

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

ICS 23.060.40

National foreword

This British Standard is the UK implementation of EN 13785:2005+A1:2008. It supersedes BS EN 13785:2005 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee GSE/24, Dedicated LPG appliances.

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.

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English Version

**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**

Détendeurs de débit inférieur ou égal à 100 kg/h, à
pression de détente nominale maximale inférieure ou égale
à 4 bar, autres que les détendeurs relevant de l'EN 12864,
et leurs dispositifs de sécurité associés pour butane,
propane ou leurs mélanges

Druckregelgeräte mit einem höchsten Ausgangsdruck von <
4 bar und einem Durchfluss < 100 kg/h, die nicht in EN
12864 geregelt sind, für Butan, Propan oder deren
Gemische sowie die dazugehörigen
Sicherheitseinrichtungen

This European Standard was approved by CEN on 1 July 2004 and includes Corrigendum 1 issued by CEN on 14 February 2007 and Amendment 1 approved by CEN on 27 September 2008.

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Contents

Page

Foreword.....	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
3.1 General terms and definitions	7
3.2 Terms and definitions concerning gas.....	10
3.3 Terms and definitions concerning pressures.....	10
3.4 Terms and definitions concerning rates	11
4 Types of regulators.....	11
4.1 Introduction	11
4.2 Regulators for installations where the final regulator supplies a pressure specified in EN 437	12
4.3 Other regulators.....	12
5 Constructional characteristics	12
5.1 General.....	12
5.2 Materials	13
5.3 Special requirements	16
5.3.1 Pressure sensing subassembly	16
5.3.2 Regulation subassembly	16
5.3.3 Back pressure subassembly	16
5.3.4 Connection subassembly	17
5.4 Mechanical strength	19
5.4.1 Resistance to impact.....	19
5.4.2 Resistance to pressure	19
5.4.3 Strength of connections	20
5.5 Soundness.....	21
5.6 Mechanical endurance	22
5.6.1 General requirements.....	22
5.6.2 Special requirements	22
5.7 Resistance to humidity changes.....	22
5.8 Resistance to corrosion.....	22
6 Performance characteristics	23
6.1 General.....	23
6.1.1 Introduction	23
6.1.2 Supply pressure.....	23
6.1.3 Regulated pressure	23
6.2 Supply pressure and regulated pressure according to 4.2	24
6.2.1 Single stage fixed regulator for EN 437 pressures	24
6.2.2 Two stages fixed or adjustable regulators for EN 437 pressures	24
6.2.3 Three stages fixed or adjustable regulators for EN 437 pressures	25
6.3 Variable regulators	27
6.4 Regulators out of the pressures of EN 437	27
7 Test methods.....	28
7.1 General conditions	28
7.1.1 Type of test gas.....	28
7.1.2 Test conditions	28
7.1.3 Equivalence formulas.....	28
7.1.4 Test samples	29

7.2	Verification of constructional characteristics	29
7.2.1	Resistance to impact.....	29
7.2.2	Resistance to pressure	29
7.2.3	Mechanical strength of connections	30
7.2.4	Regulation subassembly	34
7.2.5	Soundness	34
7.2.6	Mechanical endurance	35
7.2.7	Resistance to humidity changes	36
7.2.8	Resistance to corrosion.....	37
7.3	Verification of performance characteristics	37
7.3.1	General	37
7.3.2	Plotting of the performance curves	40
8	Marking, packaging, instructions	40
8.1	General	40
8.2	Marking of the regulator	40
8.3	Packaging.....	41
8.4	Instructions for installation, use and maintenance	41
Annex A	(normative) Special requirements for regulators fitted with pressure or rate operated safety devices	42
A.1	Regulators fitted with an over-pressure relief.....	42
A.1.1	Definition	42
A.1.2	Constructional characteristics.....	42
A.1.3	Performance characteristics	42
A.1.4	Test methods	43
A.1.5	Regulator marking	43
A.2	Regulators fitted with an over-pressure shut off safety valve.....	43
A.2.1	Definition	43
A.2.2	Constructional characteristics.....	43
A.2.3	Performance characteristics	44
A.2.4	Test methods	44
A.3	Regulators fitted with an under-pressure shut off safety device	45
A.3.1	Definition	45
A.3.2	Constructional and performance characteristics	45
A.3.3	Test methods	46
A.4	Regulators fitted with an excess flow valve	46
A.4.1	Definition	46
A.4.2	Performance characteristics	46
A.4.3	Test methods	46
A.4.4	User and maintenance instructions	47
A.5	Regulators fitted with a regulated pressure limiter	47
A.5.1	Definition	47
A.5.2	Constructional and performance characteristics	47
A.5.3	Test methods	48
A.5.4	User and maintenance instructions	48
Annex B	(normative) Special requirements for regulators fitted with a thermal cut out	49
B.1	Definition	49
B.2	Constructional characteristics.....	49
B.3	Performance characteristics	49
B.4	Test methods	49
Annex C	(normative) Special requirements for low pressure regulators under extreme temperature conditions (temperatures below -20 °C).....	51
Annex D	(normative) Method for measuring leaks at test pressures less than or equal to 16 bar	52
D.1	Scope	52
D.2	Diagram of the test bench	52
D.3	Coefficient <i>K</i>	53
D.3.1	Method	53
D.3.2	Calculations	53

D.4	Measurement of the leak	53
D.4.1	Method	53
D.4.2	Calculations.....	53
D.5	Checks	54
Annex E	(normative) Complementary test requirements for non metallic thermoplastic or thermal setting materials used in the construction of regulators	55
E.1	Scope	55
E.2	Materials	55
E.3	Special conditions for carrying out the tests mentioned in the body of the document.....	55
E.3.1	Resistance to impact (see 5.4.1 and 7.2.1).....	55
E.3.2	Mechanical resistance of connections (see 5.4.3 and 7.2.3).....	55
E.3.3	Soundness (see 5.5 and 7.2.5).....	56
E.4	Special requirements	56
E.4.1	Resistance to hydrocarbons	56
E.4.2	Resistance to cracking under stress and when chemical agents are present	56
E.4.3	Characteristics relating to fire resistance	56
E.4.4	Accelerated ageing	57
E.5	Sampling and order of tests	57
Annex F	(normative) Requirements for elastomeric reinforced diaphragms	58
Annex G	(normative) Inlet connections	59
Annex H	(normative) Outlet connections	106
Annex I	(informative) Test method for resistance to corrosion	136
I.1	Principle.....	136
I.2	Reagents.....	136
I.2.1	Saline solution	136
I.2.2	Compressed air.....	136
I.2.3	Salt mist	137
I.3	Apparatus	137
I.3.1	Spraying chamber.....	137
I.3.2	Sprayers.....	137
I.3.3	Heating device.....	138
I.3.4	Salt solution supply device	138
I.3.5	Compressed air supply device.....	138
I.3.6	Mist collectors.....	138
I.4	Test method.....	139
I.4.1	Method of exposure of regulators.....	139
I.4.2	Duration of tests	139
I.4.3	Checks	139
I.4.4	Cleaning of regulators.....	139
I.5	Results	139
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 90/396/EEC.....	142
Bibliography		144

Foreword

This document (EN 13785:2005+A1:2008) has been prepared by Technical Committee CEN/TC 181 “Dedicated liquefied petroleum gas appliances”, the secretariat of which is held by AFNOR.

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 2009, and conflicting national standards shall be withdrawn at the latest by May 2009.

This document includes Amendment 1, approved by CEN on 2008-09-27 and Corrigendum 1 issued by CEN on 2007-02-14.

This document supersedes EN 13785:2005.

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

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags **■AC** **■AC**1).

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 includes a Bibliography.

This standard covers only type testing.

Items relating to quality assurance systems, production testing and particularly certificates of conformity are not covered in this standard.

This standard is the second part of a series of standards covering different applications of LPG Regulators. The two complementary standards are:

- EN 12864: Low pressure, non adjustable regulators having a maximum regulated pressure of less than or equal to 200 mbar, with a capacity of less than or equal to 4 kg/h, 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

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.

1) Only applicable to the German version.

1 Scope

This document defines the constructional and operational characteristics, the safety requirements, test methods and the marking of regulators having a capacity of less than or equal to 100 kg/h, other than the regulators covered by EN 12864, for butane, propane or their mixtures, in the gaseous phase.

Regulators for caravans up to 1,5 kg/h are covered by EN 12864.

NOTE 1 bar = 10^5 Pa.

This document also applies to the safety devices which are included within regulators covered by this document. The characteristics of these devices are given in annexes A and B.

The requirements apply generally to regulators used in locations where the temperature likely to be reached during use is between -20 °C and +50 °C. When the regulators are used at temperatures below -20 °C it is essential that they comply with special requirements which are defined in annex C.

This document does not include the installation rules for regulators. Reference should be made to national regulations in force in the member countries.

This document only covers type testing.

WARNING NOTICE: The figures in annexes G and H show the types of connections used according to the country of use of the regulators.

The top part of these figures (above the horizontal line) applies to the regulator and is normative.

The bottom part of these figures (below the horizontal line) applies to the part to be connected to the regulator. This is given as a guide for the tests and is not normative.

