AR 137
February 2019

Approval requirement 137

POM gate valves installed in underground PE pipelines

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Foreword

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

Approved by Board of Experts : February 10, 2019

Accepted by Kiwa Nederland B.V. : February 10, 2019

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1 Introduction

1.1 General

This GASTEC QA 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 certificate POM gate valves installed in underground PE pipelines

This GASTEC QA Approval requirements replace the GASTEC QA Approval Requirements 137 “POM gate valves installed in underground PE pipelines” dated January 2012.

List of changes:

- Update to the new format for GASTEC QA approval requirements
- These approval requirements have been fully reviewed textually.
- All general requirements have been deleted and included in the GASTEC QA general requirements document
- Change of paragraphs

The product requirements have not changed.

1.2 Scope

These Approval Requirements specify the requirements for the polyoxymethylene (POM) gate valves installed in underground PE pipelines applied for the transport of gaseous fuels in accordance with the 2nd and 3rd family as per NEN-EN 437.

These Approval Requirements are applicable to POM gate valves, with mechanical couplings and an outer diameter of ≤ 63 mm. The maximum permissible operating pressure is 4 bar.

The functional installation recommendations for polyethylene piping systems are laid down in the NEN 7244 and NEN-EN 12007 series and national and international norms and regulations.

2 Definitions

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

Board of Experts: The GASTEC QA Board of Experts

3 Product requirements

3.1 Requirements concerncing the construction

3.1.1 Influence of soil

The manufacturer shall declare that the valve is constructed in such a way that the action is not detrimentally influenced under any soil conditions (e.g. very wet or very dry soil).

3.1.2 Operating temperatures

The manufacturer shall declare that the valve is constructed in such a way that a good action is guaranteed at surrounding temperatures between -15 °C and + 40 °C.

3.1.3 Closure elements

The closure elements shall be connected to the spindle in such a way that it cannot come loose

3.1.4 Spindle

The valve shall close by turning the spindle to the right. A “rising” spindle is not acceptable

3.1.5 Safety mechanism

The valve shall have a safety mechanism fitted directly onto the spindle head, which protects the spindle against an unacceptable operating torque. The safety mechanism shall be securely fastened on the spindle head and shall be easy to replace.

3.1.6 High torque

The valve shall be constructed to prevent external leakage if the valve is operated with too high a torque.

3.1.7 Mechanical couplings

The mechanical couplings of the valve shall comply with GASTEC QA Approval Requirement 70.

3.2 Surface quality and apperance

Internally and externally the valves shall be smooth and well made. The surface may not show grooves, pits, blisters or other irregularities. The surface may not show an indication of difference in temperature during the production process.

3.3 Requirements concering the material

3.3.1 Plastic materials

The POM materials shall meet the requirements of ISO 17885 clause 5.1, 8.1 and 8.2.

3.3.2 Material properties

The POM material shall meet the following requirements:

- Tensile strength: 70 Mpa
- Elongation at break: 70%
- E-modulus: 2800 MPa
- Density: 1400-1420 kg/m^3
- Melt Flow Rate: 0-4 g/10 min

These properties shall be determined according to paragraph 5.7.1 and 5.7.2.

3.3.3 Parts in contact with gas

The closing element and other parts that can come into contact with gas shall be made of a material that is resistant to gas condensate, tested according to ISO 17885 Annex E.

3.3.4 Metal parts

The metal parts of the valves shall have at least the same corrosion resistance as steel that is alloyed with 13% chromium.

The following materials are considered similar: the copper alloys CuZn 40 Pb3 and CuZn 40 Ni.

3.3.5 Elastomeric materials

Elastomeric sealing components shall conform to the requirements of NEN-EN 682, type GAL or GBL.

3.4 Measurements and permissible deviations

The dimensions of the valves and the permissible deviations shall be in agreement with the values stated by the manufacturer and shall be recorded on a drawing.

4 Performance requirements

4.1 Strength of the operating mechanism

The operating mechanism shall be able to resist a torque as stated in table 1 for 1 minute at -20 °C ± 2 °C and 40 °C ± 2 °C without permanent deformation or leakage occurring, or until the safety activates. If the valve is forced, there may be no leakage and the safety mechanism shall be activated.

Connection size d_e	Torque Nm
25	150
32	150
40	250
50	250
63	250

Table 1: Strength operating mechanism

4.2 Tightness of the valve

4.2.1 Gas Tightness

4.2.1.1 Internal gas tightness

The valve shall be able to resist an internal air pressure of both 25 ± 5 mbar and 6 ± 0.6 bar for 15 minutes, at temperatures of both 23 °C ± 2 °C and 0 °C ± 0.5 °C and a closing torque as in table 2, without internal leakage occurring.

