

AR 214

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Validated Dutch version

Approval requirement 214

Fitness for admixtures up to and including 100% hydrogen gas



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Foreword

This GASTEC QA approval requirement (Dutch version) has been approved by the Board of Experts product certification 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 GASTEC QA approval requirement (Dutch version) will be used by Kiwa Nederland BV in conjunction with the GASTEC QA general requirements and the KIWA regulations for certification.

This approval requirement is a translation from the Dutch validated version and can only be used as a supporting document.

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1 Introduction

1.1 General

This GASTEC QA – Hydrogen gas certification approval requirement in combination with the GASTEC QA general requirements include all relevant requirements, which are adhered by Kiwa as the basis for the issue and maintenance of a GASTEC QA – Hydrogen gas certification certificate fitness for admixtures up to and including 100% hydrogen gas. This certificate is only valid in combination with a GASTEC QA certificate for the product.

1.2 Scope

The product is intended to be used in distribution systems for gas conform the Regulations gas quality for low caloric gas to be used up to and including 16 bar* with an admixture up to and including 100% hydrogen gas.**

The maximum pressure and operation temperature are mentioned in the approval requirement for the product for GASTEC QA certification.

Remark: considering hydrogen embrittlement is obtained from 40 bar and higher, the requirement for hydrogen embrittlement is not a part of this approval requirement.

* The specific pressure is mentioned in the GASTEC QA approval requirement of the product.

** However, the Dutch law and regulations do not allow these admixtures, this approval requirement is setup for the needs of a certification scheme and anticipatory on the adjustment of the Dutch law and regulations.

2 Definitions

In this approval requirement, the following terms and definitions are applicable:

Board of Experts: The Board of Experts GASTEC QA

MOP: Maximum operating pressure

Regulation gas quality: Regulation from the Minister of Economics for determine the requirements for gas quality

Hydrogen gas: Dihydrogen or molecular hydrogen (H₂) the main singular material from the element hydrogen. At normal pressure and temperature hydrogen gas is colourless, odourless, tasteless and highly flammable.

Sealing material: Materials used for sealing threads according to approval requirement 31-1, 31-2 and 31-3

Other definitions are described in product approval requirements of the GASTEC QA certificate.

3 Product requirements

3.1 General

Products approved by this approval requirement shall fulfil the requirements GASTEC QA approval requirements belonging to the product. The approval requirement is mentioned on the certificate of the product.

3.2 Materials

The materials in table 1 are proven to be suitable to hydrogen gas. For the materials which are not investigated or are not mentioned in table 1 shall be proven to be suitable for hydrogen gas to fulfil the requirements of this approval requirement.

Material	Suitable
PE80	X
PE100	X
PCV-A	X
PVC-CPE	X
NBR	X
POM	X
Nodular cast iron	X
Copper / copper alloys	X
Carbon steel (St 37/235, ASTM A106 gr B, API 5L gr B)	X
Stainless steel (AISI 316 sorts)	X
Aluminium alloys	X
Methacrylate Ester adhesive	X

Table 1: Fitness of materials

4 Performance requirements and test methods

4.1 General

The products shall be approved on the aspects of table 2.

Products:			Long-term behaviour	Functionality
	Leak tightness internal	Leak tightness external		
Valves	X	X	X	
Regulators	X	X	X	X
Maximum flow rate safety valves	X	X	X	X
Gasstopper	X		X	X

Table 2: Performance requirements

4.1.1 Test samples

The performance requirements shall be tested on 3 test samples.

4.1.2 Determination of leak tightness

The leak tightness shall be determined with air. The uncertainty of the equipment shall not exceed 5 cm³/h in air.

4.1.3 Long-term behaviour

The long-term behaviour shall be tested with hydrogen gas. Any leak tightness requirements, before or after testing, shall be determined with air.

4.1.4 Functionality

The functionality shall be tested with 3 admixtures of hydrogen gas. First with 10% hydrogen gas in natural gas, second with 70% hydrogen gas with natural gas and finally with 100% hydrogen gas. Any leak tightness requirements, before or after testing, shall be determined with air.

4.2 Leak tightness internal

4.2.1 Valves

The valves shall be tested in closed position. The test equipment for leak tightness is connected to one side of the valve.