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 437:2003, *Test gases - Test pressures - Appliances categories.*

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

EN 12164, *Copper and copper alloys - Rod for free machining purposes.*

EN 12165, *Copper and copper alloys - Wrought and unwrought forging stock.*

EN 60695-11-10, *Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods (IEC 60695-11-10:1999).*

EN ISO 75, *Plastics - Determination of temperature of deflection under load.*

EN ISO 178, *Plastics - Determination of flexural properties (ISO 178:2001).*

EN ISO 180, *Plastics - Determination of Izod impact strength (ISO 180:2000).*

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 527, *Plastics - Determination of tensile properties.*

EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions - Part 1: Country codes (ISO 3166-1:1997).*

EN ISO 4892-3, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3:1994).*

EN ISO 8434-1; *Metallic tube connections for fluid power and general use - Part 1: 24° compression fittings (ISO 8434-1:1994).*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation.*

ISO 301, *Zinc alloy ingots intended for casting.*

ISO 565, *Test sieves - Metal wire cloth, perforated metal plate and electroformed sheet - Nominal sizes of openings.*

ISO 7005-2, *Metallic flanges - Part 2: Cast iron flanges.*

ISO 9227, *Corrosion tests in artificial atmospheres - Salt spray tests.*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

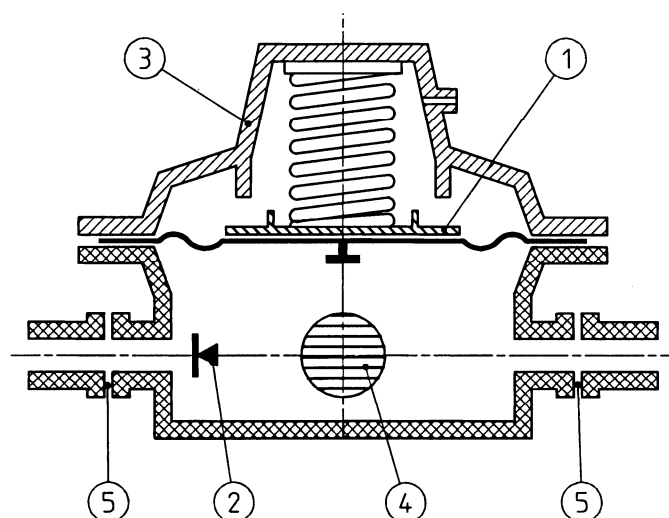
3.1 General terms and definitions

3.1.1

regulator

device which maintains a regulated pressure within preset limits, whatever the upstream pressure, rate and temperature. The regulator can have fixed, variable or adjustable regulated pressure.

The terminology given is that shown in Figure 1. The diagram is given as information; no other method is excluded



Key

1	Pressure sensing subassembly	
2	Regulation subassembly	
3	Back pressure subassembly	
4	Mechanical connection subassembly	
5	Connection subassembly	

Figure 1 - Principal parts of a regulator

3.1.2

fixed regulator

regulator whose regulated pressure is adjusted by the manufacturer and fixed and whose adjustment cannot be modified by the user

3.1.3

variable regulator

regulator whose regulated pressure may be modified by the user with simple manipulation between two fixed limits

3.1.4

adjustable regulator

regulator whose regulated pressure may only be modified by a competent person at the time of installation; it is then fixed

3.1.5

quick coupling

 connection system which allows the fitting of the regulator to the cylinder valve without a threaded connection and without using tools 

3.1.6

tap (manual closing device)

device for closing the gas flow which requires an intentional manual action (for example on a lever, a knob) 

3.1.7

self closing valve

 device allowing the automatic shut off of the gas flow, by simple disconnection of the regulator from the cylinder valve 

3.1.8

valve

component part of the regulation subassembly which ensures soundness between the part of the regulator at supply pressure and the part of the regulator at regulated pressure, when this one is higher or equal to the closing pressure

3.1.9

sealing

any arrangement of any device, for example an adjuster, such that any interference likely to change its setting causes the breaking of the device or sealing material making the interference apparent

3.1.10

nominal diameter

DN

numerical designation common to all the components of a same pipework other than those named by their external diameter or by the size of the thread. It is a whole number used as a reference and related approximately to the manufacturing dimensions

[EN 88]

3.1.11

freely rotating outlet connection

integral outlet connection designed to fully rotate 

3.2 Terms and definitions concerning gas

3.2.1

butane

mixture of third family gases whose vapour pressure (p_v) at 50 °C is greater than or equal to 4,3 bar and at most equal to 7,5 bar, of mean volumic mass in the gas phase equal to 2,4 kg/m³

3.2.2

propane

mixture of third family gases whose vapour pressure (p_v) at 50 °C is greater than or equal to 7,5 bar or at most equal to 16 bar, of mean volumic mass in the gas phase equal to 1,85 kg/m³

3.2.3

LPG

mixture of third family gases whose vapour pressure (p_v) at 50 °C is greater than or equal to 4,3 bar or at most equal to 16 bar, of mean volumic mass in the gas phase equal to 2,12 kg/m³

3.3 Terms and definitions concerning pressures

The values of pressures given in the text are to be considered as gauge pressure and are expressed in bar (bar) or millibar (mbar).

3.3.1

supply pressure

p

value of the gas pressure measured at the regulator inlet or at the self closing valve's inlet

3.3.2

regulated pressure

value of the gas pressure measured at the regulator outlet

3.3.3

nominal regulated pressure

p_d

value of the regulated pressure corresponding:

- either to the normal pressure for appliances as defined in 3.6 of EN 437:2003;
- either to the normal pressure for appliances operating outside the scope of EN 437:2003;
- or to an intermediate pressure allowing for the supply of a second or third stage regulator under the conditions fixed

3.3.4

lock up pressure

p_o

the maximum pressure obtainable at no flow for all values of the supply pressure given in 6.1.2

3.3.5

pressure loss coefficient

multiplication factor equal to 0,85 for a pressure loss of 15 % and 0,5 for a pressure loss of 50 %

3.3.6

minimum admitted pressure

p_{Mg}

minimum value of the regulated pressure supplied by the regulator for all values of the supply pressure and all values of the flow rate

3.3.7 maximum admitted pressure

p_{Mp}

maximum value of the regulated pressure supplied by the regulator for all values of the supply pressure and all values of the flow rate between the closing area and the guaranteed rate

3.4 Terms and definitions concerning rates

3.4.1 guaranteed rate

M_g

the mass flow of gas that can be obtained at the minimum allowed regulated pressure, whatever the value of the supply pressure

NOTE The guaranteed rate is expressed in grams per hour (g/h) or kilograms per hour (kg/h).

3.4.2 pilot rate

M_p

for regulators up to 4 kg/h and for pressures complying with EN 437, gas flow (15 g/h) necessary for the supply of the ignition system of the appliance, generally called pilot

NOTE The pilot rate is expressed in grams per hour (g/h).

3.4.3 closing area

for regulators over 4 kg/h or for pressures not complying with EN 437, range between 0 and 5 % of the guaranteed flow rate

3.4.4 operational area

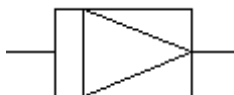
rate range between the pilot rate or the maximum of the closing area and 100 % of the guaranteed rate

4 Types of regulators

4.1 Introduction

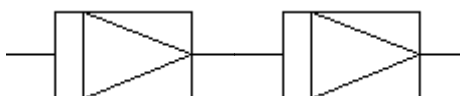
There are typically three types of pressure reduction:

1 – Single stage:



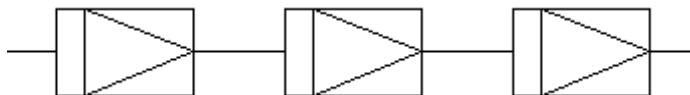
- the supply pressure of the regulator is equal to the pressure of the LPG supply container(s);
- the regulator supplies a gas appliance.

2 – Two stages



- the supply pressure of the first regulator is equal to the pressure of the LPG supply container(s);
- the supply pressure of the second regulator depends on the regulated pressure of the first regulator and on the pressure losses in the intermediate line;
- the second regulator supplies a gas appliance.

3 – Three stages



- the supply pressure of the first regulator is equal to the pressure of the LPG supply container(s);
- the supply pressure of the second and the third regulator depends on the regulated pressure of the upstream regulator and on the pressure losses in the intermediate upstream line;
- the third regulator supplies a gas appliance.

4.2 Regulators for installations where the final regulator supplies a pressure specified in EN 437

The last regulator, which supplies a gas appliance for pressures specified by EN 437 shall be a fixed regulator (see 3.1.2).

It is recommended that all the other regulators of the installation are fixed regulators.

For interchangeability the recommended nominal value of intermediate regulated pressures (p_d) are the following:

3 – 1,5 – 1 – 0,75 – 0,5 – 0,4 – 0,3 – 0,15 bar

These settings accommodate pressure losses in the interstage pipe work. In general systems are designed with a pressure loss of up to 15 %. However in some cases where additional equipment (i.e limiter) is fitted, pressure losses of 50 % are found.

4.3 Other regulators

To supply appliances with pressures which are different from those specified by EN 437 fixed, variable or adjustable regulators are used.

5 Constructional characteristics

5.1 General

Regulators shall be designed, manufactured and assembled in such a way that their operation is satisfactory under the installation and service conditions specified by the manufacturer.

The safety devices, if incorporated in or onto the regulators covered by this document shall be designed and constructed in accordance with the provisions of annexes A and B.

All the parts of a regulator shall be free from sharp corners or edges capable of causing damage, deterioration, injury or faulty operation.

Parts shall be clean internally and externally.

Holes for screws, pins, etc., intended for the assembly of the regulators components and for their fixing shall not open into the gas ways. The thickness of the wall between these holes and the gas ways shall be at least 1 mm.

Holes necessary for machining which join gas ways to the atmosphere, but which have no influence on the operation of the regulator, shall be permanently closed metallically. Appropriate additional sealing compounds may be used.

Where pressure tight joints are made on threads they shall be in accordance with ISO 7-1 or with ENPT.

Devices capable of modifying the operation of the regulator shall not go out of adjustment and shall be sealed. In particular, the regulator body and cover shall be assembled in such a way that separation is not possible without permanent damage to these parts or the sealing.

For variable regulators the adjustment range shall be limited by two fixed stops. It shall not be possible to reduce the regulated pressure below 5 mbar.

The operation of mobile parts, for example diaphragms or bellows, shall not be impaired by other parts.

So as to reproduce the adjustment, a marking device using numbers may be used (the larger figures corresponding to the higher pressures) or a gauge may be installed to indicate the regulated pressure.

It shall not be possible to remove the adjuster unless it is in the position giving the minimum pressure. When adjustment is carried out by rotation, the higher regulated pressures shall be obtained by rotation clockwise A1 *deleted text* A1.

Any tap shall close clockwise.

5.2 Materials

The quality of materials, the dimensions used and the means of assembling the various components shall be such that the construction and performance characteristics are secure. Performance characteristics shall not alter significantly during the life expectancy declared by the manufacturer when the regulator is installed and used in accordance with the manufacturer's instructions. Under these conditions all components shall withstand the mechanical, chemical and thermal conditions to which they may be submitted during their use, when operating under normal conditions of use.

