BRITISH STANDARD

BS 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

The European Standard EN 88-2:2007 has the status of a British Standard

ICS 23.060.40

British Standards

National foreword

This British Standard is the UK implementation of EN 88-2:2007.

The UK participation in its preparation was entrusted by Technical Committee GSE/22, Safety and control devices for gas and oil burners and gas burning appliances, to Subcommittee GSE/22/19, Pneumatic air/gas ratio controls and governors.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2007

ISBN 978 0 580 54317 3

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 88-2

November 2007

ICS 23.060.40

English Version

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

R6gulateurs de pression et dispositifs de s6curit6 associ6s pour appareils k gaz - Partie 2: R6gulateurs de pression pour pression amont sup6rieure & 500 mbar et inferieure ou 6gale ci 5 bar

Druckregler und zugehorige Sicherheitseinrichtungen fur Gasgerate - Teil 2: Druckregler fur Eingangsdrucke uber 500 mbar bis einschlieBlich 5 bar

This European Standard was approved by CEN on 8 May 2007.

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 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 Management Centre has the same status as the official versions.

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Ref. No. EN 88-2:2007: E

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Foreword

This document (EN 88-2:2007) has been prepared by Technical Committee CEN/TC 58 "Safety and control devices for gas-burners and gas-burning appliances", 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 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

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.

EN 88 consists of the following parts under the general title "Pressure regulators and associated safety devices for gas appliances":

Part 1: Pressure regulators for inlet pressures up to and including 500 mbar;

Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar.

This European Standard should be used in conjunction with EN 13611 "Safety and control devices for gas burners and gas burning appliances — General requirements."

SIL classification according to EN 61508 cannot automatically be claimed based upon compliance with this standard. Pressure regulators with SIL classification do not meet automatically the requirements of this 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This standard is a particular standard for Pressure Regulators for gas-burners and gas-burning appliances which cites EN 13611 "Safety and control devices for gas burners and gas-burning appliances - General requirements" wherever possible. This standard supplements or modifies the corresponding clauses of EN 13611. The construction and performance requirements are as far as applicable in total conformity with EN 13611.

1 Scope

This European Standard specifies the safety, construction and performance requirements for pressure regulators (hereafter referred to as regulators) intended for use with gas burners and gas-burning appliances using fuel gases of the 1^{s}, 2^{nd} and 3^{rd} families. This European Standard covers type testing only. It also provides additional information for the purchaser and user.

This European Standard is applicable to regulators that may be tested independently of gas burners and gas-burning appliances, which have a declared working pressure from above 500 mbar up to and including 5 bar.

This European Standard is also applicable to regulators incorporating safety devices.

NOTE 1 For safety accessories and pressure accessories, the requirements of EN 13611:2007, Annex F also apply.

NOTE 2 Regulators conforming to EN 88-2 fulfil also the requirements of EN 88-1.

Regulators intended to be used on pipe work installations for third family gases are also covered by EN 13785 and EN 13786.

This European Standard is not applicable to:

a) pressure regulators that are connected directly to mains pipe-work or to a container that maintains a standard distribution pressure;

b) pressure regulators which use electrical auxiliary energy.

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 88-1:2007, *Pressure regulators and associated safety devices for gas appliances — Part 1: Pressure regulators for inlet pressures up to and including 500 mbar*

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

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

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

EN 13787, *Elastomers for gas pressure regulators and associated safety devices for inlet pressures up to 100 bar*

EN 60534-1:2005, *Industrial-process control valves — Part 1: Control valve terminology and general considerations (IEC 60534-1:2005)*

EN 60534-2-3, *Industrial-process control valves — Part 2-3: Flow capacity — Test procedures (IEC 60534-2-3:1997)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 6708, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708:1995)*

ISO 7-1, *Pipe threads where pressure tight joints are made on the threads — Part 1: Designation, dimensions and tolerances*

ISO 3419, *Non-alloy and alloy steel butt-welding fittings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13611:2007, EN 60534-1:2005 and the following apply.

3.1 Pressure regulator

3.1.1
pressure regulator
device that maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits

3.1.2
nominal inlet diameter
nominal size DN of the inlet connection in accordance with EN ISO 6708

3.1.3
nominal outlet diameter
nominal size DN of the outlet connection in accordance with EN ISO 6708

3.2 Components

NOTE The main components of a pressure regulator and a safety shut-off device are shown in Annex A.

3.2.1
control member
movable part of the pressure regulator that is positioned in the flow path to restrict the flow through the pressure regulator

NOTE A control member may be a plug, ball, disk, vane, gate, diaphragm, etc.

3.2.2
body
part of the pressure regulator that is the main pressure containing envelope

3.2.3
valve seat
corresponding sealing surfaces within a pressure regulator, or SSD that make full contact only when the pressure regulator or SSD is in the closed position

3.2.4
seat ring
replaceable component of a regulator valve seat assembly

3.2.5
actuator
device or mechanism which changes the signal from the controller into a corresponding movement controlling the position of the control member

3.2.6
casing of actuator
housing of the actuator

NOTE There may be two chambers under pressure within it. When the pressure in each chamber is different from atmospheric pressure, the chamber at the higher pressure is termed the "motorization chamber"

3.2.7
controller

device that controls the regulator

NOTE It includes:

— setting element, normally a spring, to obtain the set value of the controlled variable;

— detector element, normally a diaphragm, for the controlled variable.

3.2.8
pilot controller

device that controls the regulator

NOTE It includes:

— setting element to obtain the set value of the controlled variable;

— detector element for the controlled variable;

— unit which compares the set value of the controlled variable with its feedback value;

— system which provides the motorization energy for the actuator.

3.2.9

main diaphragm
device that detects the controlled variable feedback pressure and provides the force to position the valve

3.2.10
pressure containing parts
parts where failure would result in release of gas to the atmosphere

NOTE Such parts comprise bodies, control member, bonnets, the casing of the actuator, blind flanges and pipes for process and sensing lines.

3.2.11
inner metallic partition wall
metallic wall that divides internal chambers which have differing operating pressures

3.2.12
process and sensing line
line that connects impulse points to the pressure regulator

NOTE Sensing and process lines may be integrated into the pressure regulator or external to the pressure regulator. Those lines with no internal flow are termed "sensing lines"; those with internal flow are termed "process lines".

3.2.13
breather line
line between the controller and/or pilot regulator and atmosphere which equalizes the pressure on a detector element when it changes its position

3.2.14
exhaust line
line to atmosphere between the regulator or fixtures for the safe venting of gas in the event of a component failure

3.2.15
fixtures

functional devices connected to the main components of the pressure regulator or SSD

3.3 Safety shut-off devices

3.3.1
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

3.3.2
closure member
movable part of the safety shut off device that shuts off the gas flow

3.3.3
trip mechanism
mechanism that releases the closure member when activated by the controller

3.3.4
actuator
device that is activated by the trip mechanism which shuts the closure member

3.3.5
relatching device
device that enables the complete opening of an SSD

3.3.6
safety shut-off device controller
safety device for the regulator

NOTE It may include:

— setting element to adjust the set value of the trip pressure;

— sensing element for the control of the monitored pressure (e.g. a diaphragm);

— unit which compares the set value of the trip pressure with the monitored pressure;

— system which gives the energy to operate the trip mechanism.

3.4 Control variables

3.4.1 Reference values

3.4.1.1 Pressure

NOTE All pressures specified in this European Standard are static gauge pressures. They are measured in bar[1]).

3.4.1.1.1
inlet pressure
Pe
gas pressure at the inlet of the pressure regulator

3.4.1.1.2
outlet pressure
Pa
gas pressure at the outlet of the pressure regulator

3.4.1.1.3
differential pressure
Ap
difference between values of pressure measured at two different points

3.4.1.1.4
motorization pressure,
Pm
gas pressure in the motorization chamber

3.4.1.1.5
motorization chamber
chamber at the higher pressure of two chambers under pressure within the casing of actuator

3.4.1.1.6
pilot feeding pressure
Pep
gas pressure at the inlet of the pilot

3.4.1.2 Flow conditions

3.4.1.2.1
normal conditions
absolute pressure p_n of 1 013,25 mbar and temperature T_n of 0 °C (273,15 K)

NOTE For calculation purposes a value of 273 K is used in this European Standard.

3.4.1.2.2
gas volume

volume of gas at normal conditions

NOTE It is expressed in m^3.

3.4.1.2.3
volumetric flow rate
Q
volume of gas which flows through the pressure regulator in unit time

1) 1 bar = 1000 mbar = 10^5 N/m^2 = 10^5 Pa = 10^{-1} MPa.

NOTE It is expressed in m^3/h at normal conditions.

3.4.2 Variables in the controlling process

3.4.2.1
controlled variable
X

variable which is monitored by the controlling process

NOTE 1 This controlled variable in pressure regulators may be:

inlet pressure, $p_{e;}$

outlet pressure, p_a-

— differential pressure, Ap.

NOTE 2 In this European Standard, only the outlet pressure "p_a" is considered as the controlled variable.

