which form a thread and do not produce swarf may be used provided that they can be replaced by metric machine screws.

6.2.6 Jointing

Shall be according to EN 13611:2007+A2:2011, 6.2.6.

6.2.7 Moving parts

Shall be according to EN 13611:2007+A2:2011, 6.2.7 with the following addition:

There shall be no exposed shafts or operating levers which could adversely affect the ability of valves to close by unintended blockage.

6.2.8 Sealing caps

Shall be according to EN 13611:2007+A2:2011, 6.2.8.

6.2.9 Dismantling and reassembly

Shall be according to EN 13611:2007+A2:2011, 6.2.9.

6.2.101 Closed position indicator switch

Closed position indicator switches, where fitted, shall not impair the correct operation of valves. Adjusters shall be sealed to indicate interference. Any drift of the switch and actuating mechanism from its setting shall not impair correct valve operation.

6.2.102 Valve with modulating control

Flow rates of valves with modulating control shall be adjustable over the full range as stated in the installation and operating instructions. If the adjustment of one flow rate affects the setting of any other flow rate, this shall be clearly stated in the installation and operating instructions. The setting of any flow rate shall require the use of mechanical or electrical tools and shall be designed to discourage unauthorized adjustment.

6.2.103 Other controls assembled to a valve

Other controls assembled to a valve shall not interfere with its shut-off function.

6.2.104 Balanced valves

The closure member of a balanced valve shall have a resulting force in the closing direction where the sealing force is not decreased by the gas inlet pressure.

For a balanced valve with one single valve seat a resulting force in the closing direction shall remain, if the balancing force is removed. The closure member shall have the same closing direction as the flow direction through the valve.

6.2.105 Additional requirements for shut-off function

6.2.105.1 Diaphragms that assist the shut-off function

Shut-off functions using a diaphragm to apply (part of) the closing force to the closure member shall be designed in such a way that, when the diaphragm is damaged, the closure member closes and the maximum internal leakage rate of the valve is limited to 1 dm^3/h. Conformity shall be verified by the method given in 6.2.105.2.

6.2.105.2 Leakage test

Rupture the diaphragm assisting the shut-off function. De-energize the valve. Measure the internal leakage rate of the valve according to EN 161:2011+A3:2013, 7.3.3.

6.3 Materials

6.3.1 General material requirements

Shall be according to EN 13611:2007+A2:2011, 6.3.1 and Annex F.

6.3.2 Housing

EN 13611:2007+A2:2011, 6.3.2 is replaced by the following:

Parts of the housing which directly or indirectly separate a gas-carrying compartment from atmosphere shall be made from metallic materials.

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

EN 13611:2007+A2:2011, 6.3.3 is not applicable.

6.3.4 Zinc alloys

EN 13611:2007+A2:2011, 6.3.4 is not applicable.

6.3.5 Springs providing closing and/or sealing force

Shall be according to EN 13611:2007+A2:2011, 6.3.5 with the following addition.

This requirement applies also for pilot and release valves for pneumatic or hydraulic actuators.

6.3.6 Resistance to corrosion and surface protection

Shall be according to EN 13611:2007+A2:2011, 6.3.6.

6.3.7 Impregnation

EN 13611:2007+A2:2011, 6.3.7 is replaced by the following.

Valves conforming to this standard shall not be impregnated.

6.3.8 Seals for glands for moving parts

Shall be according to EN 13611:2007+A2:2011, 6.3.8.

6.3.101 Closure members

Closure members of valves shall either have a mechanical support (e.g. metallic) to withstand the sealing force or shall be made of metal.

6.3.102 Parts transmitting the closing force

Parts transmitting the closing force shall be made of metal and shall be designed to withstand a force equal to 5 times the closing force.

6.3.103 Balanced valves

The strength of the connection between closure members of a balanced valve shall be at least five multiplied by the maximum inlet pressure multiplied by the total opening area of the closure members.

6.3.104 Bellows

When bellows are used as sealing elements proof of limiting fatigue stress shall be provided for at least the number of cycles stated in Table 4.

For the calculation not less than the number of cycles as stated in Table 4 shall be taken for the respective nominal widths.

NOTE As calculation basis EN 14917:2009+A1:2012 or comparable methods may be used.

6.3.105 Resistance to pressure

6.3.105.1 Requirement

Parts of the valve that are subjected to inlet pressure under normal operating conditions, or could be subjected to inlet pressure in the event of a failure, shall resist a pressure equal to the maximum allowable withstand pressure (PS) multiplied by a safety factor F according to Table 1. Pressure containing parts, including those that become pressure containing parts in case of a diaphragm or differential pressure seal failure and inner metallic partition walls shall be pressure tested.