The regulator shall withstand the action of organic substances, either of vegetable or animal origin.

The body shall be made of metallic material. However for regulators having a regulated pressure of up to 200 mbar and of a rate smaller than 4 kg/h, directly fitted onto the cylinder using a quick coupling with self closing valve and non threaded outlet connection, non metallic (thermoplastic or thermal setting) materials may be used if the characteristics meet the requirements of this document as well as the complementary special requirements defined in annex E.

Internal parts and parts of the cover not relating to pressure (except for connections, see Figure 2) may be made of non metallic (thermoplastic or thermal setting) materials provided that they meet the following requirements:

- the materials used shall meet the requirements of annex E;
- the whole regulator shall withstand the various tests specified in the body of the document;
- the regulator, with non metallic parts removed, shall resist a pressure test as in 7.2.2.3 remaining sound in the sense of 5.5 and without causing any danger.

A1 Zinc alloys shall only be used if they are of the Zn Al4 or Zn Al4 Cu1 quality, in accordance with ISO 301. Brass alloys shall comply with EN 12164 or EN 12165.

Components made of non-metallic materials shall only be used if they are not submitted to a temperature higher than 80 °C. 

The rotating threaded parts of connections, whether they are male or female, shall be made of brass in accordance with EN 12164 or EN 12165, or equivalent standard, or of steel. The materials and manufacturing processes used shall not cause subsequent risk of stress corrosion.

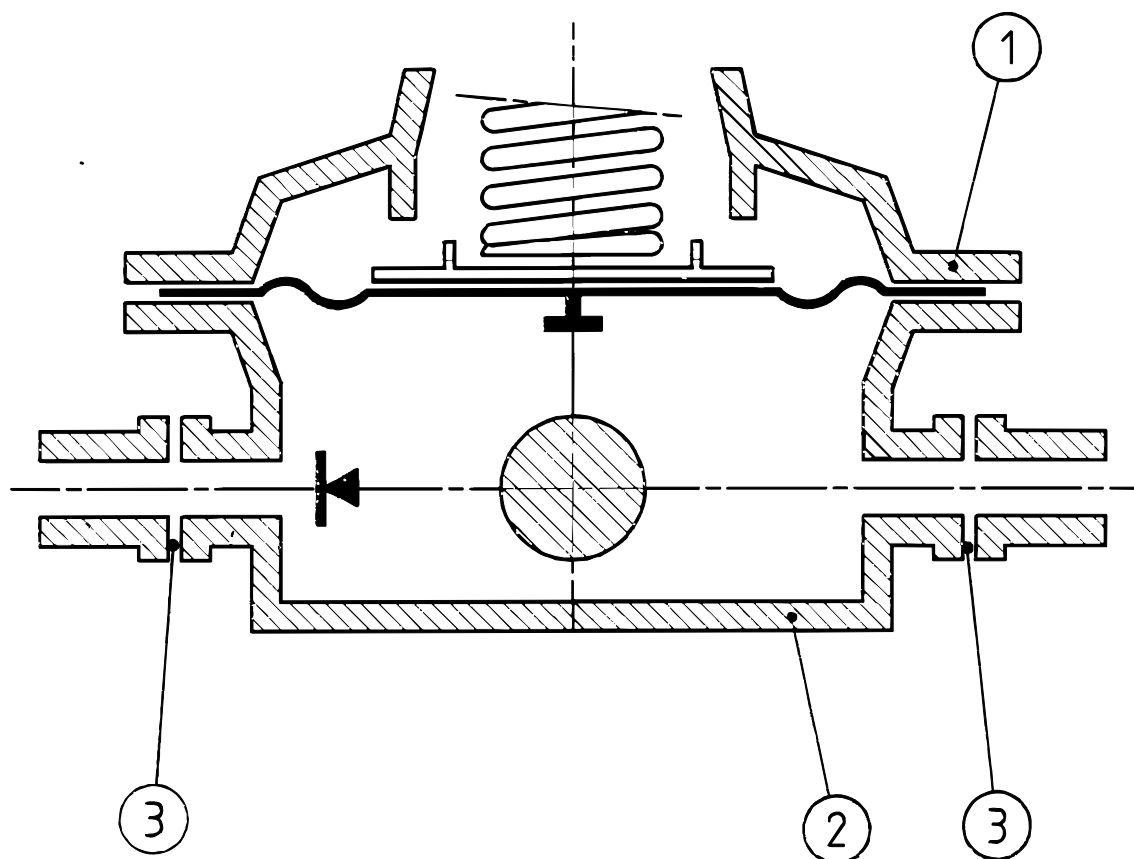
Steel internal parts shall be protected against corrosion.

Fixed threaded parts of connections shall be made of metallic material. Non threaded fixed parts of connections may be made of non metallic (thermoplastic or thermal setting) material, provided that they comply with the tests specified in annex E.

The assembly of parts of the gas ways intended to assure soundness shall not be made with solder whose lowest temperature in the melting range, after application, is below 450 °C.

Non metallic (thermoplastic or thermal setting) components used in the construction of the regulator shall meet the special requirements of annex E.

Elastomeric components shall comply with the requirements defined in EN 549, within the temperature range specified in 1, including, for diaphragms, the requirements concerning resistance to ozone. In addition, reinforced materials shall comply with the additional requirements defined in annex F.



Key

- 1 Cover
- 2 Body
- 3 Connections

Figure 2 - Regulator diagram showing the metallic parts

5.3 Special requirements

5.3.1 Pressure sensing subassembly

The dimensions, shape and the method of assembly of the components of the pressure sensing subassembly shall avoid any risk of damaging the diaphragm.

The pressure sensing subassembly shall be manufactured in such a way that the operation of the regulator complies with the requirements defined in 6 in the mounting positions of the regulator on the installation as specified by the manufacturer in his instructions. The regulator shall meet the lock-up requirements in all the specified mounting positions.

Whatever the position taken by the diaphragm, the spring shall not be fully compressed.

The diaphragm shall withstand, without rupture or slipping out of its fixing, the tests described in 7.2.2.2.

5.3.2 Regulation subassembly

At lock-up, the regulation subassembly shall act as a seal between the supply pressure and the regulated pressure. It shall not move accidentally in use.

The soundness and function of the regulation subassembly shall not be affected by the tensile strength and bending tests on the connections

After the test defined in 7.2.4, the valve shall not be displaced or come out of its housing.

5.3.3 Back pressure subassembly

The support surfaces of the cover and of the body shall be designed in such a way that they maintain the diaphragm firmly in its housing and make it capable of resisting the pressure tests defined in 7.2.2.

Vent holes shall be:

- mounted or placed in such a way that the risks of accidental blockage are reduced and to minimize the penetration of rain water, particularly if their cross section is greater than 3 mm²;
- constructed in such a way that accidental damage to the internal parts of the regulator, caused by an object inserted through the vent hole, may be reasonably prevented;

when the regulator is installed in accordance with the manufacturers instructions.

For adjustable regulators, after the adjustment to the adjustable value made at the time of installation, it shall be possible to block the setting and it shall be possible to seal the regulator.

5.3.4 Connection subassembly

5.3.4.1 General

First and single stage regulators connected to mobile cylinders shall be fitted with an integrated filter. The filter shall be manufactured from a corrosion and gas resistant material, situated on the regulator inlet upstream of the valve pad. The filter mesh shall not exceed the recommended dimensions for the 125 opening in accordance with ISO 565, or exceed 0,14 mm diameter in case of perforated sheet.

For other types of regulators the manufacturers instructions shall state the requirements relating to the installation of a filter upstream.

The connections shall be of the following types:

- flanged: when flanges are used, they shall fit connections in accordance with ISO 7005-2 with dimensions corresponding to PN 16;
- threaded: A_1 threaded connections A_1 where the seal is made on the thread may be used up to a nominal diameter DN 50. Parallel internal connections threads in zinc or aluminium are permitted up to and including DN 10 only;
- non threaded.

The equivalent dimensions of connections are given in Table 1.

Table 1 — Connection dimensions

Nominal diameter DN	Thread designation according to ISO 7-1 or EN ISO 228-1	Nominal dimension of flanges according to ISO 7005-2
6	1/8	6
8	1/4	8
10	3/8	10
15	1/2	15
20	3/4	20
25	1	25
32	1 1/4	32
40	1 1/2	40
50	2	50

The connections shall comply with

a) inlet connections:

- 1) one of the types in Figures G.1 to G.49²⁾ if they are threaded;
- 2) one of the types in Figures G.50 to G.99³⁾ if they are not threaded;
- 3) future types will be acceptable providing they are not interchangeable with the connections specified in this document, and providing their assembly gives an equivalent degree of safety;
- 4) for connections made with a rotating nut using a seal the backward movement of the nut shall be sufficient to expose the seal completely.

b) outlet connections:

- 1) one of the types in Figures H.1 to H.49⁴⁾ if they are threaded;
- 2) one of the types in Figures H.50 to H.99⁵⁾ if they are non threaded;
- 3) other connections may be mounted provided that the regulator is sold with a fixed outlet tube;
- 4) future types will be acceptable providing they are not interchangeable with the connections specified in this document, and providing their assembly gives an equivalent degree of safety.

²⁾ A range of 49 figures has been reserved for each type of connections. However, the needs of this document do not use all this range.

³⁾ A range of 50 figures has been reserved for each type of connections. However, the needs of this document do not use all this range.

⁴⁾ A range of 49 figures has been reserved for each type of connections. However, the needs of this document do not use all this range.

⁵⁾ A range of 50 figures has been reserved for each type of connections. However, the needs of this document do not use all this range.

Tables G.1, G.2 and H.1, H.2 show, for information, the inlet and outlet connections used in the various countries depending on their use.

If the regulator incorporates a pressure test point, the diameter of the hole through the pressure test point shall not exceed 1,5 mm.

The connection shall be designed in such a way that it ensures the soundness function of the connection under the assembly conditions specified in the manufacturers instructions.

If the union connection incorporates a seal it shall:

- be of a distortable material;
- be mounted in such a way that it cannot fall off;
- be easily replaced by a new seal, if necessary, without using special tools;
- have a size in accordance with the indications given in annexes G and H;
- be fixed onto the regulator so as to be subject to all the tests in this document.