3.4.2.2
disturbance variable
Z
variables acting from outside on the controlling process

NOTE In the case of pressure regulators with the outlet pressure as the controlled variable, the disturbance variables are essentially:

fluctuations in the inlet pressure, p_e-

— changes in the volumetric flow rate, Q.

3.4.2.3
monitored pressure
pressure monitored and safeguarded by the SSD

3.4.2.4
trip pressure
pressure value at which the closing member starts to move

3.4.2.5
upper trip pressure
Po
upper limit of the monitored pressure (over-pressure)

3.4.2.6
lower trip pressure
Pu
lower limit of the monitored pressure (under pressure)

3.4.3 Possible values of all variables

3.4.3.1
actual value
instantaneous value of any variable at any instant

NOTE It is specified by the subscript Y added to the symbol of the variable

3.4.3.2
maximum value
highest value to which any variable can be adjusted, limited or reached during a series of measurements or during a certain time period

NOTE It is specified by the subscript "max" added to the symbol of the variable.

3.4.3.3
minimum value
lowest value to which any variable can be adjusted, limited or reached during a series of measurements or during a certain time period

NOTE It is specified by the subscript "min" added to the symbol of the variable.

3.4.4 Terms pertinent to the controlled variable

3.4.4.1
set point
Pas
nominal value of the controlled variable

NOTE The set point is not directly measurable but determined as shown in Figure 1.

3.4.4.2
set point range
W_h
whole range of set points, which can be obtained from a pressure regulator by adjustment and/or the replacement of some components

NOTE Components might be replacement of the valve seat or adjustment element e.g. spring.

3.4.4.3
specific set point range
Wa
whole range of set points which can be obtained in a pressure regulator by adjustment and with no replacement of its components

3.4.4.4
control deviation
X_w
difference between the actual value of the controlled variable and the set point

3.4.4.5
regulation change
control deviation, X_w expressed as a percentage of the set point

3.5 Operating features in stable conditions

3.5.1
stable conditions
conditions when the controlled variable settles to a stable value after a disturbance has occurred

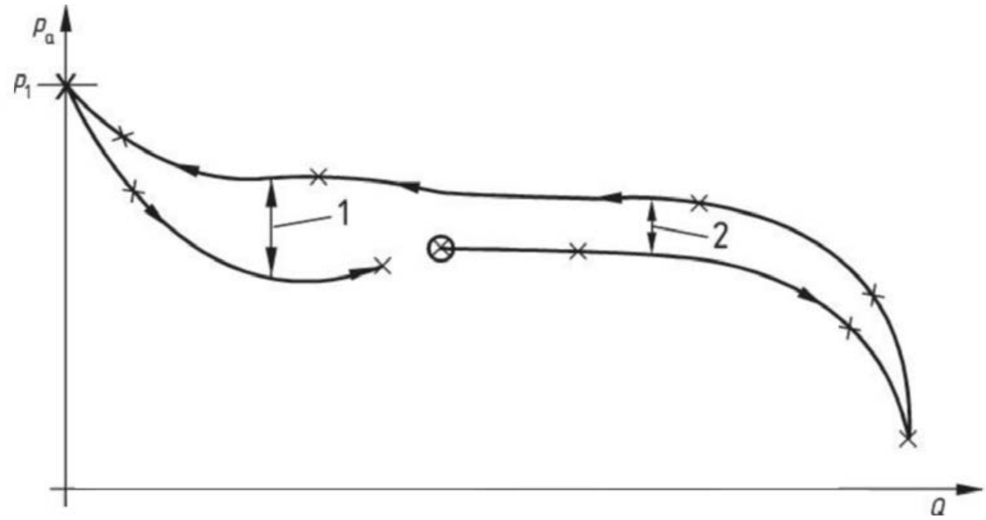
3.5.2
performance curve
graphic representation of the controlled variable as a function of the volumetric flow rate

NOTE This curve is determined by increasing and then decreasing the volumetric flow rate with constant inlet pressure and set point (see Figure 1).

3.5.3
hysteresis band

difference between the two values of outlet pressure for a given volumetric flow rate

NOTE See Figure 1.



Key

1 Max hysteresis band

2 Hysteresis band

ⓧ Start setting

X Measured values

Figure 1 — Performance curve (p_{as} constant, p_e constant)

3.5.4
family of performance curves

set of the performance curves for each value of inlet pressure determined for a given set point

NOTE See Figure 2.

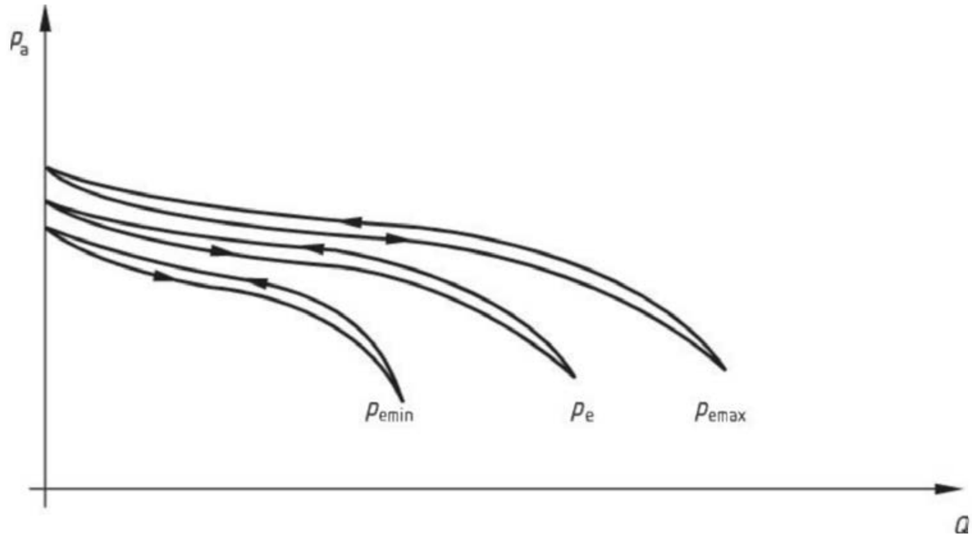


Figure 2 — Family of performance curves (p_{as} constant)

3.6 Features pertinent to accuracy

3.6.1
accuracy
average, expressed as a percentage of the set point, of the absolute maximum values of the positive and negative control deviation within the operating range

3.6.2
accuracy class
AC

maximum permissible value of the accuracy

NOTE In German *AC* was designated *RG.*

3.6.3
inlet pressure range
bpe
range of the inlet pressure for which the pressure regulator ensures a given accuracy class.

NOTE The inlet pressure range is characterized by its limit values p_{emax} and p_{emin}

3.6.4
maximum accuracy flow rate
lowest value of the maximum volumetric flow rate

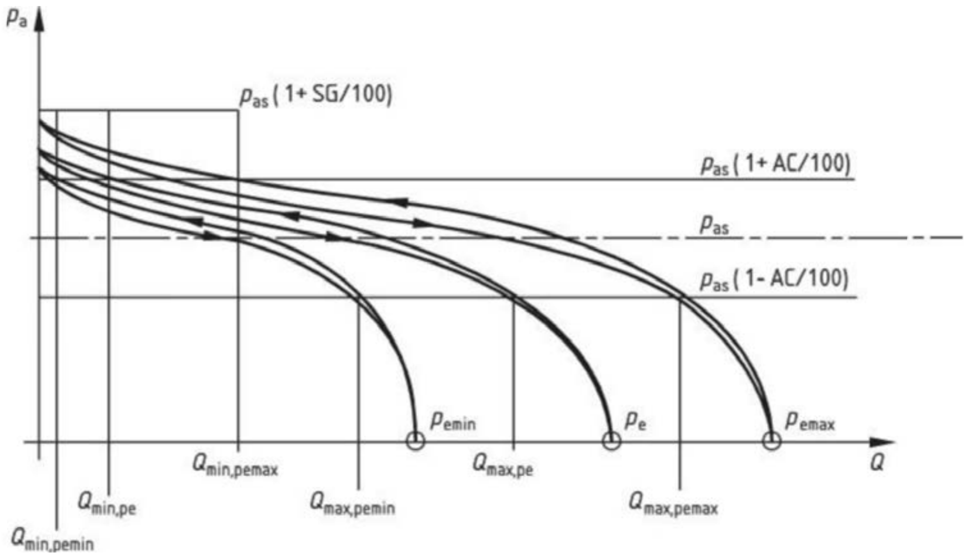
NOTE 1 Below this flow rate, and for a given set point within the ambient temperature range specified, a given accuracy class is ensured at:

— the lowest inlet pressure: $Q_{max,}$ p_{emin}

— the highest inlet pressure: Q_{max}, p_{emax}

— an intermediate inlet pressure between p_{emax} and p_{emin}: $Q_{max,pe}$

NOTE 2 See Figure 3.



Key

O = Q_{max} with the control member at the limit imposed by the mechanical stop

Figure 3 — Family of performance curves indicating maximum accuracy flow rates and minimum flow rates (p_{as} constant, stable conditions)

3.7 Features pertinent to lock-up behaviour

3.7.1
lock-up time
t_f
time taken for the control member to move from an open position to the closed position

3.7.2
lock-up pressure
P_f
outlet pressure at which a pressure regulator closes when the outlet of the pressure regulator is sealed

NOTE The increase in outlet pressure is expressed either in mbar or as a percentage.

