

ISBN 978-0-626-39877-4

SANS 50088-1:2021

Edition 1

EN 88-1:2016

Edition 2

SOUTH AFRICAN NATIONAL STANDARD

Pressure regulators and associated safety devices for gas appliances

Part 1: Pressure regulators for inlet pressures up to and including 50 kPa

This national standard is the identical implementation of EN 88-1:2016, and is adopted with the permission of CEN, Avenue Marnix 17, B-1000 Brussels.

WARNING

This document references other documents normatively.

Published by the South African Bureau of Standards
1 Dr Lategan Road Groenkloof ☒ Private Bag X191 Pretoria 0001
Tel: +27 12 428 7911 Fax: +27 12 344 1568

www.sabs.co.za

© SABS

SABS



This page has been left blank intentionally



COPYRIGHT PROTECTED DOCUMENT

© SABS

In terms of the Standards Act 8 of 2008, the copyright in all South African National Standards or any other publications published by the SABS Standards Division, vests in the SABS. Any use of South African National Standards is limited to use specifically prescribed by the SABS. In the case of a South African National Standard based on an international standard, ownership of the copyright vests in the organization from which the SABS adopted the standard, whether it be under licence or membership agreement. The SABS is obliged to protect such copyright and is authorized to make the relevant international organization aware of any misuse thereof. Unless exemption has been granted, no extract or full text of any South African National Standard may be copied, reproduced, stored in a retrieval system or transmitted in any form or by any means without prior written permission from the SABS Standards Division. This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any purpose other than implementation, prior written permission must be obtained.

Details, advice and limitations of use can be obtained from the Manager: Standards Sales and Information Services. Tel: +27 (0) 12 428 6883 email: sales@sabs.co.za

SABS – Standards Division

The objective of the SABS Standards Division is to develop, promote and maintain South African National Standards. This objective is incorporated in the Standards Act, 2008 (Act No. 8 of 2008).

The SABS continuously strives to improve the quality of its products and services and would therefore be grateful if anyone finding an inaccuracy or ambiguity while using this standard would inform the secretary of the technical committee responsible, the identity of which can be found in the foreword.

Buying Standards

Contact the Sales Office for South African and international standards, which are available in both electronic and hard copy format. Tel: +27 (0) 12 428 6883 email: sales@sabs.co.za

South African National Standards are also available online from the SABS Webstore www.store.sabs.co.za

Information on Standards

SABS Customer Services provide comprehensive standards-related information on national, regional and international standards. Tel: +27 (0) 12 428 7911 / 0861 27 7227 email: info@sabs.co.za

SANS 50088-1:2021

Edition 1

EN 88-1:2016

Edition 2

Table of changes

Change No.	Date	Scope

National foreword

This South African standard was prepared by National Committee SABS/TC 1019, *Gas supply, handling and control (fuel, industrial and medical gases)*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in May 2021.

Compliance with this document cannot confer immunity from legal obligations.

English Version

Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 50 kPa

Régulateurs de pression et dispositifs de sécurité associés pour appareils à gaz - Partie 1: Régulateurs de pression pour pression amont inférieure ou égale à 50 kPa

Druckregler und zugehörige Sicherheitseinrichtungen für Gasgeräte - Teil 1: Druckregler für Eingangsdrücke bis einschließlich 50 kPa

This European Standard was approved by CEN on 26 February 2011 and includes Amendment 1 approved by CEN on 1 December 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	6
1 Scope	8
2 Normative references	8
3 Terms and definitions	9
4 Classification	12
4.1 Classes of control	12
4.2 Groups of control	12
4.3 Classes of control functions	13
5 Units of measurement and test conditions	13
6 Construction requirements	13
6.1 General	13
6.2 Mechanical parts of the control	13
6.2.1 Appearance	13
6.2.2 Holes	13
6.2.3 Breather holes	13
6.2.4 Test for leakage of breather holes	13
6.2.5 Screwed fastenings	14
6.2.6 Jointing	14
6.2.7 Moving parts	14
6.2.8 Sealing caps	14
6.2.9 Dismantling and reassembly	14
6.2.101 Adjustments	14
6.2.102 Resistance to pressure	14
6.2.103 Blockage of canals and orifices	14
6.2.104 Signal tube connections	14
6.3 Materials	14
6.3.1 General material requirements	14
6.3.2 Housing	14
6.3.3 Test for leakage of housing after removal of non-metallic parts	15
6.3.4 Zinc alloys	15
6.3.5 Springs providing closing and/or sealing force	15
6.3.6 Resistance to corrosion and surface protection	15
6.3.7 Impregnation	15
6.3.8 Seals for glands for moving parts	15
6.4 Gas connections	15
6.4.1 Making connections	15
6.4.2 Connection sizes	15
6.4.3 Threads	15
6.4.4 Union joints	15
6.4.5 Flanges	15
6.4.6 Compression fittings	15
6.4.7 Nipples for pressure test	16
6.4.8 Strainers	16
6.5 Electronic parts of the control	16
6.6 Protection against internal faults for the purpose of functional safety	16
7 Performance	16

7.1	General	16
7.2	Leak tightness	16
7.3	Test for leak tightness.....	16
7.3.1	General	16
7.3.2	External leak-tightness.....	16
7.3.3	Internal leak-tightness	16
7.3.101	External leak-tightness for signal carrying compartment(s).....	17
7.4	Torsion and bending	17
7.5	Torsion and bending tests	17
7.6	Rated flow rate	17
7.7	Test for rated flow	17
7.7.1	Apparatus	17
7.7.2	Test procedure	17
7.7.3	Conversion of air flow rate.....	17
7.8	Durability.....	17
7.9	Performance tests for electronic controls.....	17
7.10	Long-term performance for electronic controls	17
7.101	Pressure regulator performance	17
7.101.1	General	17
7.101.2	General test procedure.....	18
7.101.3	Class A pressure regulator performance	20
7.101.4	Class B pressure regulator performance	20
7.101.5	Class C pressure regulator performance	21
7.101.6	Endurance	22
7.101.7	Lock-up pressure.....	23
7.101.8	Requirement for rendered inoperative pressure regulators	23
7.101.9	Test for rendered inoperative pressure regulators	23
7.102	Pneumatic gas/air ratio pressure regulator performance.....	23
7.102.1	General	23
7.102.2	General test procedure.....	24
7.102.3	Control performance and stability.....	24
7.102.4	Settling time	26
7.102.5	Gas/air ratio adjustment	26
7.102.6	Offset adjustment	27
7.102.7	Endurance	27
8	EMC/Electrical requirements.....	27
8.1	Protection against environmental influences.....	27
8.2	Supply voltage variations below 85 % of rated voltage.....	28
8.3	Short term voltage interruptions and decreases	28
8.4	Supply frequency variations.....	28
8.5	Surge immunity test.....	28
8.6	Electrical fast transient/burst	28
8.7	Immunity to conducted disturbances	28
8.8	Immunity to radiated fields	28
8.9	Electrostatic discharge immunity test	28
8.10	Power frequency magnetic field immunity test	28
8.11	Electrical requirements.....	28
8.11.1	General	28
8.11.2	Electrical equipment	28
9	Marking, installation and operating instructions.....	29
9.1	Marking	29
9.2	Installation and operating instructions	29

9.3	Warning notice	31
Annex A	(informative) Gas connections in common use in the various countries	32
Annex B	(informative) Leak-tightness test — volumetric method	33
Annex C	(informative) Leak-tightness test — pressure loss method	34
Annex D	(normative) Conversion of pressure loss into leakage rate	35
Annex E	(normative) Electrical/electronic component fault modes	36
Annex F	(normative) Additional requirements for safety accessories and pressure accessories as defined in EC Directive 97/23/EC	37
Annex G	(normative) Materials for pressurized parts	38
Annex H	(informative) Additional materials for pressurized parts	39
Annex I	(normative) Requirements for controls used in DC supplied gas burners and gas burning appliances	40
Annex AA	(informative) Typical pressure regulators and pressure regulator parts	41
Annex BB	(informative) Overview of requirements and test conditions (as given in Clause 7), and examples of performance curves for pressure regulators	42
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EC Directive 2009/142/EC relating to appliances burning gaseous fuels	48
Bibliography	50
Figures		
Figure 1	— Step response of a transfer element.....	11
Figure 2	— Performance test apparatus.....	19
Figure 3	— Gas/air modulation curves.....	26
A1 Figure 4 A1	— Delta p versus rated flow rate curve.....	31
Figure AA.1	— Types of constant pressure regulators.....	41
Figure BB.1	— Example for class A pressure regulator including maximum outlet pressure variations for constant outlet setting pressure p_{2s} and lock-up pressure p_{2f} including typical results.....	43
Figure BB.2	— Example for class A pressure regulator including maximum outlet pressure variations for adjustable outlet setting pressures p_{2smin} , p_{2smax} , and lock-up pressures p_{2fmin} , p_{2fmax} , including typical results.....	44
Figure BB.3	— Example for class A pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results.....	45
Figure BB.4	— Example for class B pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results.....	45
Figure BB.5	— Example for class C pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results.....	46
Tables		
Table 1	— Gas pressure at inlet to the pressure regulator.....	18

Table 2 — Outlet pressure variation from the outlet setting pressure p_{2s}	18
Table 3 — Control performance test procedure	25
Table BB.1 — Overview of pressure regulator requirements.....	42
Table BB.2 — Test procedure	47
Table ZA.1 — Correspondence between this European Standard and Directive 2009/142/EC relating to appliances burning gaseous fuels.....	48

European foreword

This document (EN 88-1:2011+A1:2016) 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 August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

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

This document includes Amendment 1 approved by CEN on 2015-12-01.

This document supersedes A1 EN 88-1:2011. A1

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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 Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This document is intended to be used in conjunction with EN 13611:2007. This document refers to clauses of EN 13611:2007 or adapts clauses by stating “with the following modification”, “with the following addition”, “is replaced by the following” or “is not applicable” in the corresponding clause. This European Standard adds clauses or sub-clauses to the structure of EN 13611:2007 which are particular to this European Standard. It should be noted that these clauses and sub-clauses are not indicated as an addition. Sub-clauses or annexes which are additional to those in EN 13611:2007 are numbered starting from 101 or are designated as Annex AA, BB, CC etc.

A1 *deleted text* A1

EN 88 *Pressure regulators and associated safety devices for gas appliances* consists of the following parts:

- EN 88-1, *Pressure regulators and associated safety devices for gas appliances — Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*;
- EN 88-2, *Pressure regulators and associated safety devices for gas appliances — Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar*.

