

Version
July 2025

English version

Approval requirement 81

Elastomeric seals



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Preface Kiwa

This approval requirement (AR) is approved by the Board of Experts (BoE) GASTEC QA, in which relevant parties in the field of gas related products are represented. This Board of Experts supervises the certification activities and where necessary require the GASTEC QA approval requirement to be revised. All references to Board of Experts in this GASTEC QA approval requirement pertain to the above-mentioned Board of Experts.

This AR will be used by Kiwa Nederland BV in conjunction with the GASTEC QA general requirements and the KIWA regulations for certification.

In this AR is established which requirements a product and the requestor/ certificate holder of the GASTEC QA product certificate should meet and the matter to which Kiwa evaluates this.

Kiwa has a method which is established in the certification procedure for the execution of:

- The investigation for provisioning and maintaining a GASTEC QA product certificate based on this AR.
- The periodic evaluations of the certified products for the purpose of maintaining a provided GASTEC QA product certificate based on this AR.

Approved by the Board of Experts: 04/07/2025

Accepted by Kiwa Nederland B.V.: 11/07/2025

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1 Introduction

1.1 General

This GASTEC QA approval requirement (AR) in combination with the GASTEC QA general requirements, is applied by Kiwa as the basis for the issuing and maintaining the GASTEC QA product certificate for elastomeric seals.

With this product certificate, the certificate holder can demonstrate to his or her customers that an expert independent organization monitors the production process of the certificate holder, the quality of the product and the related quality assurance.

Next to the requirements established in this AR and the general requirements, Kiwa has additional requirements in the sense of general procedural requirements for certification, as laid down in the internal certification procedures.

This GASTEC QA approval requirement replaces the version of November 2023.

List of changes:

- The approval requirement is fully textually reviewed.
- Annex added to the AR for additional requirements for materials in contact with di-methyl-ether.
- The list of reference standards has been adjusted

The product requirements have not changed.

1.2 Scope

This approval requirement specifies the requirements for elastomeric materials used in seals used in pipes and fittings, carrying gas and hydrocarbon fluids according to EN 437 with operating temperatures in general from - 5 °C up to 50 °C and in special cases from - 15 °C up to 50 °C.

Annex A describes the additional requirements for materials in contact with (renewable) di-methyl-ether.

2 Definitions

In this approval requirement, the following definitions are applicable:

Board of Experts (BoE): The Board of Experts GASTEC QA.

Maximum operating pressure (MOP): Maximum pressure that a component is capable of withstanding continuously in service under normal operating conditions.

See also the definitions mentioned in the GASTEC QA general requirements.

3 Product requirements

This chapter contains the material and product requirements that the raw materials, materials and products used shall meet.

3.1 General

The product shall comply with the requirements as specified in EN 682: “Elastomeric seals – Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids”, type GAL or GBL.

Next to these requirements, appendix A shall be followed for materials in contact with (renewable) di-methyl-ether.

4 Test pieces

This chapter is an addition to the requirements from EN 682.

4.1 Test pieces from products

If the dimensions of the rubber end products are such that it is possible to take out the test pieces from them, the tests shall be carried out on such test pieces.

Depending on the dimensions of the end products it is allowed and can be necessary to take test pieces with other (smaller) dimensions than those prescribed in the standards. A guideline for this preparation is given in annex B.

5 Marking

5.1 Marking

Supplementary to the required marking stated in EN 682, clause 10, the elastomeric seals or parcel of seals where the marking is not practicable, shall be marked clearly and durably with the GASTEC QA word mark or logo. This can be applied on the smallest packaging.

6 Quality system requirements

The requirements for the quality system are described in the GASTEC QA general requirements. An important part of this are the requirements for drawing up a risk analysis (e.g., an FMEA) of the product design and the production process in accordance with chapters 3.1.1.1 and 3.1.2.1. This risk analysis shall be available for inspection by Kiwa.

7 Summary of evaluation

This chapter contains a summary of the evaluation to be carried out during:

- The initial product assessment;
- The periodic product verification;

7.1 Evaluation matrix

Description of requirement	Clause EN 682	Investigation within the scope of		
		Initial product assessment	Product verification	
			Inspection	Frequency
Classification	3	X	X	1x/ year
Material	4.1	X	X	1x/ year
Finished seal requirements	4.2			
Dimensional tolerances	4.2.1	X	X	1x/ year
Imperfections and defects	4.2.2	X	X	1x/ year
Hardness	4.2.3	X	X	1x/ year
Tensile strength and elongation at break	4.2.4	X	X	1x/ year
Compression set in air	4.2.5	X		
Accelerated ageing in air	4.2.6	X		
Stress relaxation in compression	4.2.7	X		
Volume change in liquid B	4.2.8	X		
Volume change in oil	4.2.9	X		
Ozone resistance	4.2.10	X		
Compression set at -15 °C	4.2.11	X		
Designation	9	X	X	1x/ year
Marking	10	X	X	1x/ year
Additional marking GASTEC QA	AR 81: 4.1	X	X	1x/ year
Additional requirements for materials in contact with (r)DME	Annex A	X		

8 List of referenced documents and source

8.1 Standards/ normative documents

Number	Title	Version *
EN 682:	Elastomeric seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids	2002+ A1: 2005

*) If no date of issuance is specified in this column, the current version of the document applies.

8.2 Source of informative documents

Number	Title	Version *
EN 437	Test gases- test pressure – appliance categories	2021
General requirements GASTEC QA		

*) If no date of issuance is specified in this column, the current version of the document applies.