3.7.3
lock-up pressure class
SG
maximum permissible positive difference between the actual lock-up pressure and the set point expressed as a percentage of the set point

NOTE The lock-pressure pressure class, SG, is given by the following equation:

$$SG = \frac{p_f - p_{as}}{P_{as}} \times 100$$

where:

p_f = lock-up pressure

p_{as} = set point

3.7.4
minimum flow rate
largest value of the minimum volumetric flow rate

NOTE 1 Above this flow rate, and for a given set point within the ambient temperature range specified, stable conditions are obtained:

— at the lowest inlet pressure: $Q_{min,pemin}$

— at the highest inlet pressure: $Q_{min,pemax}$

— at an intermediate inlet pressure between p_{emax} and p_{emin}: $Q_{min,pe}$.

NOTE 2 See Figure 3.

3.8 Further functional terminology

3.8.1 Pressures pertinent to design of gas pressure regulator

3.8.1.1
component operating pressure
p
gas pressure occurring in any part of a pressure regulator during operation

3.8.1.2
maximum component operating pressure
P_{max}
highest operating pressure at which any component of a pressure regulator will continuously operate within specified conditions

3.8.1.3
maximum allowable pressure
PS

maximum pressure for which the equipment is designed, as specified by the manufacturer

NOTE In accordance with the strength requirements of this European Standard.

3.8.1.4
test pressure
pressure applied to a section of the pressure regulator for a limited period of time in order to prove certain characteristics

3.8.1.5
limit pressure
P_l
pressure at which yielding becomes apparent in any component of the pressure regulator or its fixtures

3.8.1.6
safety factor
S_b, S

ratio of the value of the limit pressure p_l to the value of the maximum allowable pressure PS

NOTE This term applies to two separate discrete regions of the pressure regulator:

— applied to the pressure regulator body: S_b;

— applied to the other pressure containing parts of the pressure regulator: S

3.8.1.7
permissible inlet pressure
P_{emax}
highest inlet pressure at which the pressure regulator can continuously operate within specified conditions

3.8.1.8
permissible outlet pressure
P_{amax}
highest outlet pressure at which the pressure regulator can continuously operate within specified conditions

3.8.1.9
minimum operating differential pressure
Δp_{min}
minimum operating differential pressure between the inlet and outlet pressures below which the pressure regulator will no longer function correctly within specified conditions

3.8.2
nominal pressure
PN
numerical designation that applies to flanges relating to pressure

3.8.3
operating temperature range
temperature range at which the pressure regulator components and fixtures are capable of operating continuously

4 Classification

Pressure regulators shall be classified as group 2 in accordance with EN 13611:2007, 4.2.

NOTE Group 1 controls are excluded from this European Standard.

5 Units of measurement and test conditions

5.1 Units of measurement

Units of measurement shall be as given in EN 13611:2007, 5.1, 5.2 and 5.3.

5.2 Test conditions

Test conditions shall be in accordance with EN 13611:2007, 5.4.

6 Construction requirements

6.1 General

General construction requirements shall be in accordance with EN 13611:2007, 6.1 with the following additional requirements.

External and internal leak tightness shall meet the requirements of 7.3. If in the event of a failure (e.g. of a diaphragm) leakage is possible, a tapping connection of at least DN 10 for an exhaust line shall be provided.

If a safety shut-off device for over-pressure is provided, it shall be functionally independent from the pressure regulator.

Further, when the integral shut-off safety device utilizes pipeline gas as a source of energy for its operation this shall be taken from upstream of the pressure regulator.

When the integral shut-off safety device is a slam-shut device or a cut-off device or a monitor, the motorization energy for a pilot controlled regulator shall be provided by the gas pressure downstream from the safety device.

NOTE A safety relief or under pressure device may be incorporated in the control member of a pressure regulator.

6.2 Construction

6.2.1 General

With the exception of breather holes (6.2.2), construction shall be in accordance with EN 13611:2007, 6.2, with the additional requirements given in 6.2.3, 6.2.4 and 6.2.5 of this European Standard.

6.2.2 Breather holes

6.2.2.1 Breather holes without a connection for a vent pipe

Breather holes without a connection for a vent pipe shall conform to EN 13611:2007, 6.2.3.

6.2.2.2 Breather holes with a connection for a vent pipe

If the vented capacity is greater than 70 dm^3/h of air, a connection for a vent pipe shall be provided. Any breather/exhaust line or device fitted shall be designed to prevent the ingress of foreign materials which could damage internal parts.

If a leakage rate limiter is used, it shall be able to withstand three times the maximum inlet pressure. If a safety diaphragm is used as a leakage rate limiter, it shall not take the place of the working diaphragm in case of a fault.

Breather holes shall be protected against blockage or shall be located so that they do not easily become blocked. They shall be so arranged that the diaphragm cannot be damaged by a sharp device inserted through the breather hole.

6.2.3 External visual Indication of the position of the closure member

A SSD may be fitted with an external visual device to indicate the closure member position. Where an external visual device is fitted, it shall clearly indicate whether it is in the open or closed position.

6.2.4 Parts transmitting actuating forces

Parts transmitting actuating forces shall be metallic and designed with a safety factor of > 3 against permanent deformation.

6.2.5 Pressure adjustment

The outlet pressure adjustment shall be readily accessible to authorised persons, but there shall be provision for sealing after adjustment. Means shall be provided to discourage interference by unauthorized persons.

6.3 Materials

6.3.1 General

Materials shall conform to EN 13611:2007, 6.3.1, 6.3.3, 6.3.4, 6.3.6, 6.3.7 and 6.3.8, with the additional requirements given in 6.3.2 and 6.3.3 of this European Standard.

6.3.2 Springs

6.3.2.1 General

Springs shall conform to EN 13611:2007, 6.3.5, with the additional requirements given in 6.3.2.2 of this European Standard.

6.3.2.2 Stresses and buckling

Springs shall not be overstressed under any operating conditions and there shall be sufficient free movement to allow satisfactory operation.

Springs shall be designed such that buckling does not occur, in accordance with EN 13906, parts 1 to 3.

6.3.3 Requirements for elastomers (including vulcanized rubbers)

Elastomers shall conform to EN 682 or EN 13787 or EN 549.

6.4 Gas connections

6.4.1 General

Gas connections shall conform to EN 13611:2007, 6.4.1, 6.4.4, 6.4.5, 6.4.6 and 6.4.8, with the modifications and additional requirements given in 6.4.2, 6.4.3 and 6.4.4 of this European Standard.

6.4.2 Connection sizes

Equivalent connection sizes are given in Table 1.

Table 1 — Connection Sizes

Nominal size DN	Designation of thread inches	Nominal size of flanges DN	Outside diameter of tubes for compression fittings (mm)
6	1/8	6	2 ≤ 5
8	1/4	8	6 ≤ 8
10	3/8	10	10 ≤ 12
15	1/2	15	14 ≤ 16
20	3/4	20	18 ≤ 22
25	1	25	25 ≤ 28
32	1 1/4	32	30 ≤ 32
40	1 1/2	40	35 ≤ 40
50	2	50	42 ≤ 50
65	2 1/2	65	
80	3	80	
100	-	100	
125	-	125	
150	-	150	
200	-	200	
250	-	250	

6.4.3 Threads

When the inlet or outlet thread of a pressure regulator is a pipe thread, it shall be in accordance with either ISO 7-1 or EN ISO 228-1, and shall be chosen from the series given in Table 1.

NOTE Additional information concerning the use of these threads is given in Annex B.

6.4.4 Pressure test nipples (applicable only for outlet connections operating at £ 500 mbar)

Pressure test nipples, where fitted, shall have an external diameter of (9 ± 0,5) mm and a useful length of at least 10 mm for connection to tubing. The equivalent diameter of the bore shall not exceed 1 mm.

NOTE For special test nipples with screwed connections and internal valves there are no pressure limitations.

7 Performance requirements

7.1 General

Pressure regulators and safety shut-off devices shall conform to EN 13611:2007, 7.1.

7.2 Strength of housings

7.2.1 Requirement

The safety factor, *f* shall be equal to 4 for the test pressure where f is the multiplication factor for the maximum inlet pressure.

When tested in accordance with 7.2.2 followed by 7.3, the external leakage shall not be higher than the values in Table 2 of EN 13611:2007.

7.2.2 Performance test

A pressure of *f* times the maximum inlet pressure is applied to the control at maximum ambient temperature for a minimum of 5 min. Then the control is cooled to (20 ± 5) °C.

7.3 External and internal leak tightness

When tested in accordance with EN 13611:2007, 7.3 with the following additions, the pressure containing parts and all connecting joints shall conform to EN 13611:2007, 7.2.

The internal leakage test of the assembled SSD and its fixtures shall be carried out at ambient temperature with two different test pressures, 0,1 bar and 1,1 PS, upstream of the closure member and at atmospheric pressure downstream of the closure member.

SSDs shall be tested with the pressure regulator in the open position.

7.4 Torsion and bending

When tested in accordance with EN 13611:2007, 7.5, the torsion and bending moment shall conform to EN 13611:2007, 7.4.