After the test according to 6.3.105.2 there shall be no leakage or loss of safety function.

Table 1 — Minimum value of safety factor F

Group of materials	Minimum value of safety factor F	
		For parts of the body stressed by forces from torque and bending moments (pipelines) only
Rolled and forged steel	1,70	2,13
Cast steel	2,00	2,50
Spheroidal graphite cast iron and malleable cast iron	2,50	3,13
Copper-zinc wrought alloys and aluminium alloys	2,00	2,50
Copper-tin cast alloys and copper-zinc cast alloys	2,50	3,13
Aluminium cast alloys Amin 4 %	2,50	3,13
Aluminium cast alloys Amin 1,5 %	3,20	4,00

6.3.105.2 Test

The hydrostatic pressure test is conducted after leakage and function tests.

The test is carried out in such a manner that deformations of the test sample in all directions are possible. There shall be no additional stresses due to bending, torque or tension.

The test is carried out with water at ambient temperature at a pressure according to the values in Table 1 for 5 min.

The test may also be carried out with air or nitrogen, if the necessary safety measures are taken.

Chambers separated by diaphragms are pressurized on both sides of the diaphragm at equal pressure.

6.4 Gas connections

6.4.1 Making connections

Shall be according to EN 13611:2007+A2:2011, 6.4.1 with the following addition:

If the valve is equipped with welding ends for welding to the pipe, EN 13611:2007+A2:2011, 6.4.1 is not applicable.

6.4.2 Connection sizes

Shall be according to EN 13611:2007+A2:2011, 6.4.2.

6.4.3 Threads

EN 13611:2007+A2:2011, 6.4.3 is replaced by the following:

Inlet and outlet threads shall be according to EN 10226-1:2004 or EN 10226-2:2005 and shall be chosen from EN 13611:2007+A2:2011, Table 3. Threads shall only be used for valves up to DN 25 for inlet pressures not greater than 2 500 kPa (25 bar).

6.4.4 Union joints

Shall be according to EN 13611:2007+A2:2011, 6.4.4.

6.4.5 Flanges

Shall be according to EN 13611:2007+A2:2011, 6.4.5 with the following addition:

Also flanges according to EN 1092-1:2007+A1:2013, EN 1092-2:1997, EN 1092-3:2003, EN 1092-4:2002, EN 1759-1:2004, EN 1759-3:2003 and EN 1759-4:2003 may be used.

6.4.6 Compression fittings

Shall be according to EN 13611:2007+A2:2011, 6.4.6 with the following addition:

The use of compression fittings is limited to valves up to an including DN 25.

6.4.7 Nipples for pressure test

EN 13611:2007+A2:2011, 6.4.7 is replaced by the following:

Nipples for pressure tests shall not be used.

6.4.8 Strainers

Shall be according to EN 13611:2007+A2:2011, 6.4.8 with the following addition:

Where an inlet strainer is fitted to Class A, D and E valve, the maximum strainer hole dimension shall not exceed 1,5 mm and it shall prevent the passage of a 1 mm diameter pin gauge.

Strainers fitted to valves of DN 25 and above shall be accessible for cleaning or replacement without making it necessary to remove the valve body by dismantling threaded or welded pipework.

6.4.101 Welded connections

If connections are made by welding using welding ends, these welding ends shall be according to EN 12627:1999 or EN 12760:1999.

6.5 Electrical parts of the control

6.5.1 General

Shall be according to EN 13611:2007+A2:2011, 6.5.1.

6.5.2 Switching elements

EN 13611:2007+A2:2011, 6.5.2 is not applicable.

6.5.3 Electrical components

Shall be according to EN 13611:2007+A2:2011, 6.5.3.

6.6 Protection against internal faults for the purpose of functional safety

6.6.1 Design and construction requirements

Shall be according to EN 13611:2007+A2:2011, 6.6.1.

6.6.2 Class A

Shall be according to EN 13611:2007+A2:2011, 6.6.2.

6.6.3 Class B

Shall be according to EN 13611:2007+A2:2011, 6.6.3.

6.6.4 Class C

Shall be according to EN 13611:2007+A2:2011, 6.6.4.

6.6.5 Circuit and construction evaluation

Shall be according to EN 13611:2007+A2:2011, 6.6.5.

6.101 Pneumatic and hydraulic actuating mechanisms

Pneumatic or hydraulic actuated valves shall be provided with protection to ensure that the blockage of an orifice in the control system does not adversely affect the performance requirements as given in Clause 7.

If the performance of the actuating mechanism depends on the quality of compressed air or hydraulic fluid, appropriate information shall be given in the installation and operating instructions.