Performance Level (PL) or Safety Integrity Level (SIL) classifications according to EN ISO 13849-1 or EN 61508-1 cannot automatically be claimed based upon compliance with this European Standard. Pressure regulators with PL or SIL classification do not automatically meet the requirements of this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia,

France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the safety, construction and performance requirements for pressure regulators and pneumatic gas/air ratio pressure regulators (zero pressure regulators are included as a special type of pneumatic gas/air ratio pressure regulator), intended for use with gas burners, gas appliances and similar use, hereafter referred to as 'pressure regulators'.

This European Standard is applicable to

- pressure regulators with declared maximum inlet pressures up to and including 50 kPa (500 mbar) of nominal connection sizes up to and including DN 250 for use with one or more fuel gases in accordance with EN 437,
- pressure regulators which use auxiliary energy,
- pneumatic gas/air ratio pressure regulators, which function by controlling a gas outlet pressure in response to an air signal pressure, air signal differential pressure, and/or to a furnace pressure signal (zero pressure regulators are included as a special type of pneumatic gas/air ratio pressure regulator),
- gas/air ratio pressure regulators which change an air outlet pressure in response to a gas signal pressure or a gas signal differential pressure.

This European Standard does not cover

- pressure regulators connected directly to gas distribution network or to a container that maintains a standard distribution pressure,
- pressure regulators intended for gas appliances to be installed in the open air and exposed to the environment,
- mechanically linked gas/air ratio controls,
- electronic gas/air ratio controls (EN 12067-2).

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.

EN 161:2011¹, *Automatic shut-off valves for gas burners and gas appliances*

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

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

EN 60730-1:2000, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:1999, modified)*

¹) To be published.

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13611:2007 and the following apply.

3.101

pressure regulator

device which maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits

3.102

direct regulator

pressure regulator where the spring or pressure signal acts directly on the working diaphragm

3.103

indirect regulator

pressure regulator where the spring or pressure signal acts directly on a regulator diaphragm that controls the working diaphragm or the control member with pneumatic, hydraulic or electric means

3.104

adjustable pressure regulator

pressure regulator provided with means for changing the outlet pressure setting

3.105

pneumatic gas/air ratio pressure regulator

pressure regulator, which supplies gas at specified pressure at it's outlet in response to control pressure

3.106

zero pressure regulator

pressure regulator, which maintains the outlet pressure constant at atmospheric pressure

3.107

control member

movable part of the pressure regulator which varies flow rate and/or outlet pressure directly

3.108

inlet pressure range

difference between the minimum and maximum values of the inlet pressure

3.109

maximum outlet pressure

p_{2max}

upper limit of the outlet pressure, as stated in the installation and operating instructions

3.110

minimum outlet pressure

p_{2min}

lower limit of the outlet pressure, as stated in the installation and operating instructions

3.111

outlet pressure range

difference between minimum and maximum values of the outlet pressure

3.112

inlet setting pressure

p_{1s}

inlet pressure at which the pressure regulator is set for test purposes

3.113

outlet setting pressure

p_{2s}

outlet pressure at which the pressure regulator is set for test purposes

3.114

signal pressure

p_3

pressure, differential pressure or a combination of both applied to the regulator in order to provide the specified outlet pressure

3.115

signal pressure range

range of signal pressure between the minimum and maximum values

3.116

load determining pressure

p_4

underpressure as a result of an air flow, e.g. produced by a sucking fan, through a restriction

3.117

gas/air ratio

slope of a straight line relationship between the outlet pressure p_2 and signal pressure p_3

3.118

working diaphragm

flexible member which, under the influence of the forces arising from loading and pressure, operates the control member

3.119

diaphragm plate

stiffening plate fitted to the diaphragm

3.120

lock-up pressure

p_{2f}

outlet pressure at which a pressure regulator closes when the outlet of the pressure regulator is sealed

3.121

put out of action

block the operation of the pressure regulator by fixing the control member in the fully open position

3.122

furnace pressure

pressure of combustion gases from the combustion chamber connected to the pressure regulator

3.123**signal chamber**

part of the regulator to which the air signal pressure, gas pressure, or furnace pressure signal is connected

3.124**signal connection**

connection that is used to convey pressure from part of an installation to the signal chamber

3.125**offset**

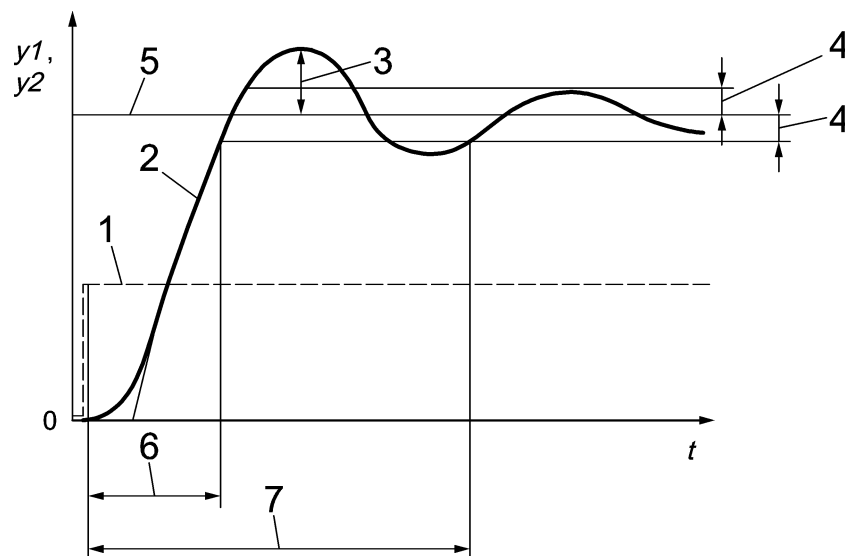
outlet pressure shift at pneumatic gas/air ratio pressure regulators independent of signal or load determining pressure(s)

NOTE Typically this is achieved by means of a spring.

3.126**step response**

outlet pressure change of a pneumatic gas/air ratio pressure regulator having a step change of the signal pressure or load determining pressure

NOTE For further information refer to Figure 1.

**Key**

1	step function (y_1)	5	steady state value
2	step response (y_2)	6	response time
3	overshoot value	7	settling time
4	settling tolerance	t	time

Figure 1 — Step response of a transfer element

3.127**steady state value**

outlet pressure measured after step response (control signal remains constant)

3.128

settling tolerance

maximum difference between the current outlet pressure and its steady state value

3.129

response time

time counted from start of the step change of the signal pressure or load determining pressure until the outlet pressure is in the settling tolerance for the first time

3.130

settling time

time counted from start of the step change of the signal pressure or load determining pressure until the outlet pressure remains in the settling tolerance

3.131

overshoot value

largest difference between the outlet pressure and its steady state value after step change of the signal pressure or load determining pressure exceeding the settling tolerance for the first time

3.132

withstand pressure

pressure that is withstood without degraded characteristic after returning below the maximum inlet pressure

[EN 1854:2010, 3.116]

NOTE The withstand pressure is equal to or higher than the maximum inlet pressure.

3.133

safety shut-off device

SSD

device whose function is to stay in the open position under normal operating conditions and to shut off the gas flow automatically and completely when the monitored pressure deviates above or below the pre-set value

[EN 88-2:2007, 3.3.1]

4 Classification

4.1 Classes of control

EN 13611:2007, 4.1 is replaced by the following:

Pressure regulators shall be classified A, B, or C according to the appropriate outlet pressure and rated flow rate limits given in 7.101.1.

Gas/air ratio pressure regulators are not classified.

4.2 Groups of control

Shall be according to EN 13611:2007, 4.2.

4.3 Classes of control functions

EN 13611:2007, 4.3 is not applicable.

5 Units of measurement and test conditions

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

6 Construction requirements

6.1 General

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

The withstand pressure shall be stated in the installation and operating instructions. If no withstand pressure is stated, the withstand pressure is equal to the maximum inlet pressure.

6.2 Mechanical parts of the control

6.2.1 Appearance

Shall be according to EN 13611:2007, 6.2.1.

6.2.2 Holes

Shall be according to EN 13611:2007, 6.2.2.

6.2.3 Breather holes

Shall be according to EN 13611:2007, 6.2.3 with the following addition:

Use the withstand pressure instead of the maximum inlet pressure, if applicable.

Alternatively, for indirect regulators the requirement of a maximum leakage rate of 70 dm³/h for breather holes can be replaced by the following requirement:

- the breather hole has a maximum diameter of 1 mm;
- a ruptured regulator diaphragm shall lead to a situation where the control member moves to the closed or the fully open position;
- stress the diaphragm with the temperature and pressure stress test of 6.2.4;
- after the tests of 6.2.4 the leakage rate shall fulfil the requirements of 7.2.

6.2.4 Test for leakage of breather holes

Shall be according to EN 13611:2007, 6.2.4 with the following addition:

If for indirect regulators the alternative requirement of 6.2.3 is used, the following test applies:

- leave the regulator diaphragm as is;
- store one pressure regulator for 1 h ± 5 min at 135 °C ± 2 °C ambient temperature;
- keep the regulator at this temperature and apply a pressure of three times the withstand pressure to gas-carrying compartments for 5 min ± 10 s;

- wait for the pressure regulator to return to room temperature;
- measure the external leakage rate according to 7.3.2.

6.2.5 Screwed fastenings

Shall be according to EN 13611:2007, 6.2.5.

6.2.6 Jointing

Shall be according to EN 13611:2007, 6.2.6.

6.2.7 Moving parts

Shall be according to EN 13611:2007, 6.2.7.

6.2.8 Sealing caps

Shall be according to EN 13611:2007, 6.2.8.

6.2.9 Dismantling and reassembly

Shall be according to EN 13611:2007, 6.2.9.

6.2.101 Adjustments

The adjustments (e.g. outlet pressure, offset and gas/air-ratio) shall be readily accessible to authorised persons, but there shall be provision for sealing after adjustment. Means shall be provided to discourage interference by unauthorised persons. If it is stated in the installation and operating instructions that a pressure regulator can be put out of action, appropriate means shall be provided to put the pressure regulator out of action.

6.2.102 Resistance to pressure

Parts of the pressure regulator 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 withstand pressure.

6.2.103 Blockage of canals and orifices

Blockage of auxiliary canals and orifices shall not lead to an unsafe situation otherwise they shall be protected against blockage by suitable means.

6.2.104 Signal tube connections

Requirements on connections for gas pressure, air pressure or furnace pressure signal tubes shall be stated in the installation and operating instructions.

6.3 Materials

6.3.1 General material requirements

Shall be according to EN 13611:2007, 6.3.1.