7.5 Control classification

7.5.1 General

If more than one function exists (e.g. pressure regulator and integral safety shut-off device) then the performance of each function shall be considered separately.

7.5.2 Control classifications for pressure regulators

7.5.2.1 Regulator accuracy

When tested in accordance with C.3.4, pressure regulators shall conform to accuracy requirements relevant to the declared accuracy class(es) chosen from Table 2 within the declared class.

Table 2 — Accuracy classes

Accuracy class	Permissible positive and negative regulation change
AC 5	± 5 % [a]
AC 10	± 10 %
AC 20	± 20 %

[a] Not lower than ± 1 mbar.

NOTE The same type of pressure regulator may have different accuracy classes depending on the set range Wh and/or the inlet pressure range bpe.

7.5.2.2 Lock-up pressure class

When a pressure regulator is claimed by the manufacturer to have the ability to lock-up, the outlet pressure shall not rise by more than stated in Table 3. Such a pressure regulator shall be tested in accordance with the test method described in C.3.3.

Table 3 — Lock-up pressure classes

Lock-up pressure class	Permissible positive regulation change within the lock-up pressure zone
SG 10	10 %[a]
SG 20	20%
SG 30	30%

[a] Not lower than 1 mbar.

NOTE The same type of pressure regulator may have different lock-up pressure groups depending on the specified set range W_h and/or the inlet pressure range b_{pe}.

7.5.3 Safety shut-off device accuracy group for over-pressure

When a pressure regulator is claimed by the manufacturer to have the ability to lock-up, the trip pressure deviation shall be as stated in Table 4. Such a pressure regulator shall be tested in accordance with the test method described in C.4.

When tested in accordance with C.4.4, the mean set value calculated from the six actual values shall correspond to the specified accuracy group.

Table 4 — Specified accuracy classes for over-pressure shut-off

Accuracy group	Permissible deviation
AG 5	± 5 %[a]
AG 10	± 10 %[a]
AG 20	± 20 %[b]
AG 30	± 30 %[b]

[a] Or 1 mbar, whichever is greater.

[b] For set values ≤ 200 mbar only.

NOTE 1 A safety shut-off device can conform to different accuracy groups as a function of the set range W_u or of the inlet operating pressure range b_{pe}.

NOTE 2 At the lower limit temperature the permissible deviation for the declared accuracy group may rise to the values given in Table 4 for the next less stringent accuracy group.

7.6 Safety devices

7.6.1 Over-pressure safety shut-off device

When tested in accordance with C.4, the over-pressure SSD shall close when the pressure reaches the pre-set trip pressure.

The shutting-off of the gas flow shall be automatic and shall not be interruptable until the closure member has reached the closed position. Re-set shall only be possible by manual means.

7.6.2 Under-pressure safety shut-off devices

When tested in accordance with C.4, the under-pressure SSD shall close when the pressure reaches the pre-set trip pressure.

NOTE Under pressure devices may by design have either manual or automatic resetting functions.

7.6.3 Bypass

If an internal bypass is fitted for the purpose of pressure equalization, it shall close safely and automatically before or during tripping.

7.6.4 Response time

When tested in accordance with C.4.5, the response time *t* shall be < 2 s;

7.7 Durability of performance

7.7.1 Pressure regulator

The leak tightness and performance shall remain within the limits specified in 7.3 and 7.5.2 respectively without further adjustment of the setting point of the pressure regulator after testing in accordance with C.5.

7.7.2 Safety slam-shut device

The internal sealing, pressure accuracy and response time shall remain within the limits specified in 7.3, 7.6.1 and 7.6.4 respectively without further adjustment of the trip pressure after testing in accordance with C.5.

8 Marking, installation and operating instructions

8.1 Marking

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

a) manufacturer and/or trade mark;

b) type reference;

c) regulator accuracy class;

d) date of manufacture (at least the year). This may be in code;

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

f) maximum inlet pressure;

g) vent connection (if applicable).

NOTE Under certain circumstances, traceable type reference only is necessary.

8.2 Installation, operating and servicing instructions

One set of instructions shall be supplied with each consignment, written in the language(s) of the country into which the controls are to be delivered.

The instructions shall include all relevant information on the use, installation, operation and servicing of pressure regulators and any associated safety devices, in particular the following:

a) maximum inlet pressure;

b) gas families for which the pressure regulator is suitable;

c) representative performance curves/data;

d) set point range;

e) ambient temperature range in °C;

f) mounting position(s);

g) instructions for changing from one gas family to another;

h) accuracy class, *AC*, accuracy group, *AG* (if applicable), lock-up group, *SG* (if applicable);

i) lock-up pressure (if applicable);

j) maintenance instructions (if applicable);

k) Instructions for changing components that may be replaced to cover the whole set point range, i.e. orifices or springs;

l) In particular, instructions for the installation and operation of any integrated safety devices;

m) If fitted with a vent connection, the installation and operation instructions shall state that the breather shall be vented to a safe place.

8.3 Warning notice

A warning notice shall be attached to each consignment of controls. This notice should state:

"Read the instructions before use. This control must be installed in accordance with the rules in force".

Annex A
(informative)

Main components for direct acting and pilot controlled pressure regulators

A.1 Main components of a pressure regulator

The main components of a gas pressure regulator normally include:

— control member;

— pressure regulator body;

— actuator;

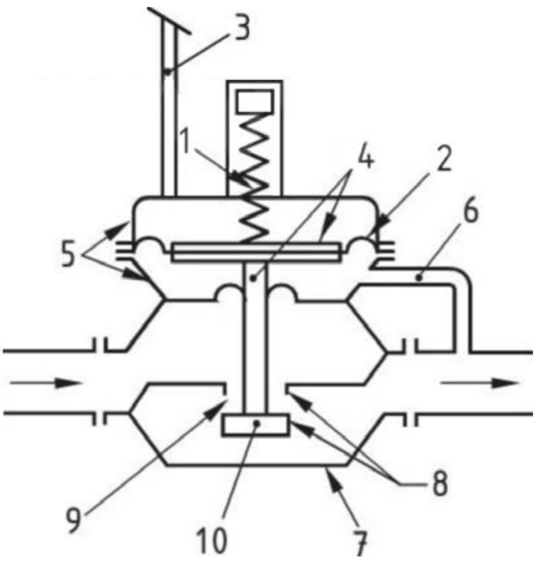
— casing of actuator;

— controller; and

— pilot (only in pilot controlled pressure regulators).

The pressure regulator might include additional units, for example a shut-off device,

and other fixtures. Examples are shown in Figures A.1 and A.2.



Key

1 Setting element

2 Detector element

1 + 2 = Controller

3 Breather/exhaust line

4 Actuator

5 Casing of actuator

6 Sensing line

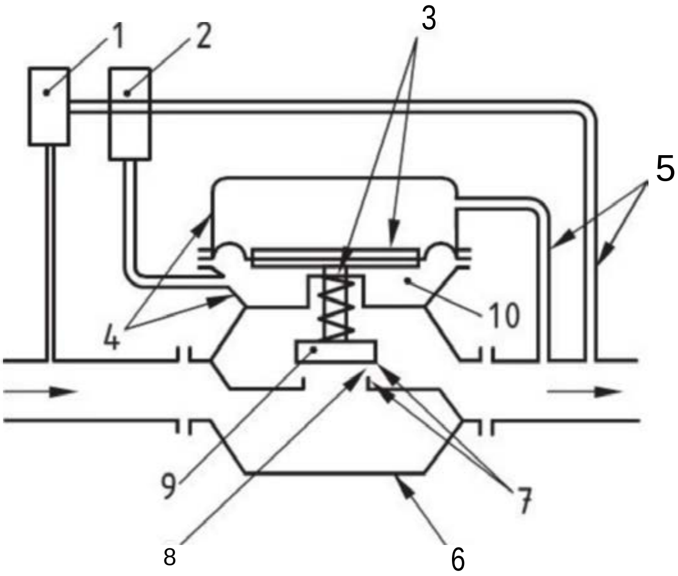
7 Regulator body

8 Valve seats

9 Seat ring

10 Control member

Figure A.1 — Example of a direct acting regulator



Key

1 Fixture
2 Pilot
3 Actuator
4 Casing of actuator
5 Sensing/process line
6 Regulator body
7 Valve seats
8 Seat ring
9 Control member
10 Motorization chamber

Figure A.2 — Example of a pilot controlled regulator

A.2 Main components of a gas safety shut-off device

The parts of a gas safety shut-off device normally include:

— controller;

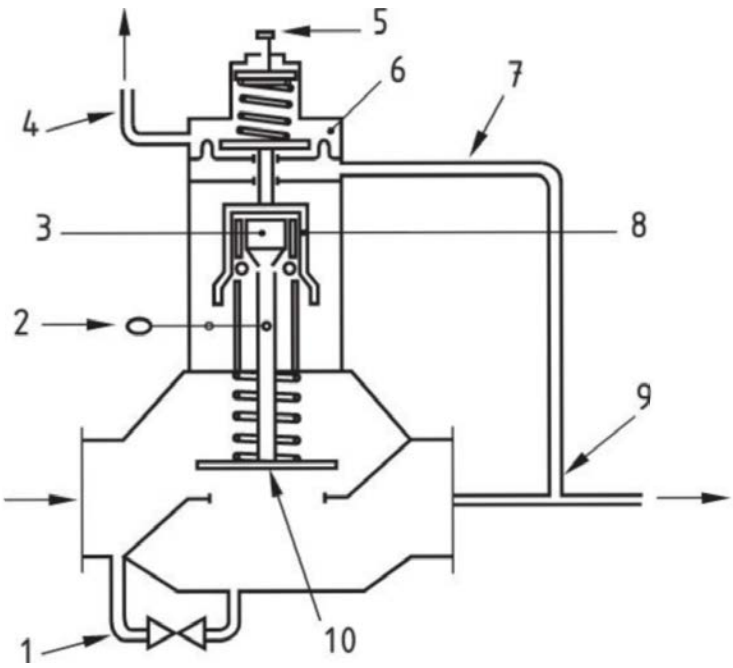
— trip mechanism;

— actuator;

— closing member and

— relatching device permitting the manual opening of the SSD.