Annex A: Additional requirements for materials in contact with (renewable) di-methyl-ether

Scope

This annex specifies additional requirements and associated test methods for seals used in pipes and fittings carrying gas and hydrocarbon fluids that are intended to be used in contact with (renewable) di-methyl-ether (r)DME pure as well as blended with LPG.

Classification

For application in contact with (r)DME, blended or pure the letter D (for pure) or DBxx (DME-blended) for blended is added to the classification given in clause 3 of EN 682. Where xx is the maximum percentage DME allowed.

Example: The classification of a rubber material applicable over the temperature range of $-20\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ with a declared nominal hardness of 70 IRHD-M which is allowed for use with a DME content up to 20 % would be B2/H3/DB20.

Additional requirements

Using liquids

When tested in accordance with the methods detailed under test method 1 in this annex, circular test pieces having a diameter between 30 mm and 40 mm and a thickness of (2 ± 0.2) mm shall be used. The material shall comply with the requirements given in table 1.

Property	Unit	Requirement
-change in volume after immersion	%	≤ 40
-change in mass after drying ^a	%	+5 -8
^a It is recommended to determine the change in volume as well, to get a better understanding what is really happening with the material.		

Table 1: additional requirements for use in contact with (r)DME.

In case the change in volume is larger than 40 %, the test in the next paragraph can be used for further examination whether the material still can be accepted or not.

Using liquified gasses

When tested in accordance with the methods detailed under test method 2 in this annex, circular test pieces having a diameter between 30 mm and 40 mm and a thickness of (2 ± 0.2) mm shall be used. The material shall comply with the requirements given in table 2.

Property	Unit	Requirement
-change in volume after immersion	%	≤ 35
-change in mass after drying ^a	%	+5 -8
^a It is recommended to determine the change in volume as well, to get a better understanding what is really happening with the material.		

Table 2: Additional requirements for use in contact with (r)DME.

Test methods

1. Using liquids

Three test pieces shall be tested in accordance with ISO 1817, using the following conditions:

- immerse for 72⁰±2 h at (23 ± 2) °C in n-butyl-acetate and pentane having a composition as given in table 3.
- after removal from the liquid, wipe dry rapidly and weigh immediately in air and in water.
- determine the change in volume with reference to the initial volume of the specimen.
- dry the test specimens for a period of 96⁰±2 h in a normal air oven at (70 ± 2) °C.
- determine the change in mass with reference to the initial mass of the specimen.

Calculate the arithmetic mean values of the three results both after immersion and after drying.

Intended use [% (r)DME in LPG]	Test liquid [% n-butyl-acetate in pentane]
0	n.a.
≤ 20	20
≤ 40	40
≤ 60	60
≤ 80	80
≤ 100	100 (so only n-butyl-acetate)

Table 3: Composition of test liquid.

2. Using liquified gasses

Three test pieces shall be tested in accordance with ISO 1817, using the following conditions:

- immerse for 72⁰±2 h at (23 ± 2) °C in blend of (r)DME and propane under pressure, such that it is assured the test pieces are in liquid. The gas mixture should have a composition as given in table 4.
- after removal from the liquid, directly determine the change in volume using the photographic method.

Note: Photographic method required to deal with the fact changes because of evaporation of gasses.

- determine the change in volume with reference to the initial volume of the specimen.
- dry the test specimens for a period of 96– 02 h in a normal air oven at (40 ± 2) °C.
- determine the change in mass with reference to the initial mass of the specimen.

Calculate the arithmetic mean values of the three results both after immersion and after drying.

Intended use [% (r)DME in LPG]	Test liquid [% (r)DME in propane]
0	n.a.
≤ 20	20
≤ 40	40
≤ 60	60
≤ 80	80
≤ 100	100 (so only (r)DME)

Table 4: Composition of test gas.

Annex B: Test pieces from products

When preparing the test pieces, it is often impossible to meet all the dimensions prescribed in the relevant standard applicable to the test.

Therefore, it is decided for this GASTEC QA approval requirement that some deviations with respect to the dimensions are to be allowed.

Most end products are (o-)rings. Use a knife to separate the rubber part from other materials, if needed. Preparation of the test pieces shall be done using the techniques given in ISO 23529: 2016. By selecting the appropriate shape and part of the product for preparing the test pieces the following should be kept in mind:

- For hardness also small pieces may be used by taking the micro method of ISO 48.
- For tensile strength and elongation, ISO 37 gives also smaller test pieces (type 3 and 4) and ring test pieces but using type 2 is preferred. A constant cross section of the parallel section is the most important. Using thinner test pieces or missing a few parts of the clamping sections will hardly influence the results as long as the break of the test piece is within the parallel section. This combined with the possible smaller test pieces makes that almost every end product can be tested.
- Compression set is a material property which is not very sensitive to dimensions of the test pieces. Taking rectangular test pieces leads to the same results. Combined with the possibility of stacking up to three layers almost every product can be tested. In case of too thin material available the test pieces can be scaled down to a smaller thickness. In that case other spacers have to be applied to get a compression of about 25 %. More important than having a compression of exact 25 % is knowing the compressed height exactly. It is known that a compression between 20 and 30 % will lead to the same results.
- For the change in volume the thickness is more important than length or width. It is not really necessary to have complete flat test pieces. Often parts of the full products may be used without having different results.
- For stress relaxation more or less the same applies as with compression set, although, knowing the exact deformation is of no importance at all.
- For ozone resistance it is important to have none machined surfaces. Here, for small products, taking full sections of the products is often better and giving more realistic results then trying to get the test pieces as mentioned in the standard.

After preparation the test pieces the test pieces shall be conditioned at least 16 hours before testing.