6.3.2 Housing

Shall be according to EN 13611:2007, 6.3.2 with the following modification:

The withstand pressure shall be used instead of maximum inlet pressure, if applicable.

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

Shall be according to EN 13611:2007, 6.3.3 with the following addition and modification:

Addition:

Any breather holes shall be blocked.

Modification:

The withstand pressure shall be used instead of maximum inlet pressure, if applicable. The test shall be performed in accordance with 7.3.2.

6.3.4 Zinc alloys

Shall be according to EN 13611:2007, 6.3.4.

6.3.5 Springs providing closing and/or sealing force

EN 13611:2007, 6.3.5 is not applicable.

6.3.6 Resistance to corrosion and surface protection

Shall be according to EN 13611:2007, 6.3.6.

6.3.7 Impregnation

Shall be according to EN 13611:2007, 6.3.7.

6.3.8 Seals for glands for moving parts

Shall be according to EN 13611:2007, 6.3.8.

6.4 Gas connections

6.4.1 Making connections

Shall be according to EN 13611:2007, 6.4.1.

6.4.2 Connection sizes

Shall be according to EN 13611:2007, 6.4.2.

6.4.3 Threads

Shall be according to EN 13611:2007, 6.4.3.

6.4.4 Union joints

Shall be according to EN 13611:2007, 6.4.4.

6.4.5 Flanges

Shall be according to EN 13611:2007, 6.4.5.

6.4.6 Compression fittings

Shall be according to EN 13611:2007, 6.4.6.

6.4.7 Nipples for pressure test

Shall be according to EN 13611:2007, 6.4.7.

6.4.8 Strainers

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

Strainers fitted to controls of DN 25 and above shall be accessible for cleaning or replacement without the need to remove the control body by dismantling threaded or welded pipe work.

6.5 Electronic parts of the control

EN 13611:2007, 6.5 is not applicable.

6.6 Protection against internal faults for the purpose of functional safety

EN 13611:2007, 6.6 is not applicable.

7 Performance

7.1 General

Shall be according to EN 13611:2007, 7.1.

7.2 Leak tightness

Shall be according to EN 13611:2007, 7.2 with the following addition:

For signal chamber(s) without combustion gas signal carrying compartment(s), when tested according to 7.3.101, the leakage rate from the signal chamber(s) shall not exceed the leakage rate at the maximum signal pressure stated in the installation and operating instructions before and after the tests specified in 7.102.7.

7.3 Test for leak tightness

7.3.1 General

Shall be according to EN 13611:2007, 7.3.1 with the following modification:

If stated in the installation and operating instructions that the regulator shall be used in combination with a safety shut-off device upstream of the regulator the following alternative external leakage test can be used:

For external leakage carry out the test with 1,5 times the withstand pressure at inlet and outlet, and with a pressure of 1,5 times the difference between withstand pressure and maximum outlet pressure on the atmospheric side of the working diaphragm (including the safety diaphragm, if any).

The test results shall meet the requirements of 7.2.

7.3.2 External leak-tightness

Shall be according to EN 13611:2007, 7.3.2 with the following addition:

If applicable the additional test conditions of 7.3.1 shall be taken into account.

7.3.3 Internal leak-tightness

EN 13611:2007, 7.3.3 is not applicable.

7.3.101 External leak-tightness for signal carrying compartment(s)

With any bleed port incorporated in the signal tube(s) or signal chamber(s) plugged, pressurize and test the compartment(s) according to 7.2 and measure the leakage rate.

The test results shall meet the requirements of 7.2.

7.4 Torsion and bending

Shall be according to EN 13611:2007, 7.4.

7.5 Torsion and bending tests

Shall be according to EN 13611:2007, 7.5.

7.6 Rated flow rate

Shall be according to EN 13611:2007, 7.6.

7.7 Test for rated flow**7.7.1 Apparatus**

Shall be according to EN 13611:2007, 7.7.1.

7.7.2 Test procedure

Shall be according to EN 13611:2007, 7.7.2 with the following addition:

If rated flow rate for pressure regulators as stated in the installation and operating instructions is specified for the control member in the fully open position, the test shall be performed with the control member in that position.

7.7.3 Conversion of air flow rate

Shall be according to EN 13611:2007, 7.7.3.

7.8 Durability

Shall be according to EN 13611:2007, 7.8.

7.9 Performance tests for electronic controls

EN 13611:2007, 7.9 is not applicable.

7.10 Long-term performance for electronic controls

EN 13611:2007, 7.10 is not applicable.

7.101 Pressure regulator performance**7.101.1 General**

When carrying out performance tests at any particular setting, the minimum inlet pressure used shall be at least 200 Pa (2 mbar) in excess of the set outlet pressure.

If the inlet pressure range includes two corresponding values for the minimum and maximum pressure, as given in Table 1, then the inlet setting pressure shall be the respective nominal pressure according to

that table. Otherwise, the inlet setting pressure and the inlet pressure range shall be stated in the installation and operating instructions.

The outlet pressure variation from the outlet setting pressure p_{2s} shall not exceed that given in Table 2 or ± 100 Pa (± 1 mbar), whichever is the greater.

Table 1 — Gas pressure at inlet to the pressure regulator

Type of gas	Nominal pressure kPa (mbar)	Minimum pressure kPa (mbar)	Maximum pressure kPa (mbar)
1 st family gases	0,8 (8)	0,6 (6)	1,5 (15)
2 nd family gases group 2H	2,0 (20)	1,7 (17)	2,5 (25)
2 nd family gases group 2L	2,5 (25)	2,0 (20)	3,0 (30)
2 nd family gases group 2E	2,0 (20)	1,7 (17)	2,5 (25)
3 rd family gases	2,9 (29)	2,0 (20)	3,5 (35)
	2,9 (29)	2,5 (25)	3,5 (35)
	3,7 (37)	2,5 (25)	4,5 (45)
	5,0 (50)	4,25 (42,5)	5,75 (57,5)
	6,7 (67)	5,0 (50)	8,0 (80)
	11,2 (112)	6,0 (60)	14,0 (140)
	14,8 (148)	10,0 (100)	18,0 (180)

Table 2 — Outlet pressure variation from the outlet setting pressure p_{2s}

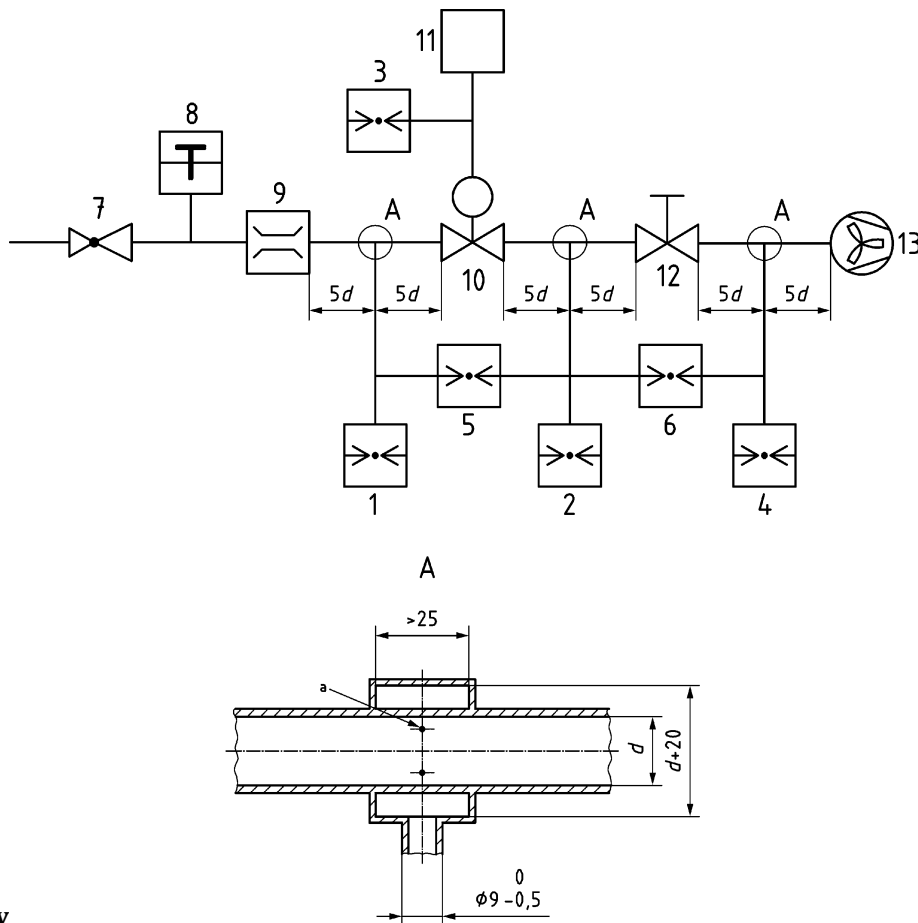
Class of pressure regulator	Maximum outlet pressure variation %		
	1 st family	2 nd family	3 rd family
Class A q_{\max} to q_{\min} and $p_{1\max}$ to $p_{1\min}$	± 15	± 15	± 15
Class B By variation of the inlet pressure for each of the rated flow rates	+15 -20	+10 -15	± 10
By variation of rated flow rates from q_{\max} to q_{\min} (constant inlet pressure) for each of the inlet pressures	+40	+40	+40
Class C At constant q (within the rated flow rate range)	+15 -20	+10 -15	± 10

7.101.2 General test procedure

7.101.2.1 Apparatus

Carry out the tests using the apparatus shown in Figure 2. The uncertainty of measurement shall not exceed 2 %.

Dimensions in millimetres



Key

- 1 inlet pressure gauge p_1
- 2 outlet pressure gauge p_2
- 3 signal pressure gauge p_3 (see NOTE)
- 4 load determining pressure gauge p_4 (see NOTE)
- 5, 6 differential pressure gauges (see NOTE)
- 7 adjustable regulator for inlet pressure
- 8 thermometer
- 9 flow meter
- 10 control under test
- 11 signal pressure inlet (optional) (see NOTE)
- 12 manual control tap (injector orifice)
- 13 fan (optional) (see NOTE)

NOTE Key numbers 3, 4, 5, 6, 11 and 13 are only applicable for pneumatic gas/air ratio pressure regulators (refer to 3.105).

^a 4 holes $\phi 1,5$ mm

Nominal size (DN)	Internal diameter (mm)
6	6
8	9
10	13
15	16
20	22
25	28
32	35
40	41
50	52
65	67
80	80
100	106
125	131
150	159
200	209
250	260

Figure 2 — Performance test apparatus

7.101.2.2 Conversion of the air flow rate

Shall be according to EN 13611:2007, 7.7.3.