7 Performance

7.1 General

Shall be according to EN 13611:2007+A2:2011, 7.1 with the following addition:

Where valves are specified for using pilot and/or release valves the assembly shall fulfil all performance requirements and tests.

Valves shall close automatically when de-energized or in the absence of actuating energy.

Valves with DC supplies shall operate correctly from the minimum rated voltage to the maximum rated voltage, as stated in the installation and operating instructions.

For DC supplies Type A, B, and C according to Annex I, a tolerance of ± 20 % to the minimum and the maximum rated voltage applies. For DC supplies of other types the tolerance shall be stated in the installation and operating instructions.

The closing of pneumatic or hydraulic actuated valves shall be ensured over the range from 85 % to 110 % of the actuating pressure or pressure range as stated in the installation and operating instructions.

7.2 Leak-tightness

Shall be according to EN 13611:2007+A2:2011, 7.2.

7.3 Test for leak-tightness

EN 13611:2007+A2:2011, 7.3 is replaced by the following:

The limits of error of the apparatus used shall be ± 1 cm^3, 10 Pa (± 0,1 mbar) for test pressure up to 1 kPa (10 mbar) and 2 % for test pressure ≥750 kPa (7,5 bar).

The uncertainty of measurement of leakage rates shall be within ± 5 cm^3/h.

For internal leakage of closure members carry out the tests with an initial test pressure of 0,6 kPa (6 mbar). Then for internal leakage repeat the tests at 1,1 times the maximum inlet pressure or 750 kPa (7,5 bar), whichever is greater. For external leakage the test pressure is 1,5 times the maximum inlet pressure.

If the valve consists of several compartments with different pressures, the external leakage test is conducted for each compartment at 1,5 times maximum pressure.

The test fluid shall be air or suitable gas, e.g. nitrogen. The test duration shall be at least 1 h.

Use a method which gives reproducible results. Examples of such methods are shown in:

— Annex B (volumetric method) for test pressures up to and including 15 kPa (150 mbar);

— Annex C (pressure loss method) for test pressures above 15 kPa (150 mbar). The formula for conversion from the pressure loss method to the volumetric method is given in Annex D;

— EN 12266-1:2012, A.3.2.1 for external leakage;

— EN 12266-1:2012, Table A.3 for internal leakage. Test pressure is applied in the direction of flow as stated in the installation and operating instructions.

7.4 Torsion and bending

Shall be according to EN 13611:2007+A2:2011, 7.4 with the following modification.

For valves with housing designed according to EN 12516-1:2014, EN 12516-2:2014, EN 12516-3:2002 and EN 12516-4:2014 and valves for installation between flanges with wafer or lug type housing no test for torsion and bending is applied.

7.5 Torsion and bending tests

Shall be according to EN 13611:2007+A2:2011, 7.5.

7.6 Rated flow rate

EN 13611:2007+A2:2011, 7.6 is not applicable.

7.7 Test for rated flow rate

EN 13611:2007+A2:2011, 7.7 is not applicable.

7.8 Durability

7.8.1 Elastomers in contact with gas

EN 13611:2007+A2:2011, 7.8.1 is replaced by the following:

Elastomers in contact with gas (e.g. valve pads, O-rings, diaphragms and lip seals) shall comply with requirements and tests given in EN 682:2002.

Alternatively EN 549:1994 may be used, in which case the following additional requirements of Table 2 apply.

Table 2 — Test method and acceptance criteria referred to the properties of elastomeric materials

Property	test method		Unit	range of hardness IRHD[a]				
				≥45 to 55	>55 to 65	>65 to 75	>75 to 85	>85
	reference standard	test conditions		acceptance criteria				
accelerated ageing	ISO 188	change in hardness at (70 ± 1) °C for (168 ± 2) h	%	± 10	± 10	± 10	± 10	± 10
		change in tensile strength at (70 ± 1) °C for (168 ± 2) h		± 15	± 15	± 15	± 15	± 15
		change in elongation at break at (70 ± 1) °C for (168 ± 2) h		from 10 to -25	from 10 to -25	from 10 to -25	from 10 to -25	from 10 to -25
resistance to gas	ISO 1817	change in volume after immersion in liquid B at (23 ± 2) °C after (72 + 0/-2) h	%	≤40	≤40	≤30	≤30	≤25
		change in volume after immersion in liquid B at (40 ± 1) °C for 7 days ± 2 h and after drying		≥-20	≥-17	≥-15	≥-15	≥-15
Resistance to lubricant	ISO 1817	change in hardness after immersion in oil N. 3 (IRM 903) at (70 ± 1)°C for 7 days ± 2 h	%	± 10	± 10	± 10	± 10	± 10
		change in volume after immersion in oil N. 3 (IRM 903) as above		from 15 to -5	from 15 to -5	from 15 to -5	from 15 to -5	from 15 to -5
Resistance to ozone cracking	ISO 1431-1	Procedure A: strain the test pieces at (10 ± 1)% elongation with ozone concentration (25 ± 5) pphm at (30 ± 2) °C for 24 h						