A1 No distortion or breakage shall be evident and the regulator shall comply with the soundness test described in 5.5 after application of the forces defined in 5.4.2 and 5.4.3. **A1**

In addition, the manufacturer's instructions shall specify the use of a spanner when this is necessary for fitting or removing the regulator.

5.3.4.2 Quick coupling regulators

Accidental disconnection shall not be possible, especially when operating the gas opening or closing device.

When turning off the gas and disconnecting the regulator is combined in a single control, a single continuous movement of the control shall be prevented by a mechanism which shall be separately operated before the regulator can be disconnected.

5.3.4.3 Regulators for fitting to a self closing valve

A1 For regulators intended to be fitted to a self closing valve, either with a thread, or with a quick coupling, a manual means of closure of the gas flow shall exist on the regulator to ensure manual opening and closing of the gas supply. **A1** The open and closed positions shall be marked and clearly visible in the position of use.

External soundness shall be maintained during the operation of fitting or removing the regulator on the valve, even if the manual gas opening device has been left accidentally in the open position. Only the escape of the volume of gas contained in the connection is allowed during disconnection. If this requirement cannot be met, fitting and removing shall only be possible if the gas valve is in the closed position.

5.4 Mechanical strength

5.4.1 Resistance to impact

A1 If the regulator is designed to be connected directly onto a cylinder valve it shall be capable of resisting a fall on hard ground under the conditions defined in 7.2.1 while continuing to operate as required by Clause 6. **A1**

5.4.2 Resistance to pressure

5.4.2.1 The regulator shall be capable of resisting the pressure test described in 7.2.2.1 without rupture.

5.4.2.2 The regulator shall be capable of resisting the pressure test described in 7.2.2.2, without rupturing the diaphragm.

After these two tests, the regulator shall meet the soundness requirement specified in 5.5.

5.4.2.3 The regulator shall be capable of resisting the pressure test described in 7.2.2.3 without rupturing at the level of the body/lid assembly.

5.4.3 Strength of connections

5.4.3.1 Strength of the union/regulator connection

The fixing of the inlet connection onto the regulator body, whether it is of the threaded or non threaded type or in one piece, shall withstand the following tests, under the conditions defined in 7.2.3:

- a torque of at least 30 N·m in both directions (see Table 12);
- a bending moment created by a force of 400 N directed upwards and whose application point is at the base of the outlet connection (see Table 14);
- a tensile strength test of 2 000 N (see Table 12).

The fixing of the outlet connection onto the regulator body, whether it is of the threaded or non threaded type or in one piece, shall resist the following tests, under the conditions defined in 7.2.3, Table 13:

a) for non threaded hose connections

- 1) a torque of at least 30 N·m in one direction (verification not required for one piece connection and for freely rotating connections);
- 2) a bending moment of 10 N·m;
- 3) a tensile strength test of 2 000 N (verification not required for one piece connection).

b) threaded unions

- 1) a torque of at least 30 N·m in both directions (verification not required for freely rotating connections);
- 2) a bending moment of 10 N (not required for one piece connection);
- 3) a tensile strength test of 2 000 N (not required for one piece connection).

In addition:

- for freely rotating connections, the torque necessary for the rotation of the connection shall not be greater than 0,5 N·m at the end of all the tests carried out on the samples 3 and 5 in accordance with Table 10 (see 7.1.4);
- for regulators with a nominal diameter $\geq$ DN 15, both connections shall resist a torque of 100 N·m.

5.4.3.2 Strength of regulator assembly when fitted

The regulator when installed as indicated in the manufacturers instructions, shall resist the following tests, under the conditions defined in 7.2.3:

- a) a torque in both directions

- 1) of at least 20 N·m for non threaded hose outlet connections (15 N·m for quick coupling connections);
- 2) as specified in Table 2 for threaded connections and flanged connections. In addition, regulators with screwed unions vertically mounted onto the valve, shall resist a torque of at least 20 N·m in the regulators plane (15 N·m for quick coupling connections);

Table 2 — Torque applicable to threaded connections and flanged connections

DN	Torque for cylindrical threaded connections with elastomer joint N·m	Torque for other threaded connections and flanges N·m
6	15	20
8	20	30
10	35	50
15	50	90
20	85	110
25	100	135
32	125	165
40	130	175
50	140	185

- b) a bending moment created by a force of 400 N directed upwards and whose application point is at the base of the outlet connection;
- c) a tensile strength test of 2 000 N (verification not required for inlet connections screwed onto the valve).

The mechanical strength required shall be ensured for all the positions of fixing of the regulator (as indicated in the manufacturers instructions) onto the installation.

5.5 Soundness

The regulator shall be sound for all pressures and conditions defined in 7.2.5.1.

The manual closing device shall be sound for all pressures and requirements indicated in 7.2.5.2.

Soundness is considered to be satisfactory if the value of the leak measured is less than 15 cm³/h for regulators with a nominal diameter of less than or equal to DN 15 and 30 cm³/h for regulators with a nominal diameter greater than DN 15.

For regulators with quick connections, if the regulator can be mounted in different positions, soundness of the connection shall be ensured in all positions. If the regulator can undergo rotation, soundness shall be ensured in all positions and even during rotation.

5.6 Mechanical endurance

5.6.1 General requirements

Under the conditions defined in 7.2.6.1, the regulator shall resist 50 000 cycles of opening/complete closing of the valve without mechanical failure and remaining sound in accordance with 5.5.

[A₁] After the endurance test, the closing pressure shall not deviate by more than ± 5 % from the measured value before this test. In addition, the regulation curves drawn in accordance with 7.3 shall remain within the range covered by the perimeter ABCDE in Figure 3. **[A₁]**

5.6.2 Special requirements

5.6.2.1 Regulators fitted with a tap

Under the conditions defined in 7.2.6.2, the regulator connected to its tap shall resist, for 5 000 cycles out of 50 000 defined in 5.6.1, of opening and closing of the tap.

After the test the regulator connected to its new tap shall operate, remain sound in the sense of 5.5 and meet the general requirements of 5.6.1.

5.6.2.2 Quick coupling regulators

Under the conditions defined in 7.2.6.3, the quick coupling regulator shall resist 5 000 cycles of disconnection/connection to the valve for which it is designed.

After the tests, the regulator connected to a new valve shall meet the general requirements of 5.6.1.

5.6.2.3 Regulator with freely rotating outlet connection

Under the conditions fixed in 7.2.6.4, the connection shall resist 2 500 cycles of rotation.

After the tests, the regulator shall remain sound in accordance with 5.5.

5.7 Resistance to humidity changes

Any material likely to be altered by humidity shall be submitted to a test cycle for resistance to humidity changes as defined in 7.2.7.

The increase in mass between the second and the first weighing shall not exceed 20 % of the initial mass.

The change in mass between the first and the third weighing shall not exceed 5 % of the initial mass.

5.8 Resistance to corrosion

The complete regulator, not connected at the ends, is subjected to the tests defined in 7.2.8.

After this test, a visual examination shall reveal no corrosion of parts capable of impairing correct operation (salt deposit resulting from the test is not taken into account). Performance characteristics shall remain in accordance with the requirements given in 6.

6 Performance characteristics

6.1 General

6.1.1 Introduction

Under the test conditions specified in 7.3 the regulator operation curves obtained using the method specified in 7.3.2 shall lie within the perimeter defined by the pressure and guaranteed rate limits given in 6.2.

The regulator operation curves shall show no anomalies that indicate a fault.

Adjustable and variable regulators shall comply with operating requirements of this document in the regulated pressure range declared by the manufacturer.

The range of an adjustable regulator shall remain within a tolerance of $\pm 15\%$ of the nominal regulated pressure.

6.1.2 Supply pressure

- Regulators directly supplied at the gas container pressure:

Butane : pressure range: 0,3 bar – 7,5 bar

Propane : pressure range: 1 bar – 16 bar

LPG : pressure range: 0,3 bar – 16 bar

- Regulators supplied by another regulator:

Performances are verified with the minimum and maximum supply pressures declared by the manufacturer.

6.1.3 Regulated pressure

For regulators which supply gas appliances for pressure specified by EN 437, see Table 3.

For regulators with pressures which are different from those specified in EN 437:

$p_{\max}$: coefficient of 1,2

$p_{\min}$: coefficient of 0,7

p_0 : coefficient of 1,3

**Table 3 – Pressure characteristics of the regulator
based on nominal pressures given in EN 437**

Gas	Regulator supply pressure bar	Regulator regulated pressure mbar				Maximum pressure loss mbar	Appliance supply pressure ^{a)} mbar			Appliance Categories ^{a)}
		p_d	p_{Mg}	p_{Mp}	p_0		p_n	p_{min}	p_{max}	
Butane	0,3 - 7,5	29	22	35	40	2	29 (28-30)	20	35	3B and 3+
Butane	0,3 - 7,5	50	47,5	57,5	62,5	5	50	42,5	57,5	3+
Butane	0,3 - 7,5	112	65	140	145	5	112	60	140	3+
LPG	0,3 - 16	29	27	35	40	2	29 (28-30)	25	35	3B/P
LPG	0,3 - 16	50	47,5	57,5	62,5	5	50	42,5	57,5	3B/P
Propane	1 - 16	37	27	45	50	2	37	25	45	3P and 3+
Propane	1 - 16	50	47,5	57,5	62,5	5	50	42,5	57,5	3P
Propane	1 - 16	67	55	80	85	5	67	50	80	3+
Propane	1 - 16	148	105	180	185	5	148	100	180	3+

a) For information, data from EN 437

6.2 Supply pressure and regulated pressure according to 4.2

6.2.1 Single stage fixed regulator for EN 437 pressures

Supply pressure:

Butane: 0,3 bar to 7,5 bar

LPG: 0,3 bar to 16 bar

Propane: 1 bar to 16 bar

Regulated pressure:

See Table 3

6.2.2 Two stages fixed or adjustable regulators for EN 437 pressures

6.2.2.1 First regulator, fixed or adjustable

Supply pressure:

Butane: minimum: 0,3 or $p_d + 0,2$ if greater – Maximum: 7,5 bar

LPG: minimum: 0,3 or $p_d + 0,2$ if greater – Maximum: 16 bar

Propane : minimum: 1 or $p_d + 0,5$ if greater – Maximum: 16 bar

Table 4 - Regulated pressure

Definition of the pressure		Numerical application given for information							
Nominal regulated pressure	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum lock Up pressure	$p_0 = p_d \times 1,3$	3,90	1,95	1,30	0,98	0,65	0,52	0,39	0,20
Maximum pressure	$p_{\max} = p_d \times 1,2$	3,60	1,80	1,20	0,90	0,60	0,48	0,36	0,18
Minimum pressure	$p_{\min} = p_d \times 0,7$	2,10	1,05	0,70	0,53	0,35	0,28	0,21	0,11

6.2.2.2 Last regulator

Table 5 - Supply pressure

Definition of the pressure		Numerical application given for information							
Nominal regulated pressure of the upstream regulator	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum pressure	$p_{\max} = p_d \times 1,3$	3,90	1,95	1,30	0,98	0,65	0,52	0,39	0,20
Minimum pressure	$p_{\min} = p_d \times 0,7 \times 0,85$	1,79	0,89	0,60	0,45	0,30	0,24	0,18	0,09
According to the pressure loss(es) of 15 % or 50 %	$p_{\min} = p_d \times 0,7 \times 0,5$	1,05	0,53	0,35	0,26	0,18	0,14	0,11	0,05

Regulated pressure:

See Table 3

6.2.3 Three stages fixed or adjustable regulators for EN 437 pressures

6.2.3.1 First regulator

Supply pressure:

Butane: minimum: 0,3 or $p_d + 0,2$ if greater – Maximum: 7,5 bar

LPG: minimum: 0,3 or $p_d + 0,2$ if greater – Maximum: 16 bar

Propane: minimum: 1 or $p_d + 0,5$ if greater – Maximum: 16 bar

Table 6 - Regulated pressure

Definition of the pressure		Numerical application given for information							
Nominal pressure	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum lock Up pressure	$p_0 = p_d \times 1,3$	3,90	1,95	1,30	0,98	0,65	0,52	0,39	0,20
Maximum pressure	$p_{\max} = p_d \times 1,2$	3,60	1,80	1,20	0,90	0,60	0,48	0,36	0,18
Minimum pressure	$p_{\min} = p_d \times 0,7$	2,10	1,05	0,70	0,53	0,35	0,28	0,21	0,11

6.2.3.2 Intermediate regulator

Table 7 - Supply pressure

Definition of the pressure		Numerical application given for information							
Nominal regulated pressure of the upstream regulator	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum pressure	$p_{\max} = p_d \times 1,3$	3,90	1,95	1,30	0,98	0,65	0,52	0,39	0,20
Minimum pressure	$p_{\min} = p_d \times 0,7 \times 0,85$	1,79	0,89	0,60	0,45	0,30	0,24	0,18	0,09
According to the pressure loss(es) of 15 % or 50 %	$p_{\min} = p_d \times 0,7 \times 0,5$	1,05	0,53	0,35	0,26	0,18	0,14	0,11	0,05

Table 8 - Regulated pressure

Definition of the pressure		Numerical application given for information							
Nominal regulated pressure	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum lock Up pressure	$p_0 = p_d \times 1,3$		1,95	1,30	0,98	0,65	0,52	0,39	0,20
Maximum pressure	$p_{\max} = p_d \times 1,2$		1,80	1,20	0,90	0,60	0,48	0,36	0,18
Minimum pressure	$p_{\min} = p_d \times 0,7$		1,05	0,70	0,53	0,35	0,28	0,21	0,11

6.2.3.3 Last regulator

Table 9 - Supply pressure

Definition of the pressure		Numerical application given for information							
Nominal regulated pressure of the upstream regulator	p_d	3	1,5	1	0,75	0,5	0,4	0,3	0,15
Maximum pressure	$p_{\max} = p_d \times 1,3$		1,95	1,30	0,98	0,65	0,52	0,39	0,20
Minimum pressure	$p_{\min} = p_d \times 0,7 \times 0,85$		0,89	0,60	0,45	0,30	0,24	0,18	0,09
According to the pressure loss(es) of 15 % or 50 %	$p_{\min} = p_d \times 0,7 \times 0,5$		0,53	0,35	0,26	0,18	0,14	0,11	0,05

Regulated pressure:

See Table 3

6.3 Variable regulators

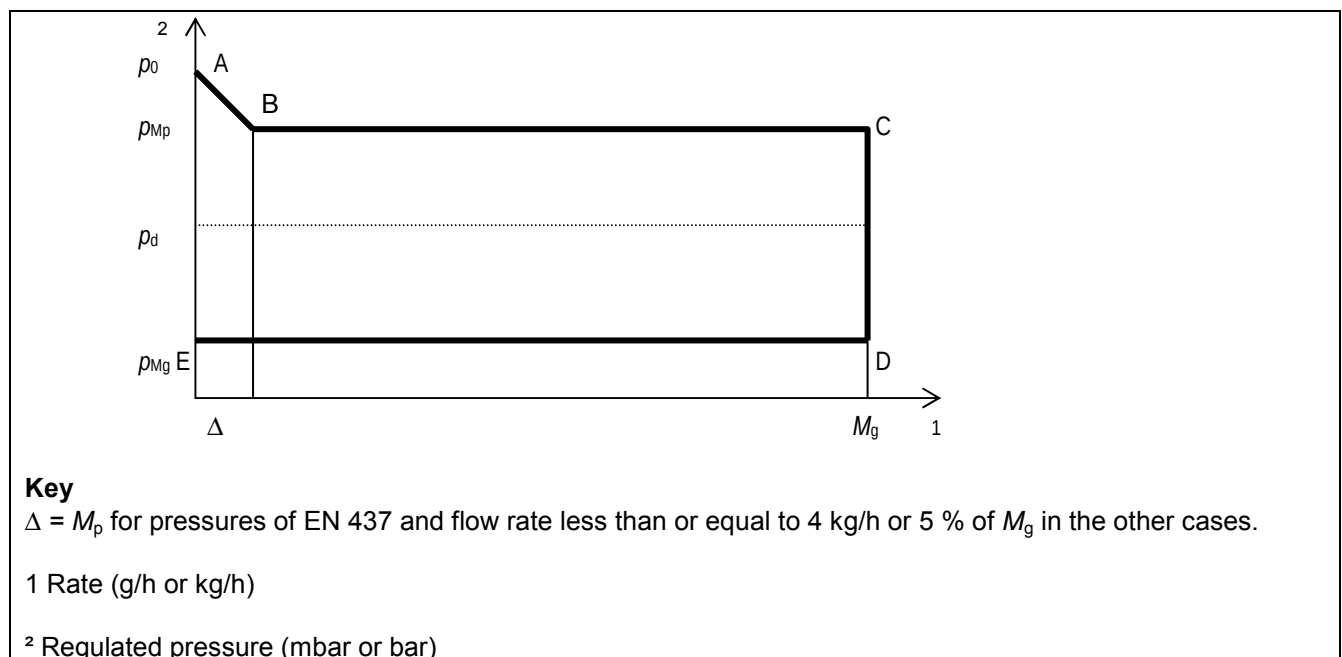
For variable regulators it is considered that those regulators may operate in a regulated pressure range specified by a minimum pressure ($p_{\min}$) and a maximum pressure ($p_{\max}$).

Their performances shall be checked in the range [$p_{\max} \times 1,3$; $p_{\max} \times 1,2$ and $p_{\max} \times 0,7$] and in the range [$p_{\min} \times 1,3$; $p_{\min} \times 1,2$ and $p_{\min} \times 0,7$] with $p_{\min} \geq 5$ mbar.

6.4 Regulators out of the pressures of EN 437

For regulators which are out of the pressures of EN 437, other pressures may be chosen.

The minimum and maximum inlet and regulated pressures are specified with the same coefficients as those given in 6.2.1 to 6.3.



a) Figure 3 - Operating limits allowed

7 Test methods

7.1 General conditions

7.1.1 Type of test gas

Whatever the gas (see 3.2) to be used with the regulator, with the exception of the soundness test which shall be carried out using air, tests which involve the passage of gas inside a regulator can be equally carried out with air at $(20 \pm 5) ^\circ\text{C}$ or reference propane.

Reference propane is that defined as G 31 in EN 437:2003, the reference air is dry air as specified in EN 437. The equivalence ratio between air and propane being defined by the formula:

$$q_n(\text{air}) = 1,245\ 4\ q_n(\text{G 31})$$

where air and propane rates are expressed in litres per hour (l/h).

7.1.2 Test conditions

Unless stated otherwise tests shall be carried out at a room temperature of $(20 \pm 5) ^\circ\text{C}$, which remains constant during each test.

All measurements are corrected to reference conditions: $15 ^\circ\text{C}$, 1 013,25 mbar.

If the regulator controls the valve opening, the tests shall be carried out on the valve/regulator assembly.

7.1.3 Equivalence formulas

From the results obtained with one of the reference gases, the mass rate corresponding to the type of gas mentioned on the regulator can be calculated, under reference conditions, from the formula:

$$M_g = q_n \times \rho \times \sqrt{\rho_g / \rho}$$

where

M_g is the mass rate of the gas under reference conditions, expressed in kilogram per hour (kg/h);

q_n is the measured volume rate, expressed in cubic metres per hour (m^3/h), of the reference gas used, corrected to reference conditions of 7.1.2, according to the formula:

$$q_n = q_{(\text{measured})} \times \frac{288,15}{273,15+t} \times \frac{p_a}{1013,25}$$

where

q_{measured} is the actual volume rate measured, in cubic metres per hour (m^3/h);

t is the temperature in degree Celsius ($^\circ\text{C}$);

p_a is the atmospheric pressure in millibars (mbar);

ρ is the density of the reference gas used under reference conditions, expressed in kilogram per cubic metre (kg/m^3), in accordance with 7.1.1 and 7.1.2;

ρ_g is the density of the average liquefied petroleum gases for the appliance, expressed in kilogram per cubic metre (kg/m^3) (see 3.2).

7.1.4 Test samples

For the full sequence of tests, six identical samples are required.

Six regulators shall be numbered and submitted to the series of tests defined in Table 10 in the order indicated.