7.101.2.3 Methods of test

Class A, class B and class C pressure regulators shall be tested according to 7.101.3.2, 7.101.4.2, and 7.101.5.2, respectively (see also Annex BB).

Steady state conditions shall always be reached before readings are taken.

Examples of performance curves are shown in Annex BB, Figures BB.1 to BB.5.

7.101.3 Class A pressure regulator performance

7.101.3.1 Requirement

Over the full range of inlet pressure from $p_{1\min}$ to $p_{1\max}$ and over the whole rated flow rate range from q_{\min} to q_{\max} as stated in the installation and operating instructions the outlet pressure variation from the outlet setting pressure p_{2s} shall not exceed the values given in Table 2 or ± 100 Pa (± 1 mbar), whichever is the greater. The stated minimum rated flow rate q_{\min} shall not exceed 10 % of q_{\max} .

7.101.3.2 Test

Class A pressure regulators shall be tested by measuring the outlet pressure p_2 with variation of the inlet pressure p_1 and of the flow rate q , as follows:

- a) In order to adjust the outlet setting pressure p_{2s} of the pressure regulator, set the manual control tap to obtain a rated flow rate of 50 % of q_{\max} (or any other value declared by the manufacturer). For adjustable pressure regulators, adjust the outlet setting pressure p_{2s} to the maximum outlet pressure $p_{2\max}$, the inlet pressure p_1 being the nominal pressure (or respectively any other value declared by the manufacturer).

Once the outlet setting pressure p_{2s} has been set, there shall be no further adjustment of the pressure regulator.

- b) With inlet pressure $p_{1\min}$ kept constant, vary the rated flow rate q to q_{\max} to q_{\min} and back to q_{\max} by using the manual control tap and record the outlet pressure p_2 for at least 5 values of q in each case. Ensure that there is no change of the inlet pressure p_1 during the whole time of this procedure.

- c) Readjust the inlet pressure p_1 from $p_{1\min}$ to $p_{1\max}$ and then vary the rated flow rate from q_{\max} to q_{\min} and back to q_{\max} (as in step b).

- d) For adjustable pressure regulators readjust the outlet setting pressure p_{2s} to $p_{2\min}$ according to step a) and repeat steps b) and c).

7.101.4 Class B pressure regulator performance

7.101.4.1 Requirement

Over the full range of inlet pressure from $p_{1\min}$ to $p_{1\max}$ at any rated flow rate q within the rated flow rate range q_{\min} to q_{\max} , as stated in the installation and operating instructions, the outlet pressure variation from the outlet setting pressure p_{2s} shall not exceed the values given in Table 2 or ± 100 Pa (± 1 mbar), whichever is the greater.

For any change of rated flow rate q within the rated flow rate from q_{\min} to q_{\max} , as stated in the installation and operating instructions, at any inlet pressure p_1 within the full inlet pressure range from p_{\min} to p_{\max} the outlet pressure variation from the outlet setting pressure p_{2s} shall not exceed the values given in Table 2 or ± 100 Pa (± 1 mbar), whichever is the greater.

7.101.4.2 Test

Class B pressure regulators shall be tested by measuring the outlet pressure p_2 with variation of the inlet pressure p_1 and of the rated flow rate q , as follows:

- a) In order to adjust the outlet setting pressure p_{2s} of the pressure regulator, set the rated flow rate to q_{\max} by adjusting the manual control tap. For adjustable pressure regulators, adjust the outlet setting pressure p_{2s} to the maximum outlet pressure $p_{2\max}$, the inlet pressure p_1 being the nominal pressure (or another value declared by the manufacturer).

Once the outlet setting pressure p_{2s} has been set, there shall be no further adjustment of the pressure regulator.

- b) Vary the inlet pressure p_1 from the nominal pressure over the minimum inlet pressure $p_{1\min}$, to the maximum inlet pressure $p_{1\max}$, and back to $p_{1\min}$, and record the outlet pressure p_2 for at least 5 values of p_1 in each direction without resetting the rated flow rate.
- c) With inlet pressure p_1 at the nominal pressure or at the value declared under a), readjust the rated flow rate q from q_{\max} to q_{\min} by using the manual control tap without any other adjustment of the previously set value of the outlet pressure p_2 .
- d) Repeat step b).
- e) For adjustable pressure regulators, readjust the outlet setting pressure p_{2s} according to a) to $p_{2\min}$ and repeat steps b) to d).

7.101.5 Class C pressure regulator performance

7.101.5.1 Requirement

Over the full range of inlet pressure from $p_{1\min}$ to $p_{1\max}$ at any rated flow rate q within the rated flow rate range from q_{\min} to q_{\max} , as stated in the installation and operating instructions, the outlet pressure variation from the outlet setting pressure p_{2s} shall not exceed the values given in Table 2 or ± 100 Pa (± 1 mbar), whichever is the greater.

7.101.5.2 Test

Class C pressure regulators shall be tested by measuring the outlet pressure p_2 with variation of the inlet pressure p_1 , as follows:

- a) In order to adjust the outlet setting pressure p_{2s} of the pressure regulator, set the rated flow rate to q_{\max} by adjusting the manual control tap. For adjustable pressure regulators, adjust the outlet setting pressure p_{2s} to the maximum outlet pressure $p_{2\max}$, the inlet pressure p_1 being the nominal pressure (or another value declared by the manufacturer).

Once the outlet setting pressure p_{2s} has been set, there shall be no further adjustment of the pressure regulator.

- b) Vary the inlet pressure p_1 to the minimum inlet pressure $p_{1\min}$, to the maximum inlet pressure $p_{1\max}$, and back to $p_{1\min}$, and record the outlet pressure p_2 for at least 5 values of p_1 in each direction without resetting the rated flow rate.
- c) By means of the manual control tap, adjust the rated flow rate to q_{\min} , the outlet setting pressure p_{2s} readjusted as in step a).
- d) Repeat step b).
- e) For adjustable pressure regulators, readjust the outlet setting pressure p_{2s} according to a) to $p_{2\min}$ and repeat steps b) to d).

7.101.6 Endurance

7.101.6.1 Requirement

The leak tightness and performance shall remain within the limits specified in 7.2, 7.3, 7.101.1, 7.101.3, 7.101.4, and 7.101.5, respectively, after testing according to 7.101.6.2.

7.101.6.2 Test

Position the pressure regulator in a temperature controlled chamber with an air supply at ambient temperature and maximum inlet pressure $p_{1\max}$ as stated in the installation and operating instructions. The pressure regulator is controlled according to manufacturer's instructions to ensure that working diaphragm and safety diaphragm, if any, are fully flexed and the control member moves between fully open and fully closed position.

The test consists of 50 000 cycles with each fully open and fully closed position of the control member is held for at least 5 s.

Of the 50 000 cycles:

- a) 25 000 cycles are with the pressure regulator environment at the maximum ambient temperature stated in the installation and operating instructions, but at least 60 °C and
- b) 25 000 cycles are with the pressure regulator environment at the minimum ambient temperature stated in the installation and operating instructions, but at most 0 °C.

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

In addition, where the pressure regulator incorporates an electric device which may be required to run continuously, it shall be additionally operated in a condition where the electric device operates continuously for a period of 3 000 h at 110 % of maximum rated voltage.

The period of 3 000 h shall consist of:

- 2 000 h at ambient temperature of 20 °C;
- 500 h at the maximum ambient temperature stated in the installation and operating instructions, but at least 60 °C and
- 500 h at the minimum ambient temperature stated in the installation and operating instructions, but at most 0 °C.

This electric device shall be in accordance with 8.11.

7.101.7 Lock-up pressure

7.101.7.1 Requirement

When it is stated in the installation and operating instructions that a pressure regulator has the ability to lock-up, the outlet pressure p_2 shall not rise by more than 15 % or +750 Pa (+7,5 mbar), whichever is the greater, above the outlet pressure at 5 % of q_{\max} . Such a pressure regulator shall be tested according to 7.101.7.2.

7.101.7.2 Test

Proceed as follows:

- a) Install the pressure regulator in the apparatus according to EN 13611:2007, 7.7.1;
- b) adjust the inlet pressure p_1 to $p_{1\max}$, the outlet pressure p_2 to $p_{2\min}$, and the manual control tap to 5 % of q_{\max} ;
- c) measure the outlet pressure p_2 ;
- d) slowly close the manual control tap in not less than 5 s;
- e) 30 s after the manual control tap has been completely closed, measure the outlet pressure p_2 ;
- f) repeat steps b) to e) with the outlet pressure p_2 adjusted to $p_{2\max}$;
- g) repeat steps b) to f) for every outlet pressure range (typically determined by a different spring).

Check conformity to 7.101.7.1 for every lock-up value p_{2f} .

7.101.8 Requirement for rendered inoperative pressure regulators

If it is stated in the installation and operating instructions that the pressure regulator can be rendered inoperative, for example, for 3rd family gas applications, the method shall be given in the installation and operating instructions.

7.101.9 Test for rendered inoperative pressure regulators

The pressure regulator shall be rendered inoperative according to the method given in the installation and operating instructions. After it has been confirmed by observation that the control member is fixed in the fully open position, the external leak tightness shall meet the requirements of 7.2 and 7.3.

When the action of the pressure regulator is restored, the pressure regulator shall continue to conform to all requirements of this European Standard.

7.102 Pneumatic gas/air ratio pressure regulator performance

7.102.1 General

When carrying out performance tests at any particular setting, the minimum inlet pressure used shall be at least 200 Pa (2 mbar) in excess of the set outlet setting pressure p_{2s} .

If the inlet pressure range includes two corresponding values for the minimum and maximum pressure, as given in Table 1, then the inlet setting pressure shall be the respective nominal pressure according to that table. Otherwise, the inlet setting pressure and the inlet pressure range shall be declared by the manufacturer.

7.102.2 General test procedure

7.102.2.1 Apparatus

Shall be according to 7.101.2.1.

7.102.2.2 Conversion of the air flow rate

Shall be according to EN 13611:2007, 7.7.3.

7.102.3 Control performance and stability

7.102.3.1 Control performance requirement

A1

7.102.3.1.1 Control pressure variation with signal pressure

When tested in accordance with 7.102.3.3.2 the control performance over the modulating range shall be such that for each test result the deviation of pressure p_2 from the ideal line (see Figure 3 a)) is within $\pm 15\%$ of the value stated in the installation and operating instructions or ± 100 Pa (± 1 mbar), whichever is the greater.

According to the application, as stated in the installation and operating instructions, the control pressure, which is the signal pressure p_3 (e.g. air pressure, air differential pressure, furnace pressure, or a combination of them) is varied. Where tighter tolerances are stated in the installation and operating instructions, these shall be verified during testing.