[a] For equivalence between the hardness IRHD and shore see in "Roger Brown, Physical Testing of Rubber, 4th Edition, Springer Science + Business Media, Inc. – Clause 4 "Hardness" – sub-clause 4.4 "Accuracy and comparison of hardness tests".

7.8.2 Marking

Shall be according to EN 13611:2007+A2:2011, 7.8.2.

7.8.3 Tests for marking

Shall be according to EN 13611:2007+A2:2011, 7.8.3.

7.8.4 Resistance to scratching

Shall be according to EN 13611:2007+A2:2011, 7.8.4.

7.8.5 Scratch test

Shall be according to EN 13611:2007+A2:2011, 7.8.5.

7.8.6 Resistance to humidity

Shall be according to EN 13611:2007+A2:2011, 7.8.6.

7.8.7 Humidity test

Shall be according to EN 13611:2007+A2:2011, 7.8.7.

7.9 Performance test for electronic controls

Shall be according to EN 13611:2007+A2:2011, 7.9.

7.10 Long-term performance for electronic controls

Shall be according to EN 13611:2007+A2:2011, 7.10.

7.101 Closing function concerning remanence

7.101.1 Requirement

Valves shall close automatically on reducing the voltage or current to 15 % of the minimum rated value.

Valves with pneumatic or hydraulic actuating mechanisms shall close automatically on reducing the voltage or current to 15 % of the minimum rated voltage of the pilot valve.

Valves shall close automatically on removal of the voltage or current of between 15 % of the minimum rated value and the maximum rated value including the tolerance according to 7.1.

In all cases, the closing time shall be in accordance with 7.104.

7.101.2 Test of closing function

Energize the valve at the maximum rated voltage or current and at the maximum actuating pressure, if applicable. Slowly reduce the voltage or current to 15 % of the minimum rated value. Verify that the valve has closed.

Energize the valve at the maximum rated voltage or current and at the maximum actuating pressure, if applicable. Increase the voltage or current to the maximum rated value increased by the tolerance according to 7.1, keeping the actuating pressure, if any, unchanged. De-energize the valve and verify that it has closed. For AC valves, remove the voltage at the peak of the current waveform.

Energize the valve at the maximum rated voltage or current and at the maximum actuating pressure, if applicable. Reduce the voltage or current to a value between 15 % of the minimum rated value and the maximum rated value decreased by the tolerance according to 7.1, keeping the actuating pressure, if any, unchanged. De-energize the valve and verify that it has closed. Carry out this test at 3 different voltages or currents between 15 % of the minimum rated value and the maximum rated value decreased by the tolerance according to 7.1.

7.102 Closing force

7.102.1 Requirement

Valves with sealing force independent of the closing force (e.g. ball, guillotine valves etc.) shall have a closing force of:

— at least 5 times the value of the frictional force where the frictional force is up to and including 5 N;

— at least 2,5 times the value of the frictional force but at least 25 N where the frictional force is above 5 N.

The frictional force is measured in the ungreased condition.

This requirement also applies to disc-on-seat valves.

7.102.2 Test of closing force

This measurement is carried out in the ungreased condition.

Measure the minimum closing force over the travel of the closure member from the open position to the closed position.

Remove the spring(s) providing the closing force from the valve and measure the maximum force required to move the closure member from the open position to the closed position.

7.103 Delay time and opening time

7.103.1 Requirement

The deviation of the delay time and the opening time before and after the endurance test shall be within ± 20 % of the initial measured delay and opening time

7.103.2 Test of delay time and opening time

Measure the time interval between energizing the valve and the start of the release of the closure member.

Measure the time interval between energizing the valve and the attainment of the fully open position.

Carry out the tests under the following conditions, allowing the de-energized valve to reach thermal equilibrium before carrying out the tests:

— at 20 °C at the maximum inlet pressure, at the minimum rated voltage or current increased by the tolerance according to 7.1, and at the minimum actuating pressure, if applicable.

7.104 Closing time

7.104.1 Requirement

The closing time for valves shall not exceed 1 s when tested in accordance with 7.104.2 except the closing time for Class D valves shall not exceed the values stated in the installation and operating instructions.

