

Elastomers for gas pressure regulators and associated safety devices for inlet pressures up to 100 bar

The European Standard EN 13787:2001 has the status of a
British Standard

ICS 23.040.80

National foreword

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 30 November 2001

ISBN 0 580 36790 8

EUROPEAN STANDARD

EN 13787

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2001

ICS 83.060; 83.140.50

English version

Elastomers for gas pressure regulators and associated safety devices for inlet pressures up to 100 bar

Elastomères pour régulateurs de pression de gaz et dispositifs de sécurité associés pour pressions amont jusqu'à 100 bar

Elastomere für Gas-Druckregelgeräte und zugehörige Sicherheitseinrichtungen für Eingangsdrücke bis 100 bar

This European Standard was approved by CEN on 15 September 2000.

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 Management Centre or to any CEN member.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 235 "Gas pressure regulators and associated safety devices for use in gas transmission and distribution", the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by April 2002, and conflicting national standards shall be withdrawn at the latest by April 2002.

This European Standard includes one informative annex (Annex A) and one normative annex (Annex B related to a special national condition for Sweden).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the minimum requirements for elastomeric materials intended to be used as static seals, dynamic seals or diaphragms in the gas pressure regulators covered by EN 334 and in the safety devices for gas pressure regulating stations and installations covered by the corresponding European Standards, as well as the relevant test methods to assess these requirements.

This European Standard applies to elastomeric materials for use with gases of the first and second gas families to EN 437, for inlet pressures less than or equal to 100 bar, and in an operating temperature range between $-10\text{ }^{\circ}\text{C}$, (or $-20\text{ }^{\circ}\text{C}$ when applicable), and $+60\text{ }^{\circ}\text{C}$.

This European Standard also gives some additional characteristics and recommendations for their application likely to be requested for elastomers in the order specifications, and the corresponding test methods (see informative Annex A).

This European Standard only applies for type testing.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

EN 437, *Test gases – Test pressures – Appliance categories.*

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

ISO 37, *Rubber vulcanized or thermoplastic – Determination of tensile stress-strain properties.*

ISO 48, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

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

ISO 815, *Rubber, vulcanized or thermoplastic – Determination of compression set at ambient, elevated or low temperatures.*

ISO 1817, *Rubber, vulcanized – Determination of the effect of liquids.*

3 Terms and definitions

For the purposes of this European Standard, the following definitions apply:

3.1

static seal

component which ensures a seal between two parts of a gas pressure regulator or parts of its associated safety devices which do not have relative movement ('O' rings, sheet gaskets, etc.)

NOTE Adapted from EN 549.

3.2

dynamic seal

component which ensures a seal between two parts of a gas pressure regulator or parts of its associated safety devices which have relative movement (lip seals, some 'O' rings)

NOTE Adapted from EN 549.

3.3

diaphragms

3.3.1

diaphragm

membrane of rubber material located in a fixture and serving as a flexible gas tight partition between two chambers

[EN 549]

3.3.2

main diaphragm

diaphragm, the function of which is to detect the feedback of the controlled variable and/or the diaphragm which provides the thrust to move the control member

[EN 334]

3.3.3

control member

movable part of the regulator which is positioned in the flow path to restrict the flow through the regulator. A control member may be a plug, ball, disk, vane, gate, diaphragm, etc.

[EN 334]

3.4

seat ring

part assembled in a component of the regulator to provide a removable soft seat

[EN 334]

4 Characteristics

4.1 General requirements

Elastomeric materials used for non reinforced diaphragms and static and dynamic seals, shall conform to the required values and tolerances given in Table 1. Test methods are detailed in clause 5.

All materials shall be free from porosity, inclusion, blisters and surface imperfections visible to the naked eye.

Table 1 — Requirements of elastomers for seals and diaphragms

Property	Units	Hardness Class				
		50	60	70	80	90
Hardness Tolerances on stated nominal hardness	IRHD	± 5	± 5	± 5	± 5	+3 / -5
Tensile strength , minimum	MPa	6	9	9	10	10
Elongation at break , minimum	%	400	300	200	150	80
Compression set ^a						
- at 70 °C, after 24 h	%	25	25	25	25	25
- where applicable, at -10 °C after 24 h or at -20 °C after 24 h	%	40	40	40	40	40
		50	50	50	50	50
Resistance to ageing						
- Change in hardness	IRHD	± 10	± 10	± 10	± 8	± 6
- Change in tensile strength	%	± 15	± 15	± 15	± 15	± 15
- Change in elongation at break	%	+10 / -25	+10 / -25	+10 / -25	+10 / -25	+10 / -25
Resistance to gas (n-pentane)						
- Change in mass after immersion (72 h, 23 °C)	%	+10 / -5	+10 / -5	+10 / -5	+10 / -5	+10 / -5
- Change in mass after drying (168 h, 40 °C), maximum	%	+5 / -10	+5 / -10	+5 / -10	+5 / -8	+5 / -8
Resistance to lubricants Oil IRM 902, 168 h at 70 °C						
- Change in hardness	IRHD	± 10	± 10	± 10	± 10	± 10
- Change in mass	%	+15 / -10	+15 / -10	+15 / -10	+15 / -10	+15 / -10
^a When the diaphragm has a function of detection, this test is not applicable (see 4.2.2).						