Figure A.3 shows a stand-alone safety shut-off device and is presented for information only.



Key

1 Bypass

2 Relatching device

3 Trip mechanism

4 Breather line

5 Setting element

6 Controller

7 Sensing line

8 Actuator

9 Sensing point

10 Closure member

Figure A.3 — Example of a direct acting safety shut-off device of the slam-shut type

Annex B
(informative)

Use of ISO 7-1 and EN ISO 228-1 threads for gas connections (see 6.4.3)

The use of threads for gas connections (see 6.4.3) as described in ISO 7-1 and EN ISO 228-1 in CEN members is summarized in Table B.1 for those CEN members who have provided information to the Secretariat of CEN/TC 58 for inclusion in this table.

Table B.1

Country	AT	BE	CH	DE	DK	ES	FR	GB	NL	PL	PT
Internal connections the appliance											
ISO 7-1 taper/taper	no	-	no	no	no	no	yes	yes	no	no	yes
ISO 7-1 parallel/taper	yes	-	yes	yes	yes	yes	yes	yes	yes	yes	yes
EN ISO 228-1	no	-	yes	no	no	no	yes	yes	no	yes	yes
Appliance connections Category I_3											
ISO 7-1 taper/taper	no	-	no	no	no	-	-	yes	no	no	yes
ISO 7-1 parallel/taper	yes	-	yes	yes	yes	-	-	yes	yes	yes	yes
EN ISO 228-1	no	-	yes	no	no	-	-	yes	no	yes	yes
Other categories		[a]									
ISO 7-1 taper/taper	no	no	no	no	no	no	no	yes	no	no	yes
ISO 7-1 parallel/taper	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes
EN ISO 228-1	no	no	yes	no	no	no	yes[b]	yes	no	yes	yes
Installation area		[c]					[d]				
ISO 7-1 taper/taper	no	no	no	no	no	no	no	yes	no	no	yes
ISO 7-1 parallel/taper	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes
EN ISO 228-1	yes	no	yes	yes	no	no	yes	yes	no	yes	yes

[a] Only category I_2

[b] *G* 1/2 for cooking appliances

[c] Natural gas only

[d] Installation connected to a distribution system

Annex C
(normative)

Performance test methods

C.1 General

If the pressure regulator has built-in safety device(s) it shall be tested with the safety device(s) in its (their) normal operating position.

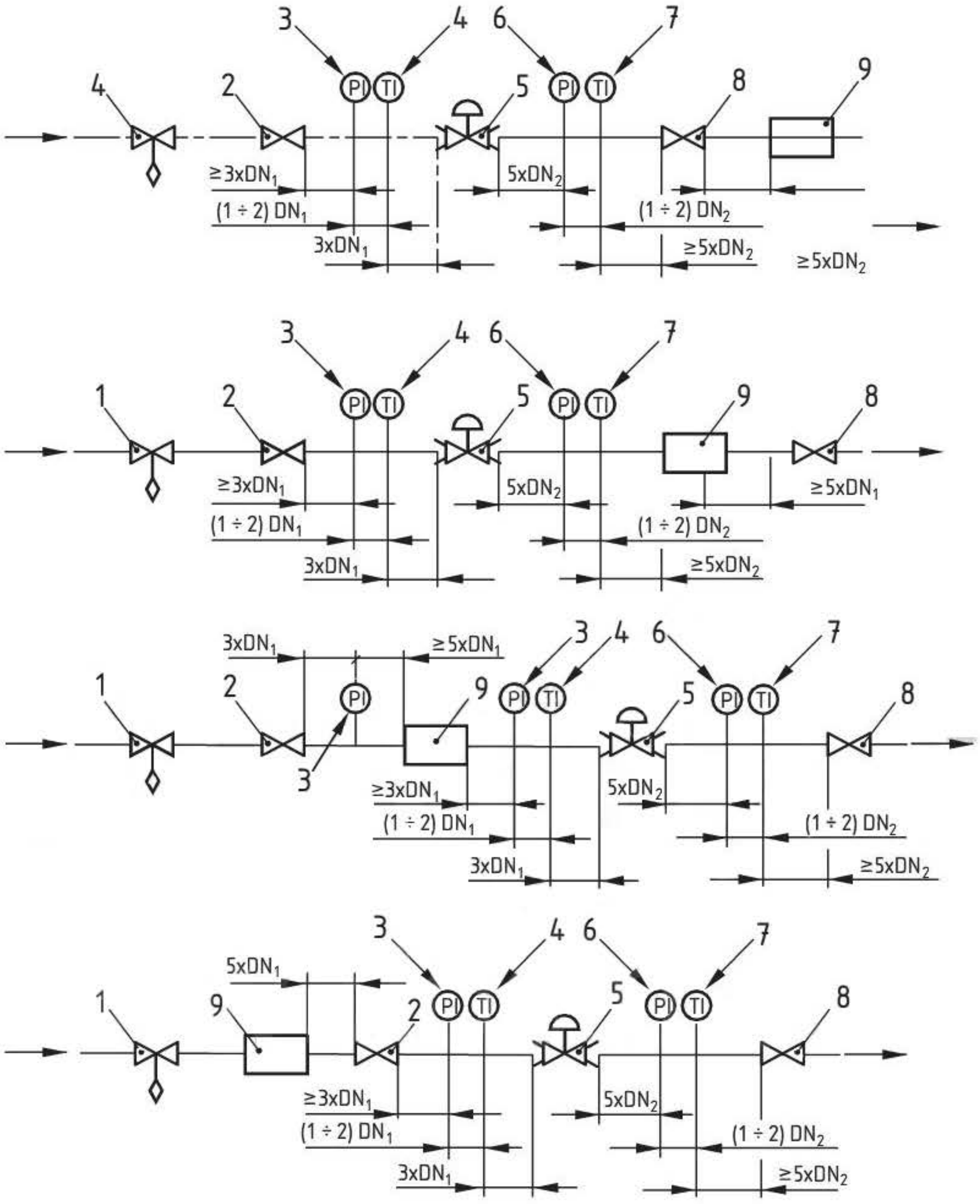
NOTE The tests may be carried out either with air or with gas.

Where necessary, measured volumetric flow rates shall be converted into values that are related to air at normal conditions. Due to the need to obtain a homogeneous set of test results that will permit different types of pressure regulators to be compared with each other, or to assess in the laboratory the requested performance of a pressure regulator in the field, or make the assessments specified in 7.5, the measured values shall be converted into volumetric flow rates related to an inlet reference temperature of 15 °C. Pressure gauges shall have an accuracy of at least *ACl4* (in %) in the range of the scale according to the applicable standard and a full scale not greater than twice the value of the variable to be measured. Tests shall be carried out at ambient temperature. Pressure regulators shall be tested in the mounting position specified by the manufacturer.

The external sensing/process lines shall be located on the downstream pipework according to the recommendations of the manufacturer.

C.2 Apparatus and test rig

The tests shall be carried out on a test rig built as specified in Figure C.1 or in accordance with EN 60534-2-3 as appropriate. The nominal diameter of the pipework connecting the full bore valves and the flow rate regulating valves with the pressure regulator shall not be smaller than the nominal diameter of the pressure regulator and so chosen as to ensure that in all operating conditions of the tests the velocity of the gas does not exceed 50 m/s for pressure > 0,5 bar.