NOTE Details concerning sampling are outside the field of this document and should be agreed between the manufacturer and the certification body.

Table 10 — Order of tests

Clause	Test	Regulator number					
		1	2	3	4	5	6
7.2.2	Resistance to pressure	X	X				
7.2.3	Mechanical strength of connections						X
7.2.5	Soundness (before)	X	X	X	X	X	X
7.2.4	Regulation subassembly	X	X				
7.3	Verification of performance characteristics (before)			X	X	X	
7.2.6	Mechanical endurance			X			
7.2.1	Shock				X		
7.2.8	Resistance to corrosion					X	
7.2.5	Soundness (after)			X	X	X	X
7.3	Verification of performance characteristics (after)			X	X	X	

7.2 Verification of constructional characteristics

7.2.1 Resistance to impact

A complete regulator, whose unions have not been protected, is dropped from a height of one metre in any position onto a hard floor (for example a concrete area).

The requirements given in 5.4.1 shall be verified, only the distortion due to the fall onto the ground is allowed.

7.2.2 Resistance to pressure

During the whole duration of the tests described in 7.2.2.1, 7.2.2.2 and 7.2.2.3, the temperature of the regulator and of the supply water shall be maintained at $(50 \pm 2) ^\circ\text{C}$.

NOTE Tests intended to be carried out with water can be carried out with air or with nitrogen provided that adequate safety measures are taken.

When the regulator has a safety valve, these tests shall be carried out in accordance with annex A.

7.2.2.1 A regulator is connected by its inlet to a pipe supplied with water. After reaching the required temperature, the outlet connection is blocked and the pressure of water is increased to 1,75 times the maximum supply pressure (p_a). The test shall not last less than 15 min after the application of the pressure.

At the end of this test, the requirements of 5.4.2 shall be met.

7.2.2.2  The regulator is connected by its outlet to a pipe supplied with air or nitrogen. After reaching the required temperature, the pressure of air or nitrogen is increased to 1,5 time the regulated pressure with a minimum of 0,5 bar.  The test shall not last less than 15 min after the application of the pressure period during which the leak at the regulator measured shall not exceed 50 cm³/h.

At the end of this test, the requirements of 5.3.1 and 5.4.2 shall be met.

7.2.2.3 Another regulator is connected by its outlet to a pipe supplied with water. The inlet connection, the vent and any other orifice opening to the atmosphere are blocked. It is allowed for the diaphragm to be pierced at the end of the test.

After reaching the required temperature, the water pressure is increased to the maximum supply pressure. The test shall not last less than 15 min after the application of the pressure.

After each of the three tests described above the requirements of 5.4.2 shall be met.

7.2.3 Mechanical strength of connections

Tests for mechanical strength shall be carried out using a dynametric device allowing the measurement of forces to within ± 5 % accuracy.

For the torque test a system which neutralizes bending moments shall be used (if a torque wrench is used it is desirable that this is double handed).

The conditions for applying the torques forces shall be as follows:

- a) for regulators with a capacity of less than or equal to 4 kg/h, the points where the regulator is fixed are those in figures of Tables 12, 13 and 14;
- b) for regulators with a capacity greater than 4 kg/h, the checks of 5.4.3 shall be carried out with the regulator installed in accordance with the manufacturer's instructions;
- c) for flanged connections as in ISO 7005-2, the tightening force for the flange nuts is given in Table 11;

Table 11 — Tightening force for the flange bolts as in ISO 7005-2

Nominal diameter DN	6	8	10	15	20	25	32	40	50
Tightening force N·m	20	20	30	30	30	30	50	50	50

- d) The duration of application of the torques and forces shall be 1 min.

Table 12 - Mechanical strength test on inlet connections (union/regulator connection)

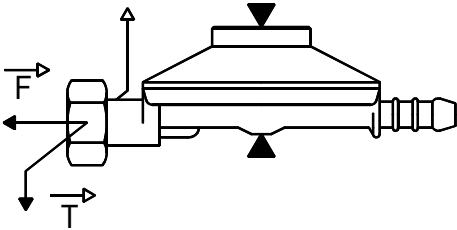
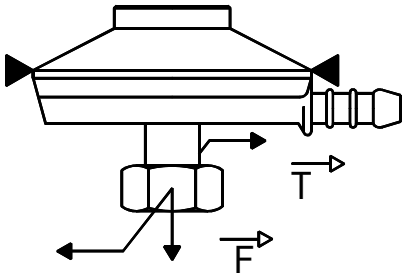
Test diagram	Force	Assembled	Integral
	T F	30 N·m 2 000 N	
	T F	30 N·m 2 000 N	

Table 13 – Mechanical strength test on outlet connections (union/regulator connection)

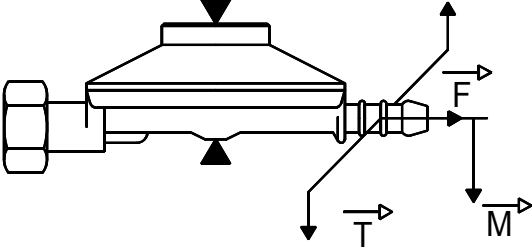
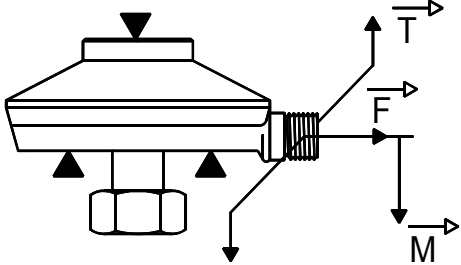
Test diagram	Force	Assembled	Integral
	T F M	30 N·m 2 000 N 10 N·m	10 N·m
	T F M	30 N·m 2 000 N 10 N·m	30 N·m
Key ► ◄ regulator fixing points ; T = torque; F = tensile strength; M = bending moment			

**Table 14 - Mechanical strength tests for the regulator assembly mounted on its cylinder valve
(self closing valve or manual valve)**

Test diagram	Force	Threaded inlet connection	Quick coupling connection
	T F F1	20 N·m 400 N	15 N·m 500 N 400 N
	T F F1	20 N·m 400 N	15 N·m 500 N 400 N
	T F F1	30 N·m 400 N	30 N·m 500 N 400 N
	T1 T2 F F1	30 N·m 20 N·m 400 N	30 N·m 15 N·m 500 N 400 N
Key 	regulator fixing points; valve T and T2 are not applied if the regulator is freely turning on its cylinder valve.	F = tensile strength ; T, T1, T2 = torque	F1 = bending moment

For the tests carried out as in Table 14,

- for regulators with threaded connections, the connection shall be mounted on its valve as indicated in the manufacturers instructions;
- for regulators with quick coupling, if the inlet connection rotates the tensile strength test of 15 N·m is not necessary; if the connection is locked in the original position, the regulator shall be tested as such.

In all cases the requirements of 5.4.3 shall be met.

7.2.4 Regulation subassembly

The valve in position in its housing is placed in a pressurized container filled with liquid propene in such a way that the assembly is immersed completely, for example 50 ml of liquid in a 200 ml container.

After 72 h at $(20 \pm 5) ^\circ\text{C}$, the container is emptied, the valve and its housing are taken out.

At the time when it is taken out of the container and during the 10 min which follow, the assembly is checked and shall comply with the requirements of the last paragraph of 5.3.2 concerning the valve.

7.2.5 Soundness

7.2.5.1 Soundness of the regulator

This test can be carried out according to the methods used in the laboratories provided that these methods give results that can be reproduced.

The measurement shall be given with an accuracy of 20 % of the maximum permitted value.

In the event of disagreement the method described in annex D shall be used.

The regulator is connected through its inlet connection to a pipe supplied with air at a pressure of 150 mbar, then at a pressure of 8,25 bar for butane regulators and 17,6 bar for propane and LPG regulators. The test shall last for not less than 2 min, after reaching the pressure.

The regulator connection and tightening torque shall be as specified by the manufacturer unless otherwise specified in this document.

If the regulator is fitted with a manual closing device, this shall be in the open position.

The regulator is then connected through its outlet connection to a pipe supplied with air at a pressure of 150 mbar for regulators for which the regulated pressure is less than 100 mbar and 1,5 times the regulated pressure for regulators for which the regulated pressure is greater than 100 mbar.

When the regulator is fitted with a freely rotating outlet connection, the tests shall be carried out in any position of the outlet connection.

The requirements of 5.5 shall be met.

7.2.5.2 Soundness of the manual closing device

A thin, flexible hose is fitted to the regulator's outlet. The regulator is connected to its valve.

The valve being in the "closed" position and at the supply pressure p , the gas flow ceases with the absence of bubbles when the flexible hose is dipped into water for a minimum of 2 min (water depth: 15 mm approximately).

The test shall be carried out for two values of the supply pressure p , equal to the values of minimum and maximum pressures to be used with the regulator under test.

The requirements of 5.5 shall be met.

7.2.6 Mechanical endurance

7.2.6.1 General

The regulator is connected

- at its inlet to a pipe supplied with air at a pressure of 1,4 bar for butane regulators and 7,5 bar for propane and LPG regulators directly supplied by the gas container pressure, and the nominal supply pressure for other regulators, at a temperature of $(20 \pm 5) ^\circ\text{C}$;
- at its outlet, to a jet giving a rate equal to 20 % of the guaranteed rate.

Quick acting valves are installed upstream and downstream of the regulator.

The valves are connected to an appropriate timer in such a way that when one of the valves opens, the other closes with a length of complete cycle of approximately 5 s.

The test shall be carried out in such a way that the diaphragm has completely relaxed and the valve maintained on its seat for a period of at least 1 s.

The requirements of 5.6.1 shall be met.

7.2.6.2 Regulator fitted with a tap

The life test on the tap shall be carried out at ambient temperature in accordance with the following method:

- through the tap passes air at a pressure of 1,4 bar for butane regulators and 7,5 bar for propane and LPG regulators at a temperature of $(20 \pm 5) ^\circ\text{C}$ flowing to a calibrated injector placed downstream of the regulator giving a rate equal to 20 % of the guaranteed rate;
- the tap shall resist 5 000 cycles of opening/closing, each cycle including rotation from the closed position up to the fully open position, with the application of a torque of 0,3 N·m in the open and closed positions. The frequency shall be (6 ± 2) cycles/min.