7.102.3.1.2 Control pressure variation with load determining pressure

When tested in accordance with 7.102.3.3.3 the control performance over the modulating range shall be such that for each test result the deviation of pressure difference p_6 from the ideal line (see Figure 3 b)) is within $\pm 15\%$ of the value stated in the installation and operating instructions or ± 100 Pa (± 1 mbar), whichever is the greater. According to the application, as stated in the installation and operating instructions, the load determining pressure p_4 , is varied. Where tighter tolerances are stated in the installation and operating instructions, these shall be verified during testing. **A1**

7.102.3.2 Stability requirement

A1 When tested according to 7.102.3.3 any continuous oscillation or hunting of the pressure p_2 (for signal pressure systems) or the pressure difference p_6 (for load determining pressure systems) shall not exceed $\pm 10\%$ or ± 100 Pa (± 1 mbar), whichever is the greater, of the outlet value at any point within the working range stated in the installation and operating instructions, and shall not cause the pressure p_2 or the pressure difference p_6 to fall outside the tolerance defined in 7.102.3.1. **A1**

A1

7.102.3.3 Test

7.102.3.3.1 General

For this test, the test apparatus of 7.102.2.1 is used.

Table 3 — Control performance test procedure

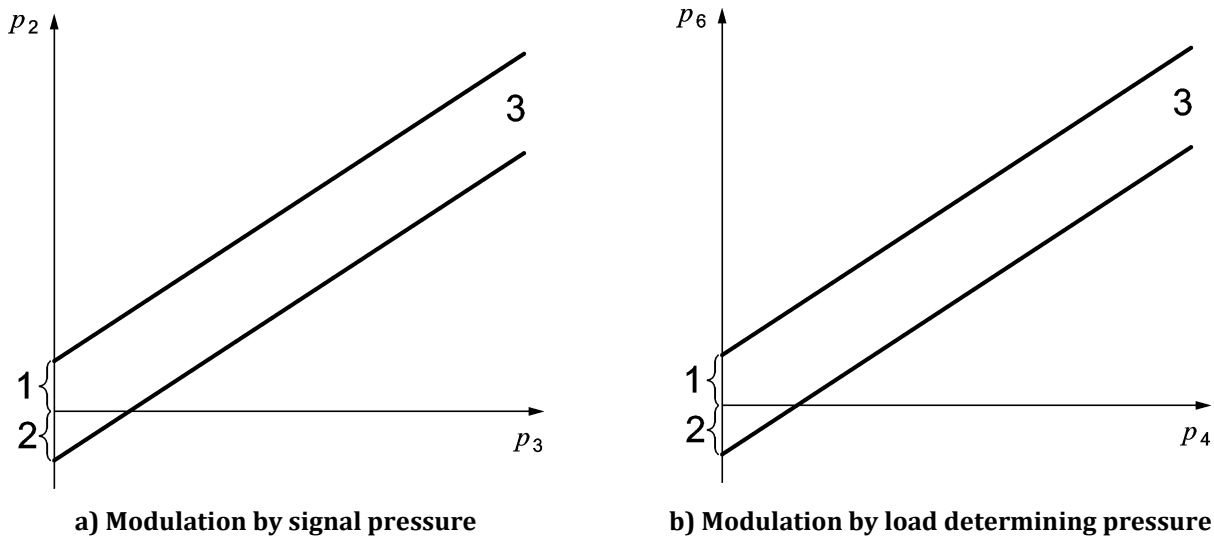
Test	Inlet pressure p_1 Pa (mbar)	Rated flow rate q m^3/h	Control pressure variation	
			Signal pressure ^a p_3 Pa (mbar)	Load determining pressure ^b p_4 Pa (mbar)
1	$p_{1\text{max}}$	q_{max}	from $p_{3\text{max}}$	from $p_{4\text{min}}$
			to $p_{3\text{min}}$	to $p_{4\text{max}}$
			and back to $p_{3\text{max}}$	and back to $p_{4\text{min}}$
2	$p_{1\text{max}}$	q_{min}	from $p_{3\text{min}}$	from $p_{4\text{max}}$
			to $p_{3\text{max}}$	to $p_{4\text{min}}$
			and back to $p_{3\text{min}}$	and back to $p_{4\text{max}}$
3	$p_{1\text{min}}$	q_{max}	from $p_{3\text{max}}$	from $p_{4\text{min}}$
			to $p_{3\text{min}}$	to $p_{4\text{max}}$
			and back to $p_{3\text{max}}$	and back to $p_{4\text{min}}$
4	$p_{1\text{min}}$	q_{min}	from $p_{3\text{min}}$	from $p_{4\text{max}}$
			to $p_{3\text{max}}$	to $p_{4\text{min}}$
			and back to $p_{3\text{min}}$	and back to $p_{4\text{max}}$
For each test the variation of the pressure p_2 , or the pressure difference p_6 respectively during the control pressure variation shall be according to the requirements of 7.102.3.1.1 and 7.102.3.1.2.				
^a The signal pressure is an overpressure.				
^b The load determining pressure is an underpressure.				

7.102.3.3.2 Control pressure variation with signal pressure

The test is performed by recording the pressure p_2 against the signal pressure p_3 (see Figure 3 a)) as the signal pressure p_3 is varied according to Table 3 with an offset adjustment within the range as stated in the installation and operating instructions. For each test in Table 3, the manual control tap (see Figure 2) shall be adjusted to the minimum or maximum rated flow rate as stated in the installation and operating instructions and remains unchanged during that test. Ensure that there is no change of the inlet pressure p_1 during each test.

7.102.3.3.3 Control pressure variation with load determining pressure

The test is performed by recording the pressure difference p_6 against the load determining pressure p_4 (see Figure 3 b)) as the load determining pressure p_4 is varied according to Table 3 with an offset adjustment within the range as stated in the installation and operating instructions. The variation of pressure p_4 can be achieved by modulating the speed of the fan (see Figure 2). For each test in Table 3 the manual control tap (see Figure 2) shall be adjusted to the minimum or maximum rated flow rate as stated in the installation and operating instructions, and remains unchanged during that test. Ensure that there is no change of the inlet pressure p_1 during each test.



Key

- | | |
|---------------------------------|----------------------------|
| p_2 outlet pressure | 1) positive offset |
| p_3 signal pressure | 2) negative offset |
| p_4 load determining pressure | 3) ideal lines with offset |
| p_6 pressure difference | |

Figure 3 — Gas/air modulation curves A1

7.102.4 Settling time

7.102.4.1 Requirement

If the settling time is stated in the installation and operating instructions, the measured settling time shall not exceed this value when tested in accordance to 7.102.4.2.

7.102.4.2 Test

Increase the control pressure in a stepwise change from minimum to maximum over a period of 0,9 times the stated settling time (see Figure 1). Measure the time taken for the pressure difference p_6 to achieve a settling tolerance of $\pm 5\%$.

Repeat the test with the control pressure decreasing in a stepwise change from maximum to minimum over a period of 0,9 times the stated settling time. Measure the time taken for the pressure difference p_6 to achieve a settling tolerance of $\pm 5\%$.

The tests are performed at minimum inlet pressure p_{1min} and maximum rated flow rate q_{max} .

7.102.5 Gas/air ratio adjustment

7.102.5.1 Requirement

If the gas/air ratio is adjustable, the gas/air ratio regulator performance shall comply with 7.102.3 and 7.102.4 when the adjustment is at its extreme limits. The range of pressure ratios achieved shall cover the adjustment range stated in the installation and operating instructions when tested.

7.102.5.2 Test

Carry out tests at maximum and minimum gas/air ratio settings and check conformity to 7.102.3 and 7.102.4.

7.102.6 Offset adjustment**7.102.6.1 Requirement**

If offset adjustment is stated in the installation and operating instructions, the offset adjustment shall cover the range stated in the installation and operating instructions when tested according to 7.102.6.2.

7.102.6.2 Test

Verify that the offset can be adjusted over the range according to 7.102.6.1.

7.102.7 Endurance**7.102.7.1 Requirement**

After testing according to 7.102.7.2 the leak-tightness and control performance shall meet the requirements of 7.2, 7.3 and 7.102.3.

7.102.7.2 Test

Position the pneumatic gas/air ratio pressure regulator in a temperature controlled chamber with an air supply at ambient temperature.

Set inlet pressure p_1 and rated flow rate q to worst conditions and use the control pressure to ensure that the working diaphragm is fully flexed and the control member moves between fully open and fully closed position.

One test cycle consists of varying the control pressure from minimum to maximum and back to minimum.

The test consists of 50 000 cycles with each fully open and fully closed position of the control member is held for at least 5 s.

Of the 50 000 cycles:

- a) 25 000 cycles are with the ratio pressure regulator environment at the maximum ambient temperature stated in the installation and operating instructions, but at least 60 °C and
- b) 25 000 cycles are with the ratio pressure regulator environment at the minimum ambient temperature stated in the installation and operating instructions, but at most 0 °C.

Provided that the pneumatic gas/air ratio pressure regulator operates over its full range it is not necessary for the cycle time to be equal to the response time.

In addition, where the pneumatic gas/air ratio pressure regulator incorporates an electric device which may be required to run continuously, it shall be tested in accordance with 7.101.6.2.

8 EMC/Electrical requirements**8.1 Protection against environmental influences**

Shall be according to EN 13611:2007, 8.1.

8.2 Supply voltage variations below 85 % of rated voltage

Shall be according to EN 13611:2007, 8.2.

8.3 Short term voltage interruptions and decreases

Shall be according to EN 13611:2007, 8.3.

8.4 Supply frequency variations

Shall be according to EN 13611:2007, 8.4.

8.5 Surge immunity test

Shall be according to EN 13611:2007, 8.5.

8.6 Electrical fast transient/burst

Shall be according to EN 13611:2007, 8.6.

8.7 Immunity to conducted disturbances

Shall be according to EN 13611:2007, 8.7.

8.8 Immunity to radiated fields

Shall be according to EN 13611:2007, 8.8.

8.9 Electrostatic discharge immunity test

Shall be according to EN 13611:2007, 8.9.

8.10 Power frequency magnetic field immunity test

Shall be according to EN 13611:2007, 8.10.

8.11 Electrical requirements

EN 13611:2007, 8.11 is replaced by the following:

8.11.1 General

Electrical equipment shall either be type tested or declared by the manufacturer.

The electrical equipment shall comply with the relevant requirements of EN 60730-1:2000, Clauses 8, 9, 10, 11.1, 11.2, 11.9, 13.1, 13.2, 14, 20.1 and 20.2. The test to EN 60730-1:2000, Clause 13 shall be carried out after the humidity test according to EN 13611:2007, 7.8.7.