Valve	Requirement	Test medium	Test time	Test temperature	Test pressure
AR 69 (-1)	≤50 DN: 6,6 cm ³ /h 50<DN≤100: 13,3 cm ³ /h	Air	10 minutes low pressure followed by 10 minutes high pressure	23 ± 2 °C	6 mbar followed by 1,5 x MOP

Table 3: Requirements for leak tightness internal for valves

4.2.2 Regulators

The regulator and combination regulator for domestic use shall be tested with a closed control valve. The inlet and outlet are connected to a leak tightness test equipment with independent configuration of the test pressure.

The internal leak tightness of a regulator or combination regulator for domestic use shall be measured at 300 mbar on the inlet and 37,5 mbar on the outlet. The internal leak tightness shall be determined according to NEN 7239:2018.

The leak between inlet and outlet shall be less or equal to 6,6 cm³/h.

4.2.3 Maximum flow rate safety valves

The leakage at fully closure of the valve shall be 1,0 l/h maximum. This leakage shall be determined according to approval requirements 191, clause 4.4

4.2.4 Gasstopper

The internal leak at a test pressure of 1x MOP at a fully close gasstopper shall be 1 l/h maximum without bypass and a third of the value, declared by the manufacturer for natural gas, for gasstopper with a bypass. The internal leakage shall be determined according to approval requirements 210, clause 5.6.

4.3 Leak tightness external

4.3.1 Valves

Both sides of the valve shall be connected to a pipe, according to the installation instructions of the manufacturer. The pipes shall be connected to equipment for measuring the leak tightness. The valve is tested in open position.

Valve	Requirement	Test medium	Test time	Test temperature	Test pressure
AR 69 (-1)	≤50 DN: 6,6 cm ³ /h 50<DN≤100: 13,3 cm ³ /h	Air	10 minutes low pressure followed by 10 minutes high pressure	23 ± 2 °C	6 mbar followed by 1,5 x MOP

Table 4: Requirements for leak tightness externally for valves

4.3.2 Regulators

The regulator, low-pressure cut-off valves and combination regulator shall be connected to equipment for measuring the leak tightness on both inlet and outlet connection

The external leak tightness shall be measured with a pressure of 300 mbar on both inlet and outlet connection. The external leak tightness shall be determined according to NEN 7239:2018.

The external leak shall be less or equal to 6,6 cm³_n/h.

4.3.3 Maximum flow rate safety valves

The body, in which a maximum flow rate safety valve is mounted, shall have an external leakage of 17cm³/h maximum at test pressures of 25 and 100 mbar. The external leakage shall be determined according to approval requirements 191, clause 4.2.

4.4 Long-term behaviour

4.4.1 Valves

The valves used in 4.2.1 can be used for this test. After the number of opening and closing, according to the GASTEC QA approval requirement of the valve the valve shall be leak tight according to table 5.

Valve	Requirement	Test medium	Test time	Test temperature	Test pressure
AR 69 (-1)	≤50 DN: 6,6 cm ³ /h 50<DN≤100: 13,3 cm ³ /h	Air	10 minutes low pressure followed by 10 minutes high pressure	23 ± 2 °C and 60 ± 5 °C	6 mbar followed by 1,5 x MOP

Table 5: Requirements for internal leak tightness after long-term behaviour

4.4.2 Regulator and combination regulator for domestic use.

The regulator and combination regulator for domestic use shall fulfil the requirements of clause 4.2.2 and 4.3.2 after 40.000 times opening and closing the control valve at a temperature of $-20 \pm 1^\circ \text{C}$ followed by 40.000 times opening and closing the control valve at a temperature of $50 \pm 1^\circ \text{C}$.

The test is executed according to the technical durability test in NEN 7239:2018 with hydrogen gas

4.4.3 Low-pressure cut-off valve.

The low-pressure cut-off valve shall fulfil the requirements of clause 4.3.2 after 5.000 times opening and closing the cut-off element at a temperature of $-20 \pm 1^\circ \text{C}$ followed by 5.000 times opening and closing the cut-off element at a temperature of $50 \pm 1^\circ \text{C}$. During the test the inlet connection is closed by e.g. a plug and the outlet connection is connected to varying pressure of 0 mbar up to and including 25 mbar.

The test is executed according to the technical durability test in NEN 7239:2018 with hydrogen gas.

4.4.4 Maximum flow rate safety valves

After repeated (10 times) closing and opening, according to approval requirements 191, clause 4.5, the valve shall meet the requirements of clause 4.2.3 and 4.3.3.