7.104.2 Test of closing time

Measure the time interval between de-energizing the valve and the closure member attaining the closed position, under the following conditions: at the maximum inlet pressure, at the maximum rated voltage or current increased by the tolerance according to 7.1, and at the maximum actuating pressure, if applicable.

7.105 Sealing force

7.105.1 Requirement

Class A valves shall have a minimum sealing force over the closure member orifice area in accordance with Table 3 when tested to 7.105.2.

Table 3 — Sealing force requirements

Valve	Test pressure kPa (mbar)	Maximum leakage rate
Class A	15 (150)	For internal leak-tightness see values 7.3

The test pressure opposing the flow direction is given in Table 3 and tested to 7.105.2.

For balanced valves with more than one opening of the closure member the force of the closing spring shall be calculated to be at least 50 % of the total opening area multiplied by 50 kPa (500 mbar) multiplied by 1,25.

Balanced valves with one valve seat shall have a minimum sealing force over the closure member orifice area according the declared class in Table 3. This sealing force shall be provided only by the closing spring, and shall be tested according to 7.105.2.1 and 7.105.2.2.

The test pressure opposing the flow direction for balanced valves with more than one opening of the closure member is 30 kPa (300 mbar).

Where the test methods of 7.105.2 are unsuitable for other designs of valve, the sealing force shall be verified by calculation or by a combined method of test and calculation. The minimum sealing force is calculated using pressures equal to 1,25 times the values given in Table 2, as appropriate to the class of valve.

7.105.2 Test of sealing force

7.105.2.1 General

Connect an air supply through a flow meter to the outlet of the valve such that the air pressure opposes the closing direction of the closure member.

Energize and de-energize the valve twice.

7.105.2.2 Class A valve

Pressurize the valve slowly to the appropriate pressure given in Table 3 and measure the leakage rate after the test system is stabilized.

7.105.2.3 Balanced valve

Pressurize the valve slowly to the appropriate pressure given in 7.105.1 and measure the leakage rate after the test system is stabilized.

7.106 Closed position indicator switch

7.106.1 Requirement

A closed position indicator switch shall indicate the closed position of the valve. The switch shall indicate closure when either:

— the flow rate is equal to or less than 10 % of the equivalent fully open flow rate at the same pressure difference; or

— the closure member is within 1 mm of its closed position.

7.106.2 Test of closed position indicator switch

Modify a single valve to enable the closure member to be moved and positioned in any partially open position. Slowly move the closure member until the switch just indicates valve closure.

7.107 Endurance

7.107.1 Requirement

This endurance test may be combined with EN 13611:2007+A2:2011, 7.10, where applicable.

After the endurance test described in 7.107.2 the valve shall conform to the requirements of 7.2, 7.3, 7.101 and 7.103 to 7.106.

7.107.2 Endurance test

Carry out tests for external leak-tightness and internal leak-tightness to 7.3 and performance requirements to 7.1, before the endurance test, after the test at 60 °C and after the test at 20 °C.

Energize the valve at the maximum rated voltage or current increased by the tolerance according to 7.1, at maximum ambient temperature for a period of at least 24 h under no flow conditions. Without de-energizing the valve, slowly reduce the voltage or current to 15 % of the minimum rated value. Verify that the valve has closed.

Connect the gas inlet to an air supply at the maximum inlet pressure.

Operate the valve to the number of cycles given in Table 4 with a cycle period of no less than that declared by the manufacturer. Ensure that the valve travels to the fully open and fully closed position during each cycle.

Carry out the part of the endurance test at maximum ambient temperature, at the maximum rated voltage or current.

For the test at 20 °C, carry out 50 % of the cycles at the maximum rated voltage or current and 50 % at the minimum rated voltage or current.

If the minimum ambient temperature is below 0 °C, carry out the following endurance test at the minimum rated voltage or current:

— for valves up to and including DN 150, carry out 25 000 cycles at -15 °C. Reduce the number of cycles for the test at 20 °C by 25 000 cycles;

— for valves above DN 150, carry out 5 000 cycles at -15 °C. Reduce the number of cycles for the test at 20 °C by 5 000 cycles.

Where the valve has a pneumatic or hydraulic actuating mechanism, carry out the endurance test at the maximum actuating pressure.

Check the operation of the valve throughout the endurance test, for example by monitoring the outlet pressure or the flow rate.

Finally, re-test the valve to 7.101.2.