If the supply voltage polarity can affect the safety, clear warnings shall be given in the installation and operating instruction (see 9.2).

8.11.2 Electrical equipment

8.11.2.1 Degree of protection

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

8.11.2.2 Plug connections

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

PE	earth contact
Pin 1	N
Pin 2	L

9 Marking, installation and operating instructions

9.1 Marking

EN 13611:2007, 9.1 is replaced by the following:

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





- a) manufacturer and/or his identification symbol;
- b) type reference;
- c) class of pressure regulator (if applicable);
- d) inlet pressure range in Pa or kPa (mbar or bar);
- e) withstand pressure in kPa (bar) (if different from maximum inlet pressure);
- f) ambient temperature range;
- g) group 1 (if applicable);
- h) direction of gas flow (by a cast or embossed arrow);
- i) date of manufacture (at least year) — may be in code;
- j) identification of signal inlet(s) (if applicable);
- k) supply details according to EN 161:2011, 9.1 i) to p) (if applicable).

9.2 Installation and operating instructions

EN 13611:2007, 9.2 is replaced by the following:

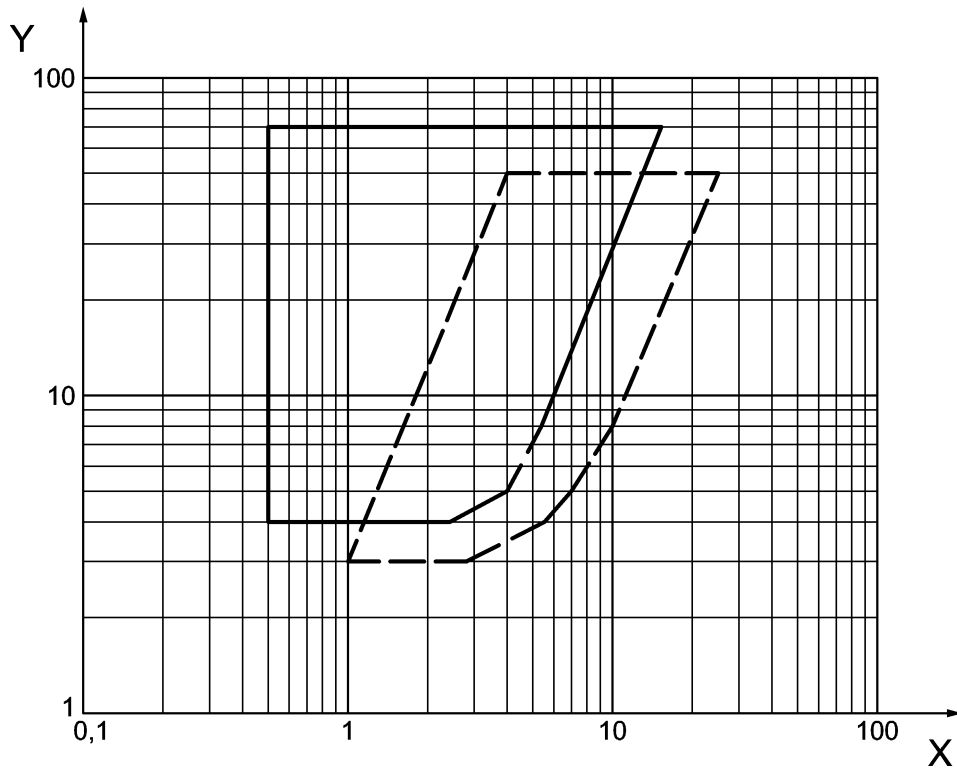
Instructions shall include all relevant information on use, installation, operating, and servicing, in particular:

- a) class of pressure regulator (A, B, or C) (if applicable);
- b) group 1 or 2;
- c) gas families for which the pressure regulator is suitable;
- d) maximum inlet pressure in Pa or kPa (mbar or bar);

- e) withstand pressure in kPa (bar) (if different from maximum inlet pressure);
- f) ambient temperature range;
- g) mounting position(s);
- h) gas connection(s);
- i) strainer details;
- j) 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;
- k) offset adjustment range in Pa or kPa (mbar) (if applicable);
- l) inlet pressure range in Pa or kPa (mbar);
- m) outlet pressure range in Pa or kPa (mbar);
- n) rated flow rate in m³/h (and rated flow rate range if applicable);
alternatively performance limits can be given in a curve, which is Δp across the regulator in Pa or kPa (mbar) versus rated flow rate in m³/h (e.g.  Figure 4 
- o) recommendations for inlet pressure regulation (if any, see Table 1);
- p) performance limits, which is Δp across the regulator in Pa or kPa (mbar) versus rated flow rate in m³/h (e.g.  Figure 4 
- q) instructions for changing from one gas family to another, e.g. changing the spring or putting the pressure regulator out of action (if applicable);
- r) lock-up ability (if applicable);
- s) electrical data (if applicable);

For pneumatic gas/air ratio pressure regulators the following items shall be declared additionally:

- t) identification of signal inlet(s);
- u) gas/air pressure ratio, e.g. nominal value or adjustment range if variable (if applicable);
- v) signal pressure range in Pa or kPa (mbar);
- w) settling time in s, (if applicable);
- x) recommendations for size/length/position of signal connections;
- y) recommendations for signal connection materials. A warning that, in applications where failure of a signal connection could lead to gas rich firing or an unsafe condition, it is essential that the signal connection be manufactured from a metallic material;
- z) setting up instructions. These shall set out in sequence the adjustments to be made and the measurements to be taken when the gas/air ratio regulator is put into service. The precise order of any adjustments shall be indicated.



Key

X rated flow rate gas or air in m³/h

Y Δp in Pa or kPa (mbar or bar)

----- performance limits regulator 1

————— performance limits regulator 2

Figure 4 — Delta p versus rated flow rate curve

9.3 Warning notice

Shall be according to EN 13611:2007, 9.3.

Annex A
(informative)

Gas connections in common use in the various countries

Shall be according to EN 13611:2007, Annex A.

Annex B
(informative)

Leak-tightness test — volumetric method

Shall be according to EN 13611:2007, Annex B.

Annex C
(informative)

Leak-tightness test — pressure loss method

Shall be according to EN 13611:2007, Annex C.

Annex D
(normative)

Conversion of pressure loss into leakage rate

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

Annex E
(normative)

Electrical/electronic component fault modes

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

Annex F
(normative)

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

EN 13611:2007, Annex F is not applicable.

Annex G
(normative)

Materials for pressurized parts

EN 13611:2007, Annex G is not applicable.

Annex H
(informative)

Additional materials for pressurized parts

EN 13611:2007, Annex H is not applicable.

Annex I
(normative)

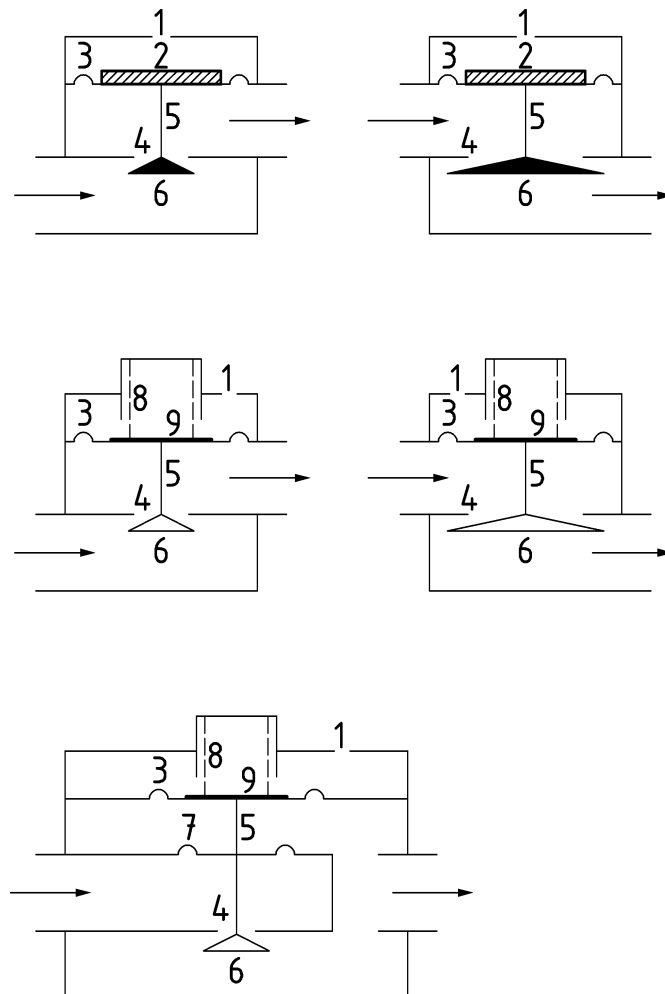
Requirements for controls used in DC supplied gas burners and gas burning appliances

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

Annex AA (informative)

Typical pressure regulators and pressure regulator parts

These diagrams are provided for information only. Pressure regulators can feature other principles of operation and combinations of components.



Key

- | | | | |
|---|-------------------------|---|-------------------------|
| 1 | breather hole | 6 | pressure regulator disc |
| 2 | weight | 7 | compensating diaphragm |
| 3 | working diaphragm | 8 | spring |
| 4 | pressure regulator seat | 9 | diaphragm plate |
| 5 | pressure regulator stem | | |

Figure AA.1 — Types of constant pressure regulators

Annex BB
(informative)

Overview of requirements and test conditions (as given in Clause 7), and examples of performance curves for pressure regulators

Table BB.1 — Overview of pressure regulator requirements

	Class A pressure regulator Outlet pressure p_2			Class B pressure regulator Outlet pressure p_2			Class C pressure regulator Outlet pressure p_2		
	1 st Family	2 nd Family	3 rd Family	1 st Family	2 nd Family	3 rd Family	1 st Family	2 nd Family	3 rd Family
Tolerance on the outlet pressure p_2 (as % of the outlet setting pressure p_{2s})									
- with change of inlet pressure from p_{1max} to p_{1min}	± 15	± 15	± 15	+ 15 - 20	+ 10 - 15	± 10	+ 15 - 20	+ 10 - 15	± 10
	or ± 100 Pa (± 1 mbar) ^a			or ± 100 Pa (± 1 mbar) ^a			or ± 100 Pa (± 1 mbar) ^a		
- with change of rated flow rate from q_{max} to q_{min}	± 15	± 15	± 15	+ 40	+ 40	+ 40	—		
	or ± 100 Pa (± 1 mbar) ^a			or ± 100 Pa (± 1 mbar) ^a					
Outlet setting pressure p_{2s}	Nominal pressure according to Table 1 or as declared by the manufacturer								
Inlet pressure range	According to Table 1 or as stated in the installation and operating instructions								
Maximum inlet pressure	As stated in the installation and operating instructions								
^a Whichever is greater									

Examples of performance curves for class A pressure regulators including maximum outlet pressure variations for the outlet setting pressure p_{2s} (corresponds to the accuracy class (AC) of EN 88-2) and the lock-up pressure p_{2f} (corresponds to the lock-up pressure class (SG) of EN 88-2), and typical results with outlet pressure p_2 as ordinate and rated flow rate q as abscissa are shown in Figures BB.1 and BB.2.