At the end of these 5 000 cycles, the tap shall be closed with a torque of 0,5 N·m and soundness shall be verified with air at working pressures and at the minimum and maximum temperatures.

The same test shall be carried out with an opened tap (injector sealed).

The requirements of 5.6.2.1 shall be met.

7.2.6.3 Regulator with quick coupling

The regulator is connected to a new valve, 5 000 cycles of disconnection and connection are carried out, each cycle lasting 5 s approximately.

If the coupling is designed in such a way as to automatically open a valve, the test shall be carried out with the valve at a pressure of 0,5 times the maximum supply pressure.

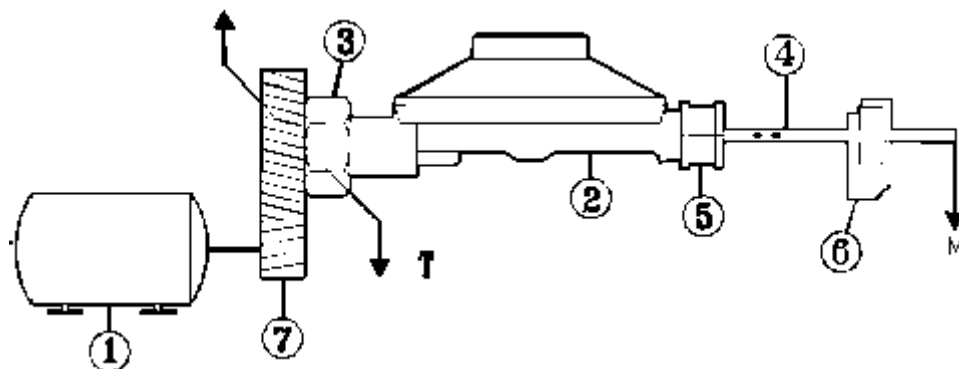
After the disconnection test the forces described in 5.4.3.2 b) and c) shall be applied to the regulator.

The requirements of 5.6.2.2 shall be met.

7.2.6.4 Regulator with a freely rotating outlet connection

Under the conditions described in Figure 4, the outlet connection shall resist a bending of 0,5 N.m and the regulator shall resist 2 500 rotation cycles.

At the end of this test, the requirements of 5.6.2.3 shall be met.



The regulator (2) is fixed onto the gear (7) via its connection (3). On the freely rotating outlet (5) a connecting rod (4) is placed enabling the application of the bending moment M of 0,5 N.m. The rod (4) is locked in rotation but left free in the direction of the bending moment using a device (6).

The motor (1), by reversing its direction of rotation, subjects the regulator to the following cycle (with a torque T of 0,3 N.m maximum):

- 1/2 turn to the right in 5 s;
- an interval of 3 s;
- 1/2 turn to the left in 5 s.

Figure 4 – Endurance test for regulators with a freely rotating outlet connection

7.2.7 Resistance to humidity changes

A sample is taken of any material capable of being altered in its structure and dimensional characteristics by humidity.

It is submitted to the following test cycle:

- drying in an oven at 50 °C for 12 h;
- weighing to an accuracy of 0,1 mg;
- immersion in distilled water at 20 °C for 24 h;
- removal from the water, superficial removal of the excessive water with filter paper;
- weighing to an accuracy of 0,1 mg;
- drying in an oven at 50 °C for 24 h;
- weighing to an accuracy of 0,1 mg.

At the end of this test, the requirements of 5.7 shall be met.

7.2.8 Resistance to corrosion

The whole regulator, not connected at the ends, is tested according to ISO 9227. Other test methods leading to equivalent results, for example the method described in informative annex I, are allowed.

The test chamber being in a steady state, the regulator is placed in the position of use recommended by the manufacturer in the instructions and left for 96 h.

At the end of this test the requirements of 5.8 shall be met.

7.3 Verification of performance characteristics

7.3.1 General

Tests shall be carried out whilst maintaining the regulator and gas at the temperatures shown in Table 15.

Performance tests shall be carried out:

- for regulators having a rate of up to and including 4 kg/h, in all possible positions for fixing the regulator onto the installation;
- for regulators having a rate exceeding 4 kg/h, in the installation position or positions recommended by the manufacturer in the instructions.

These tests, as well as the soundness test, shall be carried out before and after the endurance test.

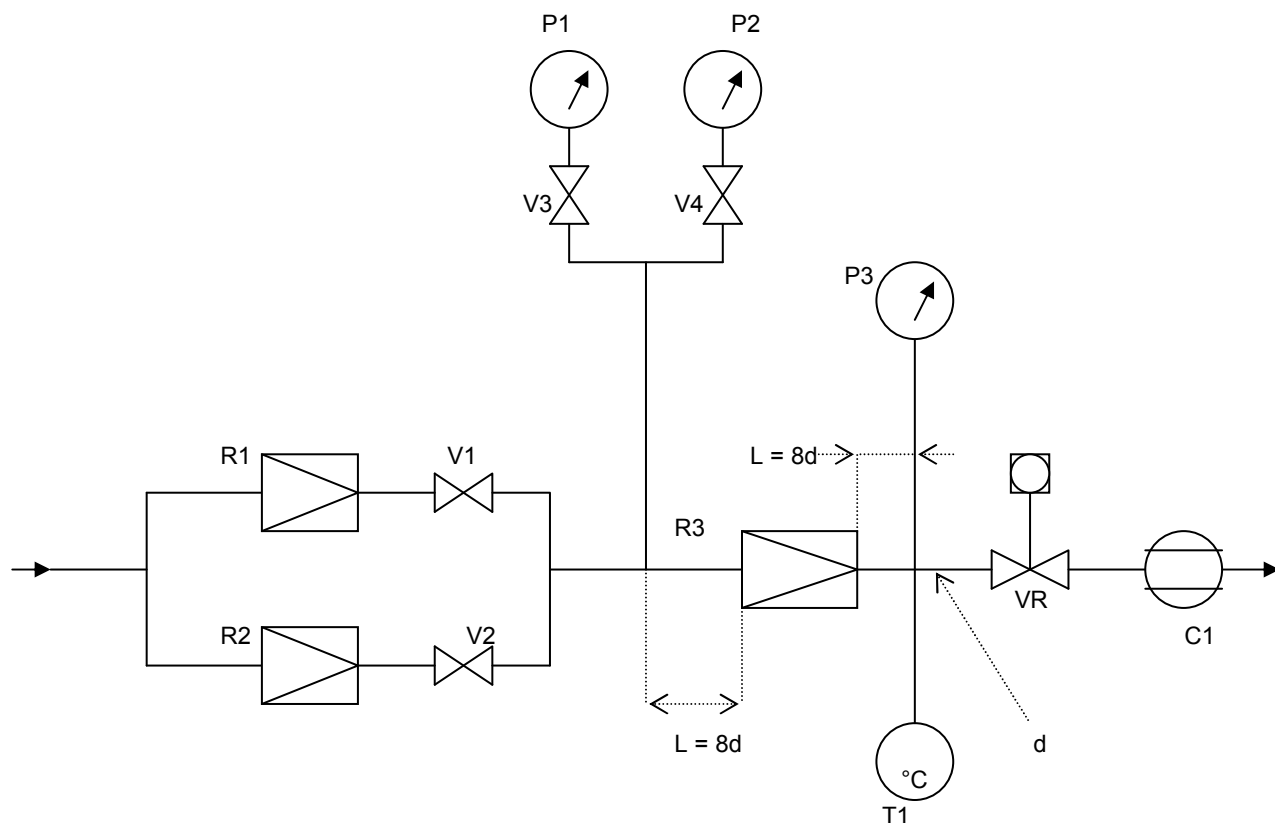
Performance tests can be carried out using calibrated orifices or using rate meters which enable the obtaining of a full range of rates up to the guaranteed rate.

NOTE The closing pressure should be measured 5 s after the effective closure.

The diameter of the pipework used shall be sufficiently large to avoid creating pressure drops which could influence the results.

Whatever the method used tests are carried out with increasing rates from 0 to the guaranteed rate, then for decreasing rates from the guaranteed rate to closure at no flow.

All the points obtained in this way give the regulation curve for the supply pressure considered.