Table 4 — Operating cycles

Nominal inlet size DN	Number of cycles at:	
	Maximum ambient temperature – at least (60 ± 5) °C	(20 ± 5) °C
DN ≤ 25	50 000	150 000
25 < DN ≤ 80	25 000	75 000
80 < DN ≤ 150	25 000	25 000
150 < DN ≤ 500	5 000	20 000
> DN 500	5 000	10 000

8 EMC/Electrical requirements

8.1 Protection against environmental influences

Shall be according to EN 13611:2007+A2:2011, 8.1.

8.2 Supply voltage variations below 85 % of rated voltage

EN 13611:2007+A2:2011, 8.2 is not applicable.

8.3 Short term voltage interruptions and decreases

Shall be according to EN 13611:2007+A2:2011, 8.3 with the following modification and addition:

Determine the influence of supply voltage interruptions by monitoring any change of flow through the valve.

8.4 Supply frequency variations

Shall be according to EN 13611:2007+A2:2011, 8.4.

8.5 Surge immunity test

Shall be according to EN 13611:2007+A2:2011, 8.5.

8.6 Electrical fast transient/burst

Shall be according to EN 13611:2007+A2:2011, 8.6.

8.7 Immunity to conducted disturbances

Shall be according to EN 13611:2007+A2:2011, 8.7.

8.8 Immunity to radiated fields

Shall be according to EN 13611:2007+A2:2011, 8.8.

8.9 Electrostatic discharge immunity test

Shall be according to EN 13611:2007+A2:2011, 8.9.

8.10 Power frequency magnetic field immunity test

Shall be according to EN 13611:2007+A2:2011, 8.10.

8.11 Electrical requirements

EN 13611:2007+A2:2011, 8.11 is replaced by the following:

8.11.101 General

The electrical equipment shall comply with the relevant requirements of EN 60730-1:2011, Clauses 8, 9, 10, 11.1, 11.2, 11.7.2, 11.8, 11.9, 11.10, 11.11.1, 11.11.2, 11.11.4, 11.11.5, 11.11.7, 11.12, 13.1, 13.2, 14, 18.1, 18.2, 18.4, 18.9, 19, 20, 21, 24, 27.2 and 28. The test to Clause 13 of EN 60730-1:2011shall be carried out after the humidity test according to EN 13611:2007+A2:2011, 7.8.7.

8.11.102 Electrical equipment

8.11.102.1 Degree of protection

The degree of protection shall be declared as stated in the installation and operating instructions in accordance with EN 60529:1991.

8.11.102.2 Switches

Switches shall conform to EN 61058-1:2002. The number of operating cycles shall be in accordance with Table 4.

8.11.102.3 Plug connections

Valves supplied with an assembled electrical plug connector in accordance with EN 175301-803:2006 shall have connections to the following pins and to earth:

— Valves

PE	earth contact
Pin 1	N
Pin 2	L

— Closed position indicators

Pin 4 (e)	earth contact
Pin 1	common
Pin 2	open valve
Pin 3	closed valve

8.11.102.4 Power saving circuits

8.11.102.4.1 Closing of the valve

Valves with power-saving circuits shall be designed such that any fault in the power-saving circuit does not affect the correct closing and the leak-tightness of the valve.

If the power-saving circuit has an independent power supply it has to fulfil 6.6.4.

8.11.102.4.2 Overheating

If the power-saving circuit meets the requirement of 6.6.4 the test under 8.11.102.4.3 does not apply.

8.11.102.4.3 Test of power-saving circuits

Energize the valve according to 7.1 at maximum rated voltage or current and at maximum ambient temperature for a period of at least 24 h under no flow conditions with the power saving circuit taken

out of function. Without de-energizing the valve, slowly reduce the voltage or current to 15 % of the minimum rated value. Verify that the valve has closed and remains tight.

9 Marking, installation and operating instructions

9.1 Marking

EN 13611:2007+A2:2011, 9.1 is replaced by the following:

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

a) manufacturer and/or his identification symbol;

b) type reference;

c) class of valve;

d) maximum inlet pressure in Pa or kPa (mbar or bar);

e) maximum allowable pressure *PS* in Pa or kPa (mbar or bar);

f) ambient temperature range;

g) group 1 (if applicable).

In addition, the valve shall be marked with:

h) direction of gas flow (by a cast or embossed arrow);

i) date of manufacture (at least year) — may be in code;

j) marking of the earth connection (if applicable);

k) supply pressure for hydraulic or pneumatic actuator in Pa or kPa (mbar or bar), if applicable.

Valves with electrical actuating mechanisms shall additionally be marked with the following:

l) identification of terminals;

m) nature and frequency of supply voltage;

n) rated voltage in V or rated current in A and its related voltage in V;

o) rated load in VA, or in W if above 25 W;

p) degree of protection (IP-Code);

q) symbol of Class II construction for Class II valves (if applicable).