Connection size d_e	Torque Nm
25	30
32	30
40	50
50	50
63	50

Table 2: Closing torque

4.2.1.2 External gas tightness

The valve shall be able to resist an internal air pressure of both 25 ± 5 mbar and 6 ± 0.6 mbar for 15 minutes, with the closure element in any random position and at temperature of both 23 °C ± 2 °C and 0 °C ± 3 °C, without external leakage occurring.

4.2.2 Tightness with external water pressure

The valve shall be able to resist an external water pressure of 10 ± 1 kPa for 2 hours and subsequently an external water pressure of 80 ± 8 kPa for 2 hours, at a temperature of 23 °C ± 2 °C, without external leakage occurring.

4.2.3 Tightness with bending moment on the spindle

The valve shall comply with paragraph 4.2.1 with a bending moment of 55 ± 5 Nm applied to the operating mechanism. The test shall be performed as described in paragraph 5.3.3.

4.3 Durability

The valve shall comply with the requirements of paragraph 4.2 after opening and closing 50 times at a temperature of 23 °C ± 2 °C, with a torque as stated in table 2.

4.4 Resistance of the valves and the connections to internal water pressure

Valves and the connections with the PE pipes shall have a resistance to the internal water pressure stated in table 3, at temperatures of both 20 °C and 60 °C, without a fracture or leak occurring.

Temperature	Time	Hoop stress [MPa]	Internal water pressure [MPa]		
°C	h		SDR 17.6	SDR 17	SDR 11
20 ± 0.5	100	12	1.40	1.50	2.40
60 ± 0.5	1000	5.6	0.68	0.70	1.12

Table 3: Resistance to increased pressure at 20 °C and 60 °C

4.5 Influence of temperature changes on the valves

Valves may show no dimension change in length or diameter of more than 3%, after exposure to a temperature of 160 °C ± 4 °C for 60 minutes in air or glycerin and subsequent cooling down to 23 °C ± 2 °C.

The angular change may not be more than 5°.

5 Test methods

5.1 General

The test pieces to be used for the various tests shall be at least 16 hours old. The tests shall be performed in triplicate, in which a representative choice shall be made from various sizes of the measurement series of the valves.

The tests shall be performed with one approved type of PE pipe as in the GASTEC QA Approval Requirements 8 for polythene (PE) pipes for gas pipelines.

The measurements of the valves shall be checked at a temperature of 23 °C ± 2 °C with suitable tools.

Visually check the finish and appearance of the valves.

5.2 Determination of the strenght of the operating mechanism

Measure the prescribed torques with an accuracy of at least 6%.

Apply a closing torque as in table 1 to the operating mechanism at both -20 °C ± 2 °C and +40 °C ± 2 °C for 1 minute. Observe a conditioning time of at least 2 hours.

Check if there has been a leak[1] by applying a pressure to the test piece of 25 ± 5 mbar, both during and after the test. Then force the valve until the safety mechanism is activated. No leak[1] may occur during this process. Change the safety mechanism after the test.

5.3 Tightness of the valve

5.3.1 Determination of the gas tightness

Perform the test on the valves that have already been subjected to the test as in article 5.2. Measure the prescribed torques with an accuracy of at least 10%.

Determine the gas tightness[1] of the valve by means of one of the following test series:

- Close the closed valve with a closing torque as in table 2.
- Set the pressure (on one side) at 25 ± 5 mbar and maintain this for 15 minutes.
- Check the valve for internal leak-tightness
- Then half open the valve.
- Set the pressure at 25 ± 5 mbar and maintain this for 15 minutes.
- Check the valve for external leak-tightness.
- Increase the pressure to 6 ± 0.6 bar and maintain this for 15 minutes.
- Check the valve for external leak-tightness.
- Then close the valve with a torque as in table 2
- Set the pressure at 6 ± 0.6 bar and maintain this for 15 minutes.
- Check the valve for internal leak tightness.
- Condition the valve for 2 hours at 0 ± 3 °C.
- Repeat the series of tests at 0 ± 3 °C on the same valve and determine the gas tightness.

[1] A leak of ≤ 50 cm^3/h is considered to be gas tight. The determination shall be performed with equipment with an accuracy of at least 5 cm^3/h

5.3.2 Determination of the tightness with external water pressure

Subject the valve to an external water pressure of 10 ± 1 kPa for 2 hours at a temperature of 23 °C ± 2 °C.

Subject the same valve to an external water pressure of 80 ± 8 kPa for 2 hours at a temperature of 23 °C ± 2 °C.

Determine if water has leaked in.

5.3.3 Determination of the tightness with a bending moment on the spindle

Apply a bending moment to the spindle during the test as in 5.3.1 of 55 ± 5 Nm sequentially in an axial direction and in a tangential direction of the valve.