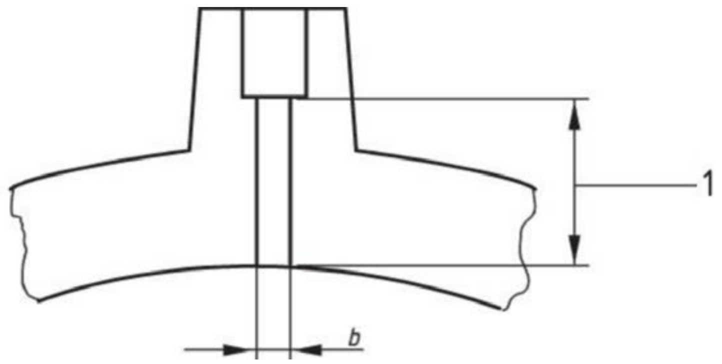
Key

1 Shut-off device to prevent overpressure, if necessary
2 Inlet full bore valve
3 Inlet pressure indicator
4 Inlet temperature indicator
5 Pressure regulator under test
6 Outlet pressure indicator
7 Outlet temperature indicator
8 Flow rate regulating valve
9 Flow meter

DN_1 = nominal diameter of the upstream pipework connected to the pressure regulator under test
DN_2 = nominal diameter of the downstream pipework connected to the pressure regulator under test

Figure C.1 — Test rig

The connections between the pressure regulator and the test rig pipework shall be made using concentric reducers according to ISO 3419 or equivalent. The pressure tapping diameter *b* shown in Figure C.2 shall be at least 3 mm and shall be no larger than 12 mm or one-tenth of the nominal pipe diameter, whichever is the lesser. The tapping shall be circular and its edge shall be clean and sharp or slightly rounded and free from burrs or other irregularities. Any suitable method of making a physical connection is acceptable provided the above recommendations are followed. However, fittings shall not protrude inside the pipework.



Key

1 Minimum 2,5 *b*, recommended 5 *b*

Figure C.2 — Pressure tapping

In the event of unstable conditions due to volumetric flow rate variations consequent to the operation of the flow regulating valve 8 (see Figure C.1), it is permissible to increase the length of the pipework connecting this valve to the pressure regulator, or to provide for an additional volume by installing a parallel line or reservoir.

The lock-up pressure tests shall always be carried out on a test rig in which the downstream pipework has the minimum specified length; for these tests an additional downstream volume is not permitted. The flow meter shall be installed in accordance with its instructions.

C.3 Performance tests under stable conditions

C.3.1 General

These tests shall be carried out at stable conditions and at ambient temperature. The purpose is to verify the values stated by the manufacturer for the:

— accuracy class;

— lock-up pressure class;

— accuracy flow rate minimum and maximum.

The tests shall be carried out where technically possible on a test rig in accordance with C.2.

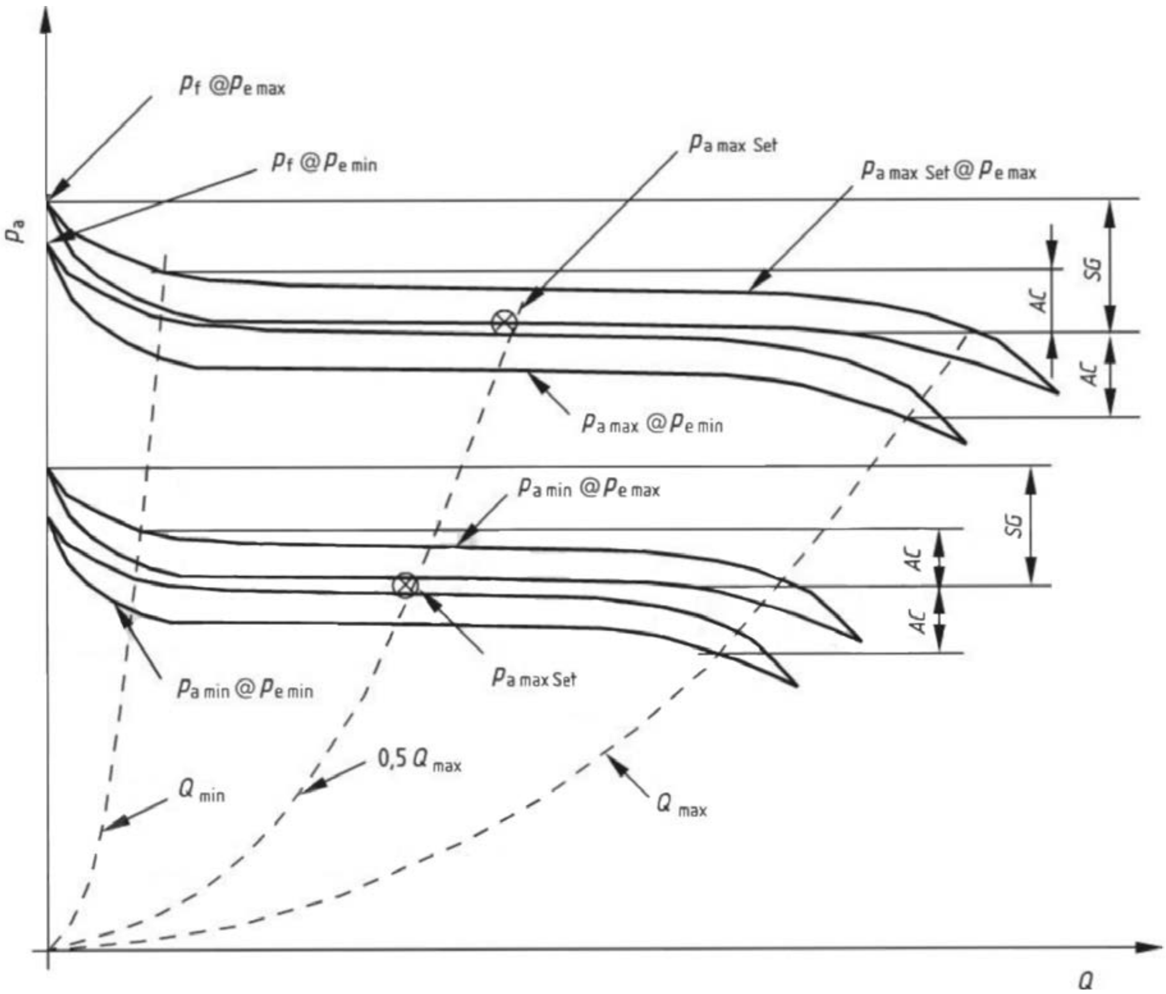
NOTE 1 Where this is not the case, alternative test and calculation methods e.g. those explained in this annex or the modelling tests on test specimens to a smaller scale as described in EN 60534-2-3, may be used for the determination of Qmax.pemin' ^max,pemax' AC, SG and hysteresis band under the following pre-conditions:

a) the maximum possible size and at least the minimum size of a series of pressure regulators shall be tested using a test rig in accordance with C.2;

b) to prove that the alternative method chosen is reliable by comparing the results with those from a test at full operating conditions in a particular pressure regulator size;

c) to use the alternative method for larger sizes of pressure regulators of the same series.

NOTE 2 However, if the pressure regulator or even the smallest pressure regulator of a series cannot be tested in accordance with C.2, the test method as that detailed in Annex C may be used without other pre-conditions.



Key

AC Accuracy Class

SG Lock-up pressure class

Figure C.3 — Performance curves

C.3.2 Determination of a performance curve

To determine the variation of the inlet pressure p_e and of the flow rate Q for a performance curve, proceed as follows:

a) Adjust the outlet pressure setting of the pressure regulator. Set the outlet control tap to obtain a flow rate of 0,5 Q_{max}(or any other value declared by the manufacturer). For adjustable pressure regulators, adjust the outlet pressure setting to the maximum value ($p_{a max}$), the inlet pressure p_e being the nominal pressure (or any other value) declared by the manufacturer. After the outlet pressure being set, there shall be no further adjustment of the pressure regulator.

b) Vary the inlet pressure p_e from the nominal pressure over the minimum ($p_{e min}$) to the maximum value ($p_{e max}$) as declared by the manufacturer and back to $p_{e min}$, and record the outlet pressure p_a for, at least, 5 values of p_e in each direction, without resetting the flow rate.

c) With inlet pressure $p_{e min}$ kept constant, vary the flow rate from Q_{max} to Q_{min} and back by using the outlet control tap, the outlet pressure p_a being recorded for, at least, 5 values of Q in each case. Make sure that there is no change of the inlet pressure during the whole time of this procedure.

d) Readjust the inlet pressure from $p_{e min}$ to $p_{e max}$ as declared by the manufacturer and then vary the flow rate from Q_{max} to G_{nin} (as in step c)).

e) For adjustable pressure regulators, repeat steps b) to d) after the outlet pressure setting has been readjusted according to step a) to the value $p_{a min}$.

After each adjustment of inlet pressure or flow the outlet pressure should have time to stabilise.

Volumetric flow rates measured by the flow meter 9 (Figure C.1) shall be recalculated to refer to:

— normal conditions (see 3.4.1.2.1);

— air at the reference temperature of 15 °C at the inlet of the pressure regulator under test.