Additional electrically operated devices which are integral parts of the valve shall be provided with the same information.

9.2 Installation and operating instructions

EN 13611:2007+A2:2011, 9.2 is replaced by the following:

Instructions shall include all relevant information on use, installation, operating, and servicing, in particular:

a) class of valve (A, D);

b) rated flow rate at a specified pressure difference or the K_{VS}-value;

c) electrical data;

d) ambient temperature range;

e) mounting position(s);

f) inlet pressure range in Pa or kPa (mbar or bar);

g) gas connection(s);

h) strainer details;

i) opening time;

j) closing time (and maximum delay time if applicable);

k) notice for installer to consider e.g. conditions for up-stream pressure (overpressure at the inlet in case of failure of upstream components), dirt, corrosion products;

l) class of control function of the valve according to 4.3 (if applicable);

m) notice for installer on specification for compressed air or hydraulic fluid regarding contaminants and purity classes (e g. according to ISO 8573-1:2010).

9.3 Warning notice

Shall be according to EN 13611:2007+A2:2011, 9.3.

Annex A
(informative)

Gas connections in common use in the various countries

See EN 13611:2007+A2:2011, Annex A.

Annex B
(informative)

Leak-tightness test – volumetric method

See EN 13611:2007+A2:2011, Annex B.

Annex C
(informative)

Leak-tightness test – pressure loss method

See EN 13611:2007+A2:2011, Annex C.

Annex D
(normative)

Conversion of pressure loss into leakage rate

Shall be according to EN 13611:2007+A2:2011, Annex D.

Annex E
(normative)

Electrical/electronic component fault modes

Shall be according to EN 13611:2007+A2:2011, Annex E.

Annex F
(normative)

Additional requirements for safety accessories and pressure accessories as defined in EU Directive 97/23/EC

Shall be according to EN 13611:2007+A2:2011, Annex F.

Annex G
(informative)

Materials for pressurized parts

See EN 13611:2007+A2:2011, Annex G.

Annex H
(informative)

Additional materials for pressurized parts

See EN 13611:2007+A2:2011, Annex H.

Annex I
(normative)

Requirements for controls used in DC supplied gas burners and gas burning appliances

Shall be according to EN 13611:2007+A2:2011, Annex I.

Annex J
(normative)

Method for the determination of a Safety Integrity Level (SIL)

Shall be according to EN 13611:2007+A2:2011, Annex J.

Annex K
(normative)

Method for the determination of a Performance Level (PL)

Shall be according to EN 13611:2007+A2:2011, Annex K.

Annex L
(informative)

Relationship between Safety Integrity Level (SIL) and Performance Level (PL)

Shall be according to EN 13611:2007+A2:2011, Annex L.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2009/142/EC relating to appliances burning gaseous fuels

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2009/142/EC relating to appliances burning gaseous fuels.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2009/142/EC relating to appliances burning gaseous fuels

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of EU Directive 2009/142/EC	Qualifying remarks/Notes
6.1	1.1, 2.1, 3.1.4, 3.1.5, 3.1.6, 3.1.8, 3.1.10, 3.2.1	
6.2.1	1.1, 3.1.1, 3.1.8	
6.2.2	1.1, 3.1.1, 3.1.8, 3.1.11, 3.1.12	
6.2.5	1.1, 3.1.1, 3.1.8, 3.2.1	
6.2.6	1.1, 2.1, 3.1.1, 3.1.8, 3.2.1	
6.2.7	1.1, 3.1.1, 3.1.8	
6.2.8	1.1, 3.1.1, 3.1.8, 3.1.11, 3.2.1	
6.2.9	1.1, 3.1.1, 3.1.8, 3.1.11, 3.1.12	
6.2.101	1.1, 3.1.1	
6.2.102	3.1.11	
6.2.103	1.1, 3.1.1	
6.2.104	1.1, 3.1.1	
6.2.105.1	1.1, 3.1.1, 3.1.8, 3.2.1	
6.3.1	1.1, 2.1, 3.1.1, 3.1.3, 3.1.8	
6.3.2	1.1, 3.1.1, 3.1.3, 3.1.8, 3.2.1	
6.3.4	1.1, 2.1, 3.1.1, 3.1.3, 3.1.8	
6.3.5	1.1, 3.1.1, 3.1.4, 3.1.8, 3.2.1	
6.3.6	1.1, 2.1, 3.1.1, 3.1.8	
6.3.7	1.1, 2.1, 3.1.1, 3.1.8	