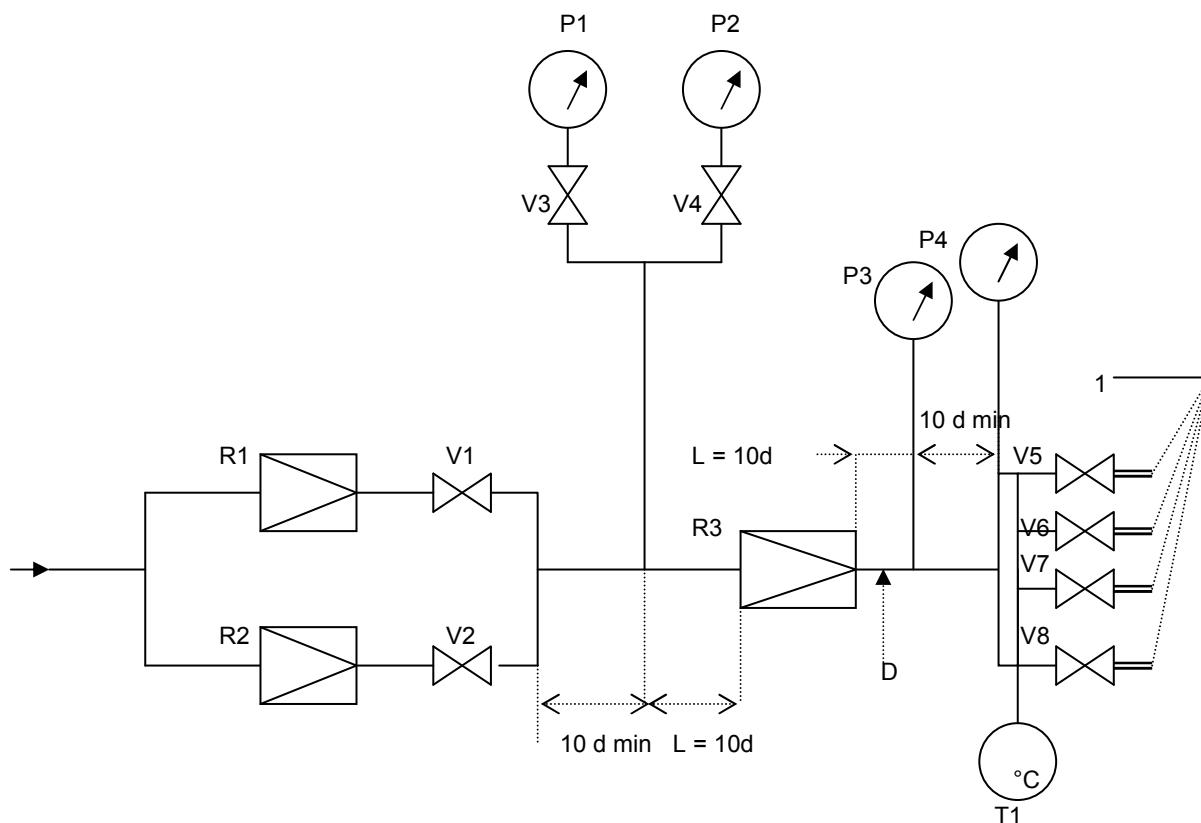


Key

- R1, R2 Supply adjustment regulators
- V1, V2 Ball valves (DN $\geq$ inlet DN of R3, minimum DN 10)
- V3, V4 Ball valves
- P1, P2 Measuring devices of upstream pressure (class 0,1)
- R3 Regulator under test
- P3 Measuring device of downstream pressure (class 0,1)
- T1 Thermometer (accuracy 1°C)
- VR Flow rate adjuster
- C1 Flow rate measuring device
- $d \geq$ outlet DN of R3, minimum DN 10

NOTE The supply device (R1/V1, R2/V2) is given as a guide.

Figure 5 a) – Performance tests: volume rate method



Key

- 1 Calibrated injectors
- R1, R2 Supply adjustment regulator
- V1 to V8 Ball valves (DN 10)
- P1, P2 Measuring devices of upstream pressure (class 0,1)
- R3 Regulator under test
- P3, P4 Measuring devices of downstream pressure (class 0,1)
- T1 Thermometer (accuracy : 1 °C)
- $d \geq DN$ (10 min)

NOTE The supply device (R1/V1, R2/V2) is given as a guide.

Figure 5 b) – Performance tests: calibrated injectors method (principle)

7.3.2 Plotting of the performance curves

The performance curves are plotted under appropriate supply conditions:

- for first or single stage regulators, the pressure values are those of Table 15, starting with maximum pressures;
- for second or third stage regulators, the sole supply pressure value is the nominal indicated by the manufacturer for the whole temperature range given in Table 15.

Table 15 — Performance curves - Supply conditions

Type of gas	Temperature °C	Pressure bar
Butane	+50 ± 2	7,5
	+20 ± 5	0,3 or $p_d + 0,2$ if greater -7,5
	0 ± 2	0,3 or $p_d + 0,2$ if greater
LPG	+50 ± 2	16
	+20 ± 5	0,3 or $p_d + 0,2$ if greater - 16
	-20 ± 2	0,3 or $p_d + 0,2$ if greater
Propane	+50 ± 2	16
	+20 ± 5	1 or $p_d + 0,5$ if greater - 16
	-20 ± 2	1 or $p_d + 0,5$ if greater

For temperatures other than 20 °C the curve will be limited to the maximum flow rate for regulators ≤ 4 kg/h or at 10% of the maximum flow rate without being less than 4 kg/h for regulators ≥ 4 kg/h.

All the curves define the typical operational range of the regulator. If the points of the curve are distributed abnormally, additional tests shall be carried out at intermediate supply pressures, to ensure that all operational points are well within the typical range.

8 Marking, packaging, instructions

8.1 General

Instructions and the information and warnings carried on the regulator and its packaging shall be written in the official language or languages of the country where the regulator is to be sold.

8.2 Marking of the regulator

The regulator shall be marked with the following information in a legible, visible and durable manner, compatible with its lifetime:

- the manufacturer's name or logo and, possibly, trademark;
- trade name of the regulator, with marking in letters or figures allowing the identification of the regulator;
- the type of gas: butane, propane or LPG;
- minimum and maximum supply pressures, expressed in millibar or bar (mbar or bar);

- nominal regulated pressure or range of pressure, expressed in bar (bar) or in millibar (mbar);
- the guaranteed rate in kilograms per hour (kg/h);
- the date of manufacture indicated by the last two figures of the year;
- an arrow to show the direction of the flow of gas, where necessary;
- a reference to this document: EN 13785.

Any additional information given by the manufacturer shall not lead to confusion with the indications required by this document.

It is recommended to mark on the regulator the type of connection (inlet/outlet) of the regulator i.e:G.52/H.1.

8.3 Packaging

The regulator shall be protected against entry of foreign material by packaging which shall indicate in a clear and unambiguous fashion the type of gas, the nominal regulated pressure and possible limits of use, in particular the type and the type and size of the cylinder valve to which the regulator may be fitted where applicable.

8.4 Instructions for installation, use and maintenance

Each regulator shall be accompanied by instructions intended for the user, which, in addition to the items in 8.2 (with the exception of the date of manufacture of the regulator), shall specify:

- the manufacturer's address and, if necessary, his agent;
- the assembly conditions, in particular the use of a filter, the preferred position, recommended by the manufacturer and the instructions concerning the use of a spanner;
- the installation, safety and soundness conditions, in particular with regard to the seal and its condition;
- the conditions of use, which will mention the following statement: "In normal conditions of use, in order to ensure correct operation of the installation it is recommended that this regulator is changed within 10 years of the date of manufacture."
- the installation conditions, which will include the statement such as "when the regulator is to be used outdoors, it shall be positioned or protected against direct penetration by any trickling water". They shall also give, when applicable, the relevant instructions to electrically isolate the regulator when mounted on to a wall.
- the operating temperature range of the regulator;
- a warning such as : "When the regulator is installed downstream of another regulator, the supply pressure range shall be correct for the regulated pressure range of the upstream regulator, plus any pressure losses in the interconnecting pipe work."
- a description of the operation of the safety devices (see annex A and annex B).

When the instructions are printed on the packaging of the regulator, they shall be easily removable so that they may be kept by the user.

Annex A (normative)

Special requirements for regulators fitted with pressure or rate operated safety devices

A.1 Regulators fitted with an over-pressure relief

A.1.1 Definition

An over-pressure relief is a device (possibly with a vent tube) for the discharge of gas, which opens to the outside as soon as the gas pressure reaches a set pressure and closes when the monitored pressure has dropped. The valve is closed during normal operation.

A.1.2 Constructional characteristics

The relief shall be integral with the regulator.

It may be part of the pressure sensing subassembly of the regulator, a measuring device is not necessary. The adjustment of the setpoint shall be protected against any unauthorized modification.

For designs where gas is discharged via the pressure sensing subassembly, the respective cross sectional area of the valve and connection pipework to the atmosphere shall be chosen in such a way that no unacceptable rise in pressure can occur within the pressure subassembly.

The device shall incorporate a component enabling connection to a relief, for example via an Rp 1/8 internal thread. This component shall be used for discharging to the outside when the regulator is used inside a dwelling. The discharge orifice shall be protected against rain water. The tube connecting to the atmosphere may also be used as a vent.

The instructions shall specify that connection to the outside shall be carried out when a regulator fitted with a relief is to be used in a dwelling. They shall provide all necessary information on this connection and in particular the dimensions of the tube (maximum diameter and length).

A.1.3 Performance characteristics

A.1.3.1 Regulators having a maximum regulated pressure of up to and including 150 mbar

The opening pressure of the relief shall be between 2 times the nominal regulated pressure and 150 mbar, for ambient temperatures between -20 °C and +50 °C.

Regulators designed to operate with pressures of 112 mbar or 148 mbar shall not be fitted with a relief valve.

A.1.3.2 Regulators having a maximum regulated pressure exceeding 150 mbar

The valve shall operate in compliance with the regulations in force in the country of destination of the appliance.

A.1.4 Test methods

Only internal soundness tests, behaviour in operation and discharge are verified for the valve, all the strength and external soundness tests being carried out in compliance with the requirements for the regulator.

A.1.4.1 Regulators having a maximum regulated pressure of up to and including 150 mbar

Tests shall be carried out under the following conditions:

— Internal soundness test before opening

The regulated pressure is increased to 1,4 times the nominal regulated pressure. The test shall be carried out at a room temperature of $(20 \pm 5) ^\circ\text{C}$. The relief shall be sound at that pressure, soundness is considered satisfactory if the value of leak measured is below $15 \text{ cm}^3/\text{h}$.

— Behaviour in operation and discharge

For ambient temperatures of $(-20 \pm 2) ^\circ\text{C}$, $(+20 \pm 5) ^\circ\text{C}$ and $(+50 \pm 2) ^\circ\text{C}$, the regulated pressure is increased up to a value of 150 mbar. The relief shall open between 2 times the nominal pressure and 150 mbar. At the upper limit pressure, the gas rate released shall be at least $0,1 \text{ m}^3/\text{h}$ (air, under the reference conditions).

— Internal soundness test after reclosing:

After opening and reclosing of the valve, the pressure shall be dropped to 1,4 times the nominal regulated pressure and soundness shall be verified under the same conditions as before the opening.

A.1.4.2 Regulators having a maximum regulated pressure exceeding 150 mbar

The manufacturer's specifications shall be verified based on the information given to the test laboratory.

A.1.5 Regulator marking

In addition to the information required in 8.2, the regulator fitted with a relief valve shall carry the opening pressure.

A.2 Regulators fitted with an over-pressure shut off safety valve

A.2.1 Definition

Shut off device, triggered by an excessive regulated pressure, which causes the complete shut off of the gas flow for all values of supply pressure.

The restoration of the gas flow shall only be possible by manual intervention when the conditions which cause the shut device to operate have disappeared.

The regulator's manual device which enables the restoration of the gas flow is called the resetting device.

A.2.2 Constructional characteristics

A.2.2.1 General

The shut off device may be either integral with the regulator or be an auxiliary component. In any case, the constructional requirements for the shut off device are the same as those for the regulator.