Materials used for reinforced diaphragms should meet the requirements of Table 1. Moreover, specific additional tests may be necessary.

4.2 Additional characteristics

4.2.1 The requirements given in 4.1 are intended for general use, however, for some applications, particularly with regard to the design of the regulator or the safety device, and according to the provisions of the order specification, additional characteristics may be asked for.

For testing these additional characteristics, the test methods given in informative Annex A should be used, taking into account test conditions and assessment criteria set up in the order specification.

For such additional characteristics, the 4.2.2 to 4.2.4 should be considered.

4.2.2 For parts in contact with the atmosphere, under normal conditions of use, elastomers resistant to ozone should be used. In particular, this characteristic should be taken into account when the diaphragm has a function of detection.

4.2.3 Where the diaphragm is used as a sensing system, compression set is not considered to be relevant and should be replaced by a type test in the regulator standard EN 334 or in the appropriate EN standard for safety devices, as applicable.

4.2.4 For seat rings the values are the same as in Table 1, but additional tests such as tear strength and abrasion could be introduced as quoted in informative Annex A.

5 Test methods for general requirements

5.1 General conditions of testing

Unless otherwise specified, tests are carried out at a temperature of (23 ± 2) °C.

5.2 Hardness

The hardness is measured by IRHD, preferably according to the micro-test method specified in ISO 48.

5.3 Tensile strength and elongation at break

Tensile strength and elongation at break are measured according to ISO 37 and expressed in MPa and percentage respectively. The test is performed preferably on dumb bell test pieces of type 2.

5.4 Compression set

Tests are carried out according to ISO 815 (type B test piece) under the following conditions:

- at high temperature: after 24 h at 70 °C;
- at low temperature: after 24 h at -10 °C or -20 °C.

5.5 Resistance to ageing

Changes in hardness, tensile strength, elongation at break are measured to 5.2 and 5.3 respectively after ageing in accordance to ISO 188, at a temperature of 70 °C for 168 h (7 days).

5.6 Resistance to gas

Resistance to gas is measured in percentage of change in mass after immersion in n-pentane (72_{-2}^0) h at (23 ± 2) °C, and after drying (168_{-2}^0) h at 40 °C, according to the test method given in ISO 1817.

5.7 Resistance to lubricants

Resistance to lubricants is measured according to the test method given in ISO 1817, under the following specific conditions:

- immersion during (168_{-2}^0) h in oil IRM 902 at 70 °C;
- changes in mass and hardness are determined with reference to the initial mass and hardness of the samples.

Annex A (informative)

Additional characteristics

A.1 General

In order to meet some special provisions of the order specifications, in particular for specific applications as stated in 4.2, elastomer materials should have additional specific characteristics of resistance to ozone, resistance to abrasion or resistance to tear.

The corresponding limit values and particular test conditions, if applicable, are defined in the order specifications.

Unless otherwise specified, the test methods given in A.2 to A.4 should be applied.

A.2 Resistance to ozone

Where applicable, resistance to ozone is measured according the test method given in ISO 1431-1, with the following test criteria:

- ozone concentration: (25 ± 5) pphm
- temperature: (40 ± 2) °C
- exposure time: $\left(48 \begin{smallmatrix} 0 \\ -2 \end{smallmatrix}\right)$ h
- relative humidity: (55 ± 10) %
- elongation: (20 ± 2) % for hardness classes 50, 60 and 70;
 (15 ± 2) % for hardness class 80;
 (10 ± 1) % for hardness class 90;
- view with 7-fold magnification;
- assessment: no cracks.

A.3 Resistance to abrasion

The relevant test method is specified in ISO 4649, method A.

A.4 Resistance to tear

The relevant test method is specified in ISO 34-1, method B, procedure a).

Annex B (normative)

Special national conditions

B.1 Special national conditions

National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions. If it affects harmonization, it forms part of the European Standard or Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

B.2 Special national condition for Sweden

In Sweden the subject dealt with in this European Standard is covered by the following national regulation:

- Regulations on handling of Vessels with Flammable Gases; SÄIFS 1997:6, clause 3.4.2:
"Pipeline shall be resistant to the gas, with additives and pollutants that might occur. It shall also be suitable for the pressures and the temperatures it might be subjected to."

<u>Clause</u>	<u>Special national condition</u>
1	The operating temperature range shall start at the lower temperature to which the equipment can be subjected, which in Sweden is $-40\text{ }^{\circ}\text{C}$.
4.1	The compression set test shall be carried out at the lower temperature to which the equipment can be subjected, which in Sweden is $-40\text{ }^{\circ}\text{C}$.
5.4	The compression set test shall be carried out at the lower temperature to which the equipment can be subjected, which in Sweden is $-40\text{ }^{\circ}\text{C}$.

Bibliography

ISO 34-1, *Rubber vulcanized or thermoplastic – Determination of tear strength – Part 1: Trouser, angle and crescent test pieces.*

ISO 1431-1, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static strain test.*

ISO 4649, *Rubber – Determination of abrasion resistance using a rotating cylindrical drum device.*

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