To this end the following equation shall be used:

$$Q = Q_M \frac{p_M + p_b}{Pn} \times \frac{T_n}{t_M + T_n} \sqrt{d} \qquad [1]$$

where:

Q = converted volumetric flow;

Q_M = volumetric flow rate measured at the flow meter;

p_M = gas pressure at the flow meter;

P_b = absolute ambient atmospheric pressure;

p_n = normal atmospheric pressure (see 3.4.1.2.1);

T_n = normal ambient temperature (see 3.4.1.2.1);

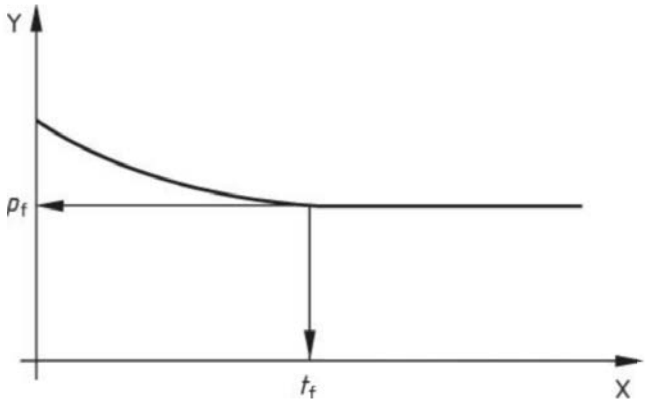
t_M = gas temperature at the flow meter in °C;

d = relative density of the test fluid (air = 1 non dimensional value).

C.3.3 Determination of the lock-up pressure

When a pressure regulator is claimed by the manufacturer to have the ability to lock-up, an additional measurement at zero volumetric flow rate shall be taken for each pair of p_e and p_{as} values.

The lock-up pressure shall be determined in connection with tests carried out to determine the performance curve of the controlled variable. The time required to reduce the volumetric flow rate to zero shall not be less than the lock-up time of the pressure regulator. This condition is deemed to be satisfied when the lock-up pressure is found to be independent of the time needed to reduce the volumetric flow rate to zero (see Figure C.4).



Key

X Time to reduce the volumetric flow rate to zero

Y Pressure with control member at closure position

Figure C.4 — Graphical representation of C.3.3

The lock-up pressure p_f shall be measured twice, after 1 min and 2 min from the pressure regulator closure.

Any lock-up pressure value that can be affected by temperature variations of the fluid contained in the volume between the pressure regulator under test and the flow rate regulating valve, shall be recalculated and related to the initial temperature by using the following equation:

$$p_f = \frac{t + 273}{t_i + 273} , (p_{fi} + p_b) - p_b \qquad [2]$$

where:

p_b = absolute ambient atmospheric pressure;

p_{fl} = lock-up pressure related to the second measurement;

t = gas temperature in °C related to the first measurement;

t_i = gas temperature in °C related to the second measurement.

The pressure regulator shall be deemed leaktight if the last two lock-up pressures, corrected for the initial temperature, are comparable (taking account of the accuracy of the measuring system) or comply with the internal leakage rate requirements given in Table 2 of EN 13611:2007.

C.3.4 Regulator accuracy class

NOTE 1 Determination of the accuracy class, the lock-up pressure class, the accuracy flow rate minimum and maximum related to a given range of inlet pressures are determined from this series of tests.

The determination is based on optimal enveloping of each family of performance curves with the vertical and horizontal limit lines as shown in Figure C.3. An example of an optimal enveloping procedure is shown in Figure C.3 and is described as follows:

— plot the performance curves of a family in a semilog diagram with volumetric flow rates on the decimal scale of the abscissa and outlet pressure on the logarithmic scale of the ordinate;

— locate on this diagram, in an optimized manner, three dashed lines spaced as shown in Figure C.3; the optimization of the location of these lines is reached when the greatest possible number of performance requirements are met;

— identify the actual set point where the horizontal line intersects the ordinate;

ensure that Qmax,pemin, Qmax,pemax, Qmin,pemax, Qmin,pemin, *AC* and P_f are within the established limits.

NOTE 2 Other equivalent optimal enveloping methods may be used.

If the performance data listed by the manufacturer are not met, the test report shall detail the actual performance data taken from the type tests.

Table C.1 — Setting and performance

	Pe	Pa	Q
setting	$\frac{P_{e\,max} + P_{e\,min}}{2}$	$P_{a\,max}$	$0,5Q_{max}$
performance	$P_{e\,max}$ or as declared by the manufacturer		$0,5Q_{max} \rightarrow Q_{max} \rightarrow Q_{min} \rightarrow Q_0 \rightarrow Q_{min} \rightarrow 0,5Q_{max}0$
	$p_{e\,minin}$ or as declared by the manufacturer		$0,5Q_{max} \rightarrow Q_{max} \rightarrow Q_{min} \rightarrow Q_0 \rightarrow Q_{min} \rightarrow 0,5Q_{max}$
setting	$\frac{P_{e\,max} + P_{e\,min}}{2}$	$P_{a\,mini}$	$0,5Q_{max}$
performance	$p_{e\,max}$ or as declared by the manufacturer		$0,5Q_{max} \rightarrow Q_{max} \rightarrow Q_{min} \rightarrow Q_0 \rightarrow Q_{min} \rightarrow 0,5Q_{max}$
	$p_{e\,min}$ or as declared by the manufacturer		$0,5Q_{max} \rightarrow Q_{max} \rightarrow Q_{min} \rightarrow Q_0 \rightarrow Q_{min} \rightarrow 0,5Q_{max}$

$P_{e\,max}$ = Maximum inlet pressure

$P_{e\,min}$ = Minimum inlet pressure (= $p_{a\,max}$ +100 mbar or as declared by the manufacturer)

$P_{a\,max}$ = Maximum outlet pressure

$P_{a\,minin}$ = Mininimum outlet pressure

Q_{max} = Maximum flow rate (depending on the outlet pressure)

Q_{min} = Minimum flow rate (≤ $0,1Q_{max}$)Mi

Qo = Lock up

The recorded values shall be used to draw a diagram as shown in Figure C.3.

C.4 Safety shut-off device accuracy group

C.4.1 General conditions and apparatus

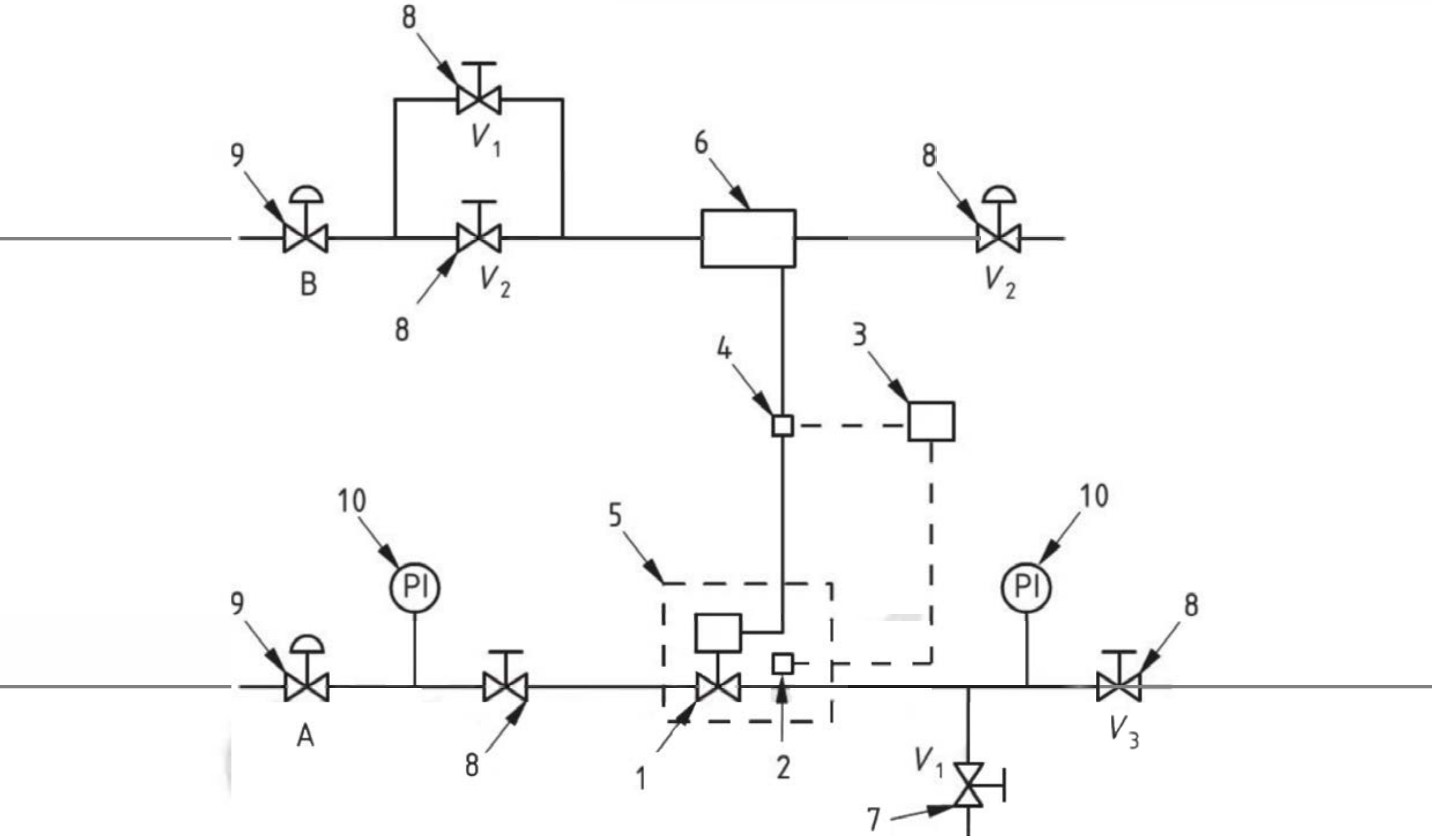
The test shall be performed in a test rig (equivalent to Figure C.5) under the following operating conditions:

— the body of the SSD is pressurized from both ends;

— the controller of the SSD is pressurized with a variable pressure representing the monitored pressure. The rate of the pressure change is kept constant;

— the whole unit is installed in a chamber with a controlled temperature between 0 °C and +60 °C for tests at limit temperatures.