The maximum outlet pressure variation, or accuracy, is defined as the average expressed as a percentage of the outlet setting pressure p_{2s} of the absolute maximum values of the positive and negative control deviation within performance limits of the pressure regulator.

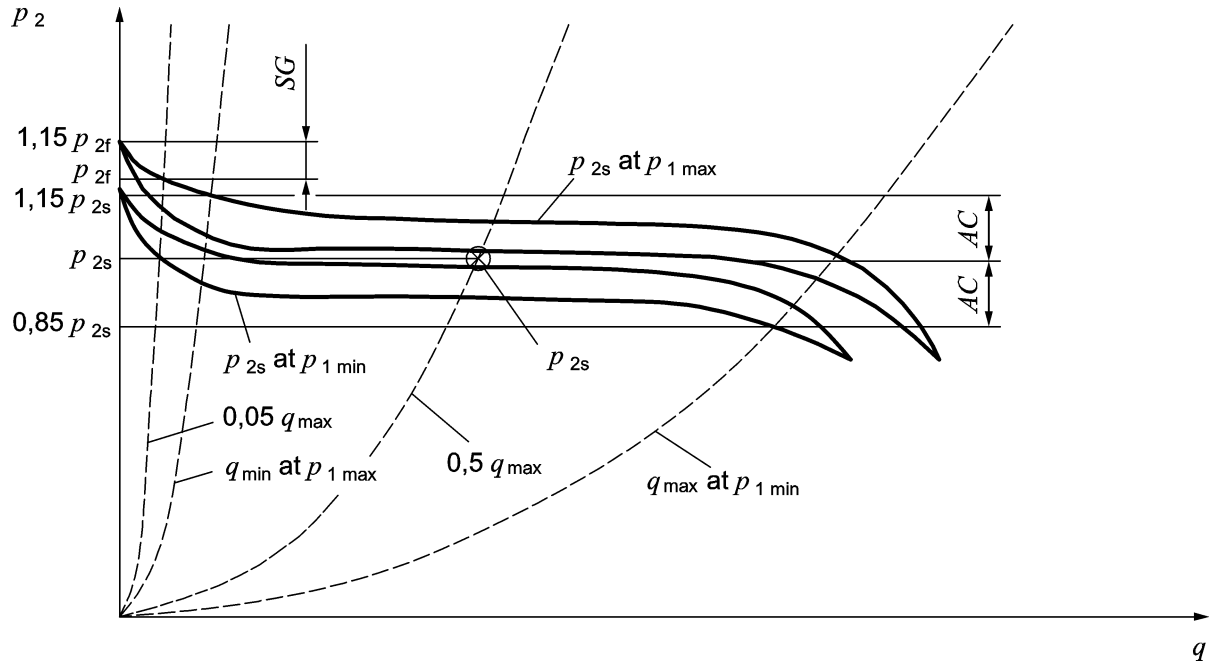
The accuracy class (AC) is defined as the maximum permissible accuracy.

According to the lock-up pressure p_{2f} the lock-up pressure class (SG) in EN 88-2 is defined as the maximum permissible positive difference between the actual lock-up pressure(s) p_{2f} and the corresponding outlet pressure(s) at a certain percentage of the maximum rated flow rate q_{max} . The lock-up pressure class SG is expressed as a percentage and calculated with the following equation:

$$SG = 100 \times \frac{(p_{2f} - p_2)}{p_2}$$

where

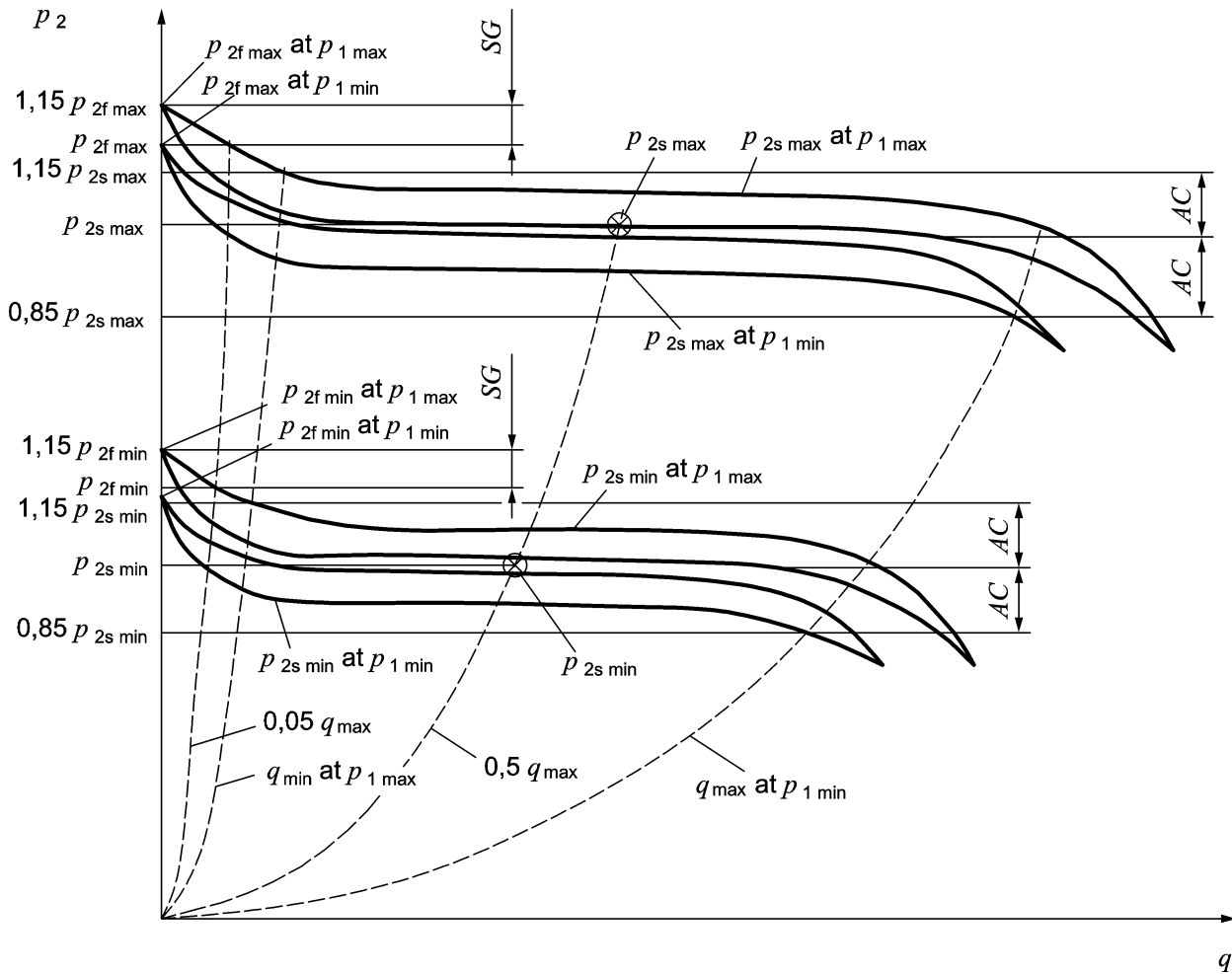
SG is the lock-up pressure class;
 p_{2f} is the lock-up pressure and
 p_2 is the outlet pressure.



Key

SG	lock-up pressure class	p_2	outlet pressure
AC	accuracy class	p_{2f}	lock-up pressure
q	rated flow rate	p_{2s}	outlet setting pressure
q_{min}	minimum rated flow rate		
q_{max}	maximum rated flow rate		
p_{1min}	minimum inlet pressure		
p_{1max}	maximum inlet pressure		

Figure BB.1 — Example for class A pressure regulator including maximum outlet pressure variations for constant outlet setting pressure p_{2s} and lock-up pressure p_{2f} including typical results



Key

<i>SG</i>	lock-up pressure class	p_2	outlet pressure
<i>AC</i>	accuracy class	p_{2fmin}	minimum lock-up pressure
q	rated flow rate	p_{2fmax}	maximum lock-up pressure
q_{min}	minimum rated flow rate	p_{2smin}	minimum outlet setting pressure
q_{max}	maximum rated flow rate	p_{2smax}	maximum outlet setting pressure
p_{1min}	minimum inlet pressure		
p_{1max}	maximum inlet pressure		

Figure BB.2 — Example for class A pressure regulator including maximum outlet pressure variations for adjustable outlet setting pressures p_{2smin} , p_{2smax} , and lock-up pressures p_{2fmin} , p_{2fmax} , including typical results

Examples of performance curves for class A, class B, and class C pressure regulators including maximum outlet pressure variation for the outlet setting pressure p_{2s} depending on the gas families, if applicable, and typical results with outlet pressure p_2 as ordinate and inlet pressure p_1 as abscissa are shown in Figures BB.3 to BB.5.