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of EU Directive 2009/142/EC	Qualifying remarks/Notes
6.3.8	1.1, 2.1, 3.1.1, 3.1.4, 3.1.8, 3.1.11, 3.2.1	
6.3.101	1.1, 3.1.1	
6.3.102	1.1, 3.1.1	
6.3.103	1.1, 3.1.1	
6.3.104	1.1, 3.1.1, 3.1.8	
6.3.105.1	1.1, 3.1.1, 3.1.3, 3.1.8, 3.2.1	
6.4	1.1, 3.1.1, 3.1.4, 3.1.8, 3.2.1	
6.5.1	1.1, 2.1, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.1.7, 3.1.9, 3.1.10	
6.5.3	1.1, 3.1.1, 3.1.7, 3.1.9	
6.6.1	1.1, 3.1.1, 3.1.6, 3.1.7, 3.1.9, 3.1.10	
6.6.3	1.1, 3.1.1, 3.1.7, 3.1.9, 3.1.10	
6.6.4	1.1, 3.1.1, 3.1.7, 3.1.9, 3.1.10	
6.101	1.1, 3.1.1	
7.1	1.1, 3.1.1, 3.1.4, 3.1.5, 3.1.8, 3.2.1	
7.2	1.1, 3.1.1, 3.1.4, 3.1.8, 3.2.1	
7.4	1.1, 3.1.1, 3.1.4, 3.1.8, 3.2.1	
7.8.1	1.1, 2.1, 3.1.1, 3.1.4, 3.1.8	
7.8.2	1.1, 2.1, 3.1.1, 3.1.4	
7.8.4	1.1, 2.1, 3.1.1, 3.1.4	
7.8.6	1.1, 2.1, 3.1.1, 3.1.4	
7.101.1	1.1, 3.1.1, 3.2.1	
7.102.1	1.1, 3.1.1, 3.2.1	
7.103.1	1.1, 3.1.1	
7.104.1	1.1, 3.1.1, 3.2.1	
7.105.1	1.1, 3.1.1	
7.106.1	1.1, 3.1.1	
7.107.1	1.1, 3.1.1	
8.1	1.1, 3.1.1, 3.1.5, 3.1.6, 3.1.7, 3.1.9, 3.1.10	
8.3	1.1, 3.1.1, 3.1.5	
8.11	1.1, 2.1, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7, 3.1.9, 3.1.10	
9.2	1.3	
9.3	1.3	

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of EU Directive 2009/142/EC	Qualifying remarks/Notes
Annex F	1.1, 3.1.1, 3.1.3, 3.1.8, 3.2.1	
Annex I	1.1, 3.1.1, 3.1.4, 3.1.5, 3.1.8	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC relating to pressure equipment

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC relating to pressure equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZB.1 — Correspondence between this European Standard and Directive 97/23/EC relating to pressure equipment

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of EU Directive 97/23/EC	Qualifying remarks/Notes
6.2.1	2.1	
6.2.2	2.1	
6.2.5	2.1	
6.2.6	2.1	
6.2.7	2.1	
6.2.8	2.1	
6.2.9	2.1	
6.2.103	2.1	
6.2.104	2.1	
6.2.105.1	2.1	
6.3.1	2.1, 2.2.1	
6.3.2	2.1	
6.3.3	2.2.4	
6.3.5	2.1, 2.2.1, 2.6	
6.3.6	2.1, 2.2.1, 2.6	
6.3.7	2.1, 2.2.1	
6.3.8	2.1, 2.2.1	
6.3.101	2.1, 2.2.1	
6.3.102	2.1, 2.2.1	
6.3.103	2.1, 2.2.1	
6.3.104	2.1, 2.2.1, 2.2.3, 2.2.4, 2.11.1	

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of EU Directive 97/23/EC	Qualifying remarks/Notes
6.3.105.1	2.1, 2.2.1, 2.11.1	
6.4.3	2.1, 2.2.1	
6.4.5	2.1, 2.2.1	
6.101	2.11.1	
7.1	2.1, 2.2.1	
7.2	2.1	
7.3	2.2.4	
7.4	2.2.1, 2.2.4	
7.8.1	2.2.4, 2.6	
7.8.4	2.2.1, 2.2.4, 2.6	
7.8.6	2.2.1, 2.2.4, 2.6	
7.101.1	2.1	
7.102.1	2.1	
7.104.1	2.1	
7.105.1	2.1	
7.106.1	2.1	
7.107.1	2.1	
7.107.2	2.2.4	
Annex F	2.1, 2.2.1, 2.2.3, 2.11.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3 a), 3.4, 4.2 b)	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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EN 13611:2007+A2:2011, Bibliography with the following addition:

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