4.4.5 Gasstopper

After repeated (100 times) opening and closing the gasstopper shall meet the requirements of 4.2.4.

4.5 Functionality

4.5.1 *Regulators and combination regulators for domestic use.*

The regulator and combination regulator for domestic use shall fulfil the requirements according to NEN 7239:2018 clause 6.4 and 6.6. The test shall be performed according to NEN 7239:2018 clause 8.4 and 8.6 with 3 admixtures of hydrogen gas according to clause 4.1.4.

4.5.2 *Low-pressure cut-off valve.*

The low-pressure cut-off valve shall fulfil the requirements according to NEN 7239:2018 clause 6.5 and 6.6. The test shall be performed according to NEN 7239:2018 clause 8.5 and 8.6 with 3 admixtures of hydrogen gas according to clause 4.1.4.

4.5.3 *Maximum flow rate safety valves*

The flow rate for closing the valve shall be at least 10% and at highest 30% more than the nominal flow rate, as declared by the manufacturer. The test shall be performed with 3 admixtures of hydrogen gas according to clause 4.1.4 and the test method according to approval requirements 191, clause 4.3.

4.5.4 *Gasstopper*

If a gasstopper is used in a piping system with MOP 200 mbar, the gasstopper shall not close at a suddenly increase of the flow rate from nominal to 115% of the nominal flow rate. The test shall be performed with 3 admixtures of hydrogen gas according to clause 4.1.4 and the test method according to approval requirements 210, clause 5.6.

5 Marking and instruction

5.1 Marking

The marking shall be according to the requirements of the GASTEC QA approval requirement of the product

In addition, the product or packaging shall be marked with:

- The words 'Bestand tegen waterstofgas' and 'Hydrogen ready'.
- For pressure regulators the outlet pressure at rising and decreasing input for the different mixtures.

5.2 Instruction

The instruction document shall be according to the requirements of the GASTEC QA approval requirements of the product. In addition, the instruction document shall mention the product is suitable to use in gas distribution systems for hydrogen gas.

Remark: for adjusting the marking and instruction documents of existing products, it's allowed to fulfil the requirements by using a sticker on the product and documents during the time needed for adjusting the marking and documentation.

6 Summary of tests

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

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

6.1 Test matrix

Description requirement	Clause	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	frequency
Product requirements	3			
General	3.1	X		
Material	3.1	X	X	Once a year
Performance requirements	4			
Leak tightness internal valves	4.2.1	X	X	Once a year
Leak tightness internal regulators	4.2.2	X	X	Once a year
Leak tightness internal maximum flow rate safety valves	4.2.3	X	X	Once a year
Leak tightness internal gasstopper	4.2.4	X	X	Once a year
Leak tightness external valves	4.3.1	X	X	Once a year
Leak tightness external regulators	4.3.2	X	X	Once a year
Leak tightness external maximum flow rate safety valves	4.3.3	X	X	Once a year
Long-term behaviour valves	4.4.1	X	X	Once a year
Long-term behaviour regulators	4.4.2	X	X	Once a year
Long-term behaviour low-pressure cut off valves	4.4.3	X	X	Once a year
Long-term behaviour maximum flow rate safety valves	4.4.4	X	X	Once a year
Long-term behaviour gasstopper	4.4.5	X	X	Once a year
Functionality regulator	4.5.1	X	X	Once a year
Functionality low-pressure cut off valves	4.5.2	X	X	Once a year
Functionality maximum flow rate safety valves	4.5.3	X	X	Once a year
Functionality gasstopper	4.5.4	X	X	Once a year
Marking and instructions				
Marking	5.1	X	X	Once a year
Instruction	5.2	X	X	Once a year

7 List of referenced documents and source

7.1 Standards / normative documents

All normative references in this GASTEC QA – Hydrogen gas certification approval requirement refer to editions of standards as mentioned in the list below.

NEN 7239:2018	Huisdrukregelaars, gasgebrekbeveiligingen en combinatie-regelaars voor aansluitingen met een capaciteit van maximaal 10 m ³ en een inlaatdruk (MOP _u) tot en met 200 mbar
EN 331:2015	Met de hand bediende kogelkranen en bodemplugkranen voor gasinstallaties in gebouwen

7.2 Source

Parts of the text of this approval requirement have been based on approval requirement 69-1, NEN 7239 and Kiwa report 'Toekomstbestendige gasdistributie netwerken'.