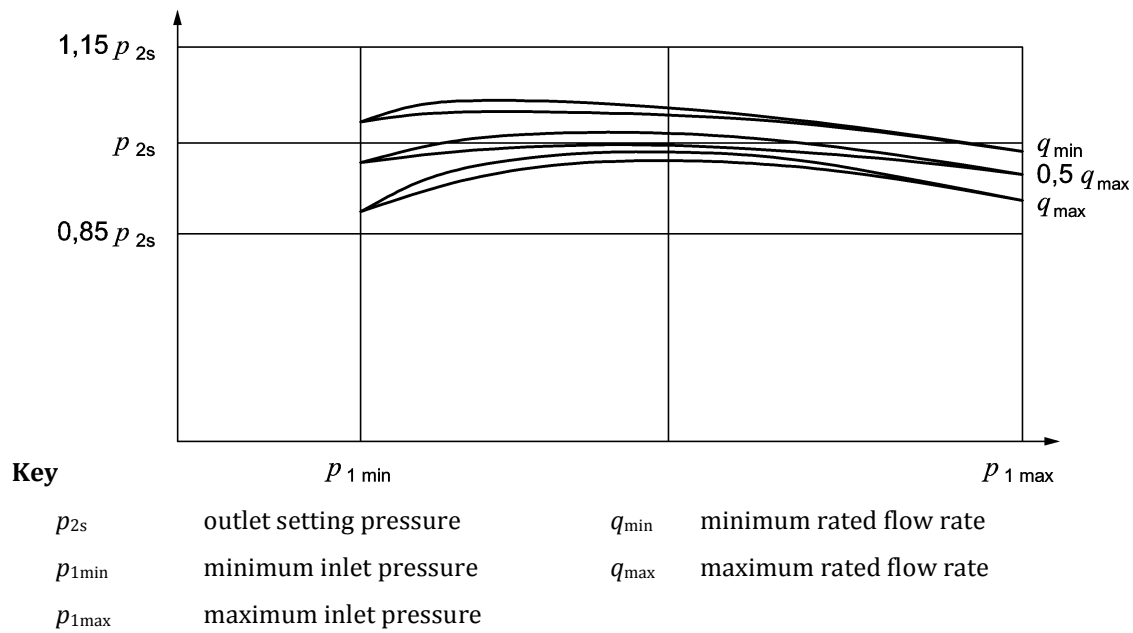


Figure BB.3 — Example for class A pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results

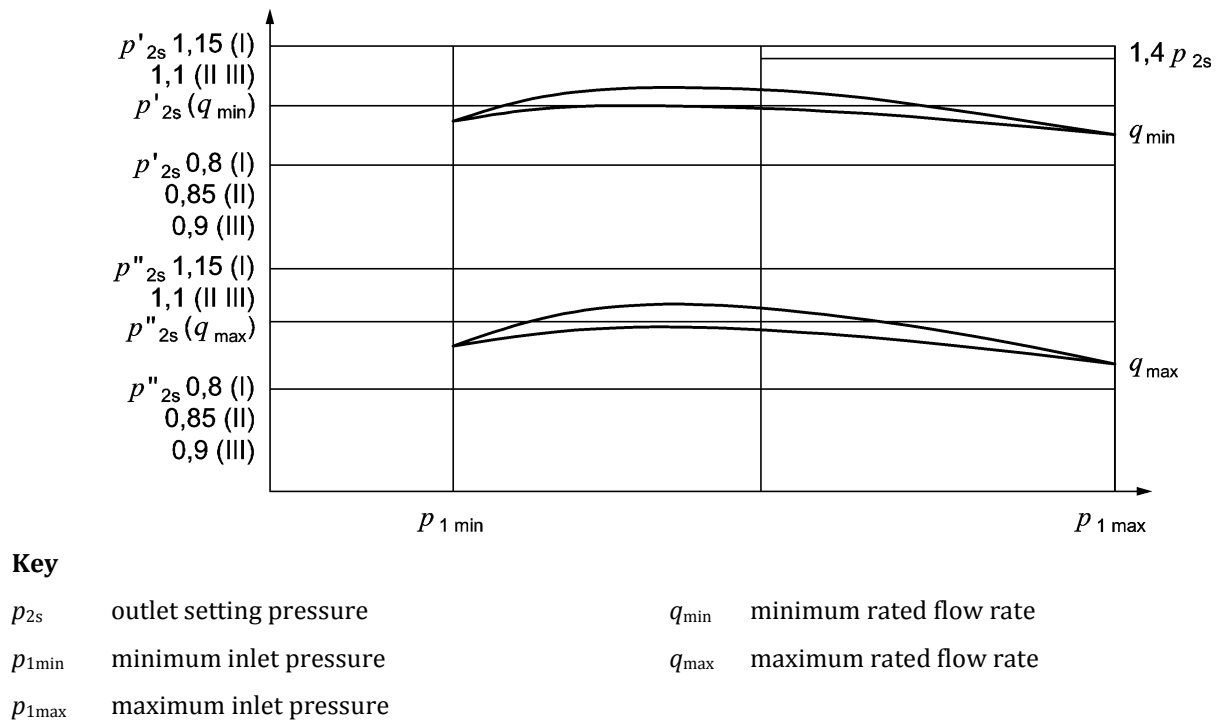
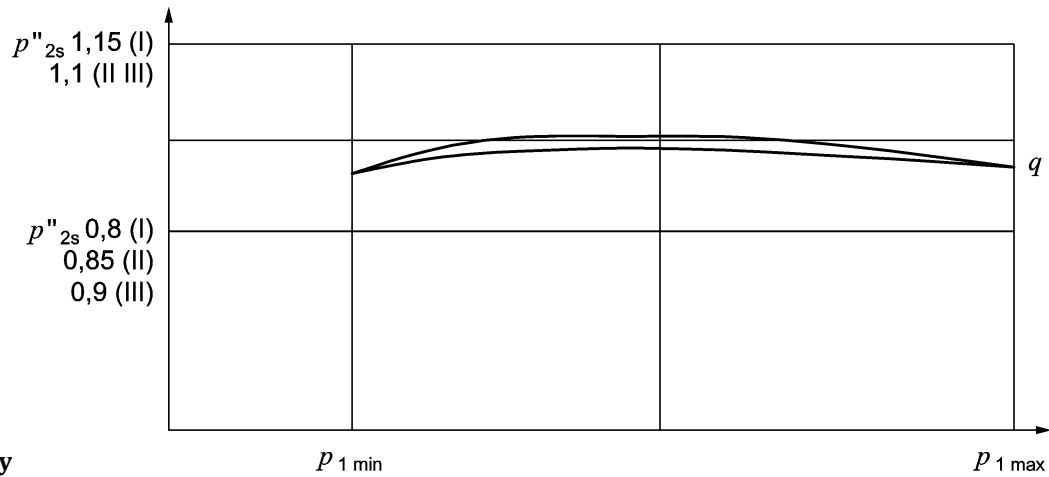


Figure BB.4 — Example for class B pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results



Key

p_{2s} outlet setting pressure

$p_{1 \min}$ minimum inlet pressure

q rated flow rate

$p_{1 \max}$ maximum inlet pressure

Figure BB.5 — Example for class C pressure regulator including maximum outlet pressure variation for constant outlet setting pressure p_{2s} including typical results

Table BB.2 — Test procedure

	Class A pressure regulator	Class B pressure regulator	Class C pressure regulator
1. Setting Set the outlet setting pressure p_{2s} to - 1.1 at an inlet pressure p_1 equal to - 1.2 and at a rated flow rate q equal to -	p_{2smax} Nominal pressure according to Table 1 or as declared by the manufacturer (p_{1min}) $0,5 \times q_{max}$	p_{2smax} q_{max}	p_{2smax} q_{max}
After this setting of the outlet setting pressure p_{2s} there shall be no further adjustment of the pressure regulator			
2. Testing 2.1 change p_1 to - 2.2 change q from - to - 2.3 change p_1 to - 2.4 change q from - to - 2.5 change p_1 to - 2.6 change q from - to -	After each change of p_1 or q , record the outlet pressure p_2		
	p_{1min}	p_{1min}	p_{1min}
	$0,5 \times q_{max}, q_{max}, q_{min}, q_{max}$	no change	no change
	p_{1max}	p_{1max}	p_{1max}
	$q_{max}, q_{min}, q_{max}$	no change	no change
	—	p_{1min}	—
	—	q_{max}, q_{min}	—
3. Setting Set the outlet setting pressure p_{2s} to - 3.1 at an inlet pressure p_1 equal to - 3.2 and at a rated flow rate q equal to -	—	—	p_{2smax}
	—	—	same p_1 as indicated in 1.1
	—	—	q_{min}
After this setting of the outlet pressure, there shall be no further adjustment of the pressure regulator			
4. Testing 4.1 change p_1 from - to -	After each change of p_1 record the outlet pressure p_2		
	—	$p_{1min}, p_{1max}, p_{1min}$	$p_{1min}, p_{1max}, p_{1min}$

All pressure regulators, irrespective of class, repeat the complete test procedure, including steps 1 to 4, but with the outlet setting pressure set to p_{2smin} .

Annex ZA (informative)

Relationship between this European Standard and the Essential Requirements of EC 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

N/A = Not applicable

Essential Requirement (ERs) of Directive 2009/142/EC		Clause(s)/sub-clause(s) of this European Standard
1	GENERAL CONDITIONS	
1.1	Safety of operation	Clause 1, Clause 6, Clause 7, Clause 8
1.2	Instructions	9.2, 9.3
1.2.1	Installation instructions	9.2
1.2.2	User instructions	9.2
1.2.3	Warning notices	9.3
1.3	Correct operation	Clause 7, 9.2
2	MATERIALS	
2.1, 2.2	Suitability for safety and intended purpose	6.2, 6.3
3	DESIGN AND CONSTRUCTION	
3.1	General	
3.1.1	Mechanical stability	6.1, 6.2, 6.3, 6.4
3.1.2	Condensation	N/A
3.1.3	Risk of explosion	7.2, 7.3
3.1.4	Water penetration	N/A
3.1.5	Normal fluctuation of auxiliary energy	7.1
3.1.6	Abnormal fluctuation of auxiliary energy	Clause 8
3.1.7	Hazards of electrical origin	Clause 8
3.1.8	Pressurized parts	N/A
3.1.9	Failure of safety, controlling and regulating devices	N/A
3.1.10	Safety/adjustment	N/A

3.1.11	Protection of parts set by the manufacturer	6.2
3.1.12	Controlling and setting devices	6.2
3.2	Unburned gas release	
3.2.1	Gas leakage	6.2.3, 6.2.4, 6.3.2, 6.3.3, 7.2, 7.3
3.2.2, 3.2.3	Gas accumulation	N/A
3.3	Ignition	N/A
3.4	Combustion	N/A
3.5	Rational use of energy	N/A
3.6	Temperatures	7.1
3.7	Foodstuffs and water used for sanitary purposes	N/A

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

Bibliography

As per EN 13611:2007, Bibliography with the following addition:

EN 88-2:2007, *Pressure regulators and associated safety devices for gas appliances — Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar*

EN 1854:2010, *Pressure sensing devices for gas burners and gas burning appliances*

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 13785, *Regulators with a capacity of up to and including 100 kg/h, having a maximum nominal outlet pressure of up to and including 4 bar, other than those covered by EN 12864 and their associated safety devices for butane, propane or their mixtures*

EN 13786, *Automatic change-over valves having a maximum outlet pressure of up to and including 4 bar with a capacity of up to and including 100 kg/h, and their associated safety devices for butane, propane or their mixtures*

EN 61508-1:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements (IEC 61508-1:1998 + Corrigendum 1999)*

EN ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*