The accuracy groups for overpressure protection and underpressure protection, if applicable, shall be determined separately.



Key

1 SSD (in the scheme including a vessel upstream inside the cabinet)

2 Microswitch or similar device

3 Recorder

4 Pressure transducer

5 Environmental cabinet

6 Pressure vessel

7 Leakage control rate

8 Isolating or needle valve

9 Pressure regulator

10 Pressure indicator

A Regulator controls the operating pressure of the SSD

B Regulator adjusts monitored pressure

Vi Valve permits emptying of the test line and testing for internal leakage

V_2 Valves for control of pressure increase

V_3 Valve to control flow rate

Figure C.5 — Test rig configuration for SSDs

C.4.2 Test at ambient temperature

For each specified accuracy class and relevant:

— maximum inlet pressure $p_{e\ max}$',

— set range.

a) ensure that the body is at atmospheric pressure;

b) adjust the trip pressure to the lower limit of the set range;

c) with the SSD in the open position, starting from approximately 80 % of the selected trip pressure, increase the monitored pressure at a rate of change not greater than 1,5 % of the selected trip pressure per second until closure of the SSD occurs;

d) repeat test c) nine times; the set value is the arithmetic mean of the ten actual values;

e) without further adjustment repeat the tests a) to d) with the body pressurized to the maximum inlet pressure ($p_{e,ma}$x);

f) the set point is the arithmetic mean of the two set values calculated in d) and e).

The test method for underpressure protection is similar to that specified above; the starting pressure for operation shall be 120 % of the selected trip pressure.

C.4.3 Test at the limit temperatures between 0 °C and 60 °C

C.4.3.1 General

The tests shall be carried out in a temperature controlled chamber, at the lower limit of (0 ± 2) °C with a dry test medium and (60 ± 2) °C.

There shall be no adjustment of the trip pressure between the test at ambient temperature, (C.4.2.) and this test.

C.4.3.2 Test method

C.4.3.2.1 General

Pressurize the body of the SSD in the open position and maintain the inlet pressure at 0,1 bar.

Adjust the temperature of the test chamber to the limit value. The test shall commence when the temperature becomes uniform in all parts of the SSD with a tolerance of ± 2 °C.

C.4.3.2.2 Overpressure protection

Starting from approximately 80 % of the selected trip pressure, increase the monitored pressure at a rate of change not greater than 1,5 % of the selected trip pressure per second until closure of the SSD occurs.'

C.4.3.2.3 Underpressure protection

Starting from approximately 120 % of the selected trip pressure, decrease the monitored pressure at a rate of change not greater than 1,5 % of the selected trip pressure per second until closure of the SSD occurs."

C.4.3.2.4 Verification of internal sealing

In both cases, verify the internal sealing

C.4.4 Verification of the upper limit of the highest set range

The test method is as follows:

a) ensure that the body is at atmospheric pressure;

b) adjust the trip pressure to the upper limit of the highest set range;

c) starting from approximately 80 % of the selected trip pressure increase the monitored pressure at a rate of change not greater than 1,5 % of the selected trip pressure per second until closure of the SSD occurs;

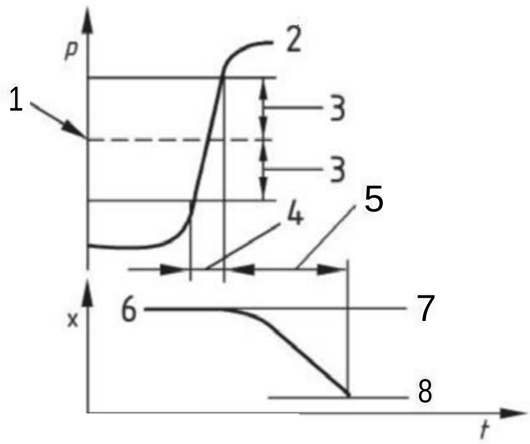
d) repeat the test c) five times;

e) calculate the arithmetic mean of the six actual values.

C.4.5 Response time

The response time for the upper trip pressure shall be determined at ambient temperature. The test starts with the closure member in the open position and with the SSD body at the maximum operating pressure. If the response time is longer for lower operating pressures the test shall also be carried out at the minimum operating pressure. The monitored pressure is set at approx. 50 % of the set value. The monitor pressure is raised so that the trip pressure plus the maximum value of deviation is reached within 0,2 s (see Figure C.6). The response time shall be determined to an accuracy of <0,1 s.

The response time shall be measured from when the monitored pressure reaches the highest limit value of the AG until the closure member has reached its closed position. The test shall comprise three consecutive operations and the response time is the arithmetic mean of the three measured values. The response time shall be stated in the type and surveillance test report (with a special note if it is longer than 2 s), together with a description of the test conditions.



Key

1 Set value of the trip pressure
2 Monitored pressure
3 AG
4 t< 0,2 s
5 Response time t
6 Closing characteristic
7 Open
8 Closed

Figure C.6 — Measurement of the response time

C.5 Durability of performance

C.5.1 General

Position the pressure regulator in a temperature controlled chamber with an air supply at ambient temperature and at the maximum inlet pressure declared by the manufacturer. With a quick acting control valve both upstream and downstream as shown in Figure 1 of EN 88-1:2007, connect the valves to a suitable time switch so that as one opens the other closes with a complete cycle every 10 s.

C.5.2 Pressure regulator

For the pressure regulator, the test consists of 50 000 cycles, in each of which the diaphragm is fully flexed and the valve is held on its seat 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 declared by the manufacturer but at least 60 °C;

b) 25 000 cycles are with the pressure regulator environment at the minimum ambient temperature declared by the manufacturer but at most 0 °C.

After cycling, the pressure regulator shall conform to the requirements of 7.7.1.

C.5.3 Safety shut-off devices

For safety shut-off devices, the test consists of 500 cycles, in each of which the device is activated.

Of the 500 cycles:

a) 250 cycles are with the safety shut-off environment at the maximum ambient temperature declared by the manufacturer but at least 60 °C;

b) 250 cycles are with the safety shut-off environment at the minimum ambient temperature declared by the manufacturer but at most 0 °C.

After cycling, the safety shut-off device shall conform to the requirements of 7.7.2.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 90/396/EEC

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 90/396/EEC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative 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 relevant Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 90/396/EEC

N/A = Not applicable
EN = covered in EN 13611:2007

Essential requirement (ERs) of Directive 90/396/EEC		Clause(s) subclause(s) of this EN
1	**GENERAL CONDITIONS**	
1.1	Safety of operation	1,6,7
	Installation instructions User instructions Warning notices Official language of instructions	EN, 8.2 EN, 8.2 EN, 8.3 EN, 8.2
1.2.1	Installation instructions	EN, 8.2
1.2.2	User instructions	EN, 8.2
1.2.3	Warning notices	EN, 8.3
1.3	Correct operation	EN, 6, 8.2
2	**MATERIALS**	
2.1	Suitability for safety and intended purpose	EN, 6.3
2.2	Properties of the materials	See Scope 1
3	**DESIGN AND CONSTRUCTION**	
3.1	General	
3.1.1	Mechanical stability	EN, 6.1,6.2
3.1.2	Condensation	N/A
3.1.3	Risk of explosion	EN, 6.3
3.1.4	Water penetration	N/A
3.1.5	Normal fluctuation of auxiliary energy	N/A
3.1.6	Abnormal fluctuation of auxiliary energy	N/A

3.1.7	Hazards of electrical origin	N/A
3.1.8	Pressurized parts	EN, 6.1,7.2, 7.3
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	EN, 6.2.5
3.1.12	Controlling and setting devices	N/A
3.2	Unburned gas release	
3.2.1	Gas leakage	EN, 6.1,7.3, 7.5.2.2
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	N/A
3.7	Foodstuffs and water used for sanitary purposes	N/A

ANNEX II	
CERTIFICATION PROCEDURES	N/A

ANNEX III		
CE CONFORMITY MARK AND INSCRIPTIONS		
1	Mark	N/A
2	Data plate	8.1

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

Bibliography

EN 334 *Gas pressure regulators for inlet pressures up to 100 bar*

EN 1092 (All parts), *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated*

EN 1759 (All parts), *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated*

EN 10045-1 *Metallic materials —Charpy impact test — Part 1: Test method*

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 13906-1, *Cylindrical helical springs made from round wire and bar — Calculation and design — Part 1: Compression springs*

EN 13906-2, *Cylindrical helical springs made from round wire and bar— Calculation and design — Part 2: Extension springs*

EN 13906-3, *Cylindrical helical springs made from round wire and bar— Calculation and design — Part 3 Torsion springs*

EN 61508 (All parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

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