Maintain the bending moment for at least 10 seconds. Check the valve for gas tightness according to 5.3.1.

Note: This test may be combined with the test of paragraph 5.3.1.

5.4 Determination of the durability of the valve

Perform the test on valves that have already been subjected to the test as in paragraph 5.2 and 5.3.1 under the following conditions:

- Closing torque: as in table 2.
- Temperature: 23°C ± 2°C.
- Opening and closing rate: 5 ± 1 turns/min.
- Number of times open and close: 50.

Then perform the test as in paragraph 5.3.1.

5.5 Determination of resistance of the valves and connections against internal water pressure at increased temperature

5.5.1 Test pieces

The test pieces (total = 3) shall be composed of valve connected to PE pipes where the free length on both sides of the valve shall be 250 ± 10 mm. Put the valve in a half open position.

5.5.2 Testing equipment

Testing equipment as per NEN-EN-ISO 1167 is required for the test. The test pieces can be connected simultaneously and subjected to the required water pressure.

5.5.3 Testing

Fix the test pieces in the testing equipment.

Subject the test pieces to the pressure and temperature stated in table 3. During the test the test pieces shall be fully submerged in water at the prescribed temperature. Keep the water temperature constant during the test within ± 0.5 °C. Keep the pressure constant during the test within ± 2%.

Check if there has been a leak or fracture during the set test time.

Check the exterior for cracks.

5.6 Influence of temperature changes on the valve

Determine the length and diameter of the valve intended for this test with an accuracy of 0.1 mm.

Place the test piece in an oven or a bath of glycerine at a temperature of 160 ± 4 °C for 60 minutes in such a way that the position of the test piece has as little hindrance on the lengthwise change as possible.

Re-determine the measurements of the test piece after cooling down to 23 °C ± 2 °C.

5.7 Determination of material properties POM

5.7.1 Density and Melt flow rate (MFR)

The density and MFR shall be determined as indicated in ISO 10838-3 annex A, table A.2.

5.7.2 Tensile strenght, stretch on fracture and E-modulus

Make a test plate as in NEN-EN-ISO 295 and make test pieces from this.

Make 5 test pieces Type B according to NEN-EN-ISO 527.

Perform the test as in ISO/DIS 527 under the following conditions:

- Test temperature: 23°C ± 2°C.
- Test velocity: 5 mm/min ± 20%.

Finally calculate the E-modulus as in NEN-EN-ISO 527 using the results obtained.

6 Marking and instructions

6.1 Marking

The following information shall be marked clearly and durably on the valves:

- The manufacturing mark.
- The material grade or trade name.
- The nominal connection measurements and the SDR indication for the PE pipes to be connected.
- The production period, in a code if needs be, which is accessible to the purchaser.
- Maximum Operating Pressure (MOP) in bar (e.g. MOP 4 bar)
- The GASTEC QA word mark, logo or punch mark

The marks to be applied shall not have a detrimental influence on the properties of the valves.

6.2 Instructions

The documentation shall contain at least:

- Clear processing instructions in Dutch.
- The pressure loss of the valve shall be presented in the following way:
  - graphically: log Δ p versus log Q, where Δ p is given in mbar and log Q in m_s^3/h (gas);
  - numerically: pressure loss at one or two different flow rates, in consultation with the inspecting body.

7 Quality system requirements

The supplier shall make a risk assessment of the product and production process according to chapter 3.1.1.1 and 3.1.2.1 of the GASTEC QA general requirements. The risk assessments shall be available to Kiwa for review.

8 Summary of tests

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

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

8.1 Test matrix

Description of requirement	Clause	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	Frequency
Construction				
Requirements on construction	3.1	X		
Surface quality and appearance	3.2	X	X	
Materials				
Plastic materials	3.3.1	X		
Material properties	3.3.2	X	X	Each year
Closing element and other parts in contact with gas	3.3.3	X		
Metal parts	3.3.4	X	X	Each year
Elastomeric materials	3.3.5	X	X	Each year
Functional Requirements				
Strength of the operating mechanism	4.1	X	X	Each year
Gas tightness of the valve	4.2.1			
Internal gas tightness	4.2.1.1	X	X	Each year
External gas tightness	4.2.1.2	X	X	Each year
Tightness with external water pressure	4.2.2	X		
Tightness with bending moment on the spindle	4.2.3	X		
Durability	4.3	X		
Resistance of the valves and the connections to internal water pressure	4.4	X	X	Each year
Influence of temperature changes on the valves	4.5	X		
Marking and documentation				
Marking	6.1	X	X	Each year
Instruction	6.2	X	X	Each year

9 List of referenced documents and source

9.1 Standards / normative documents

All normative references in this Approval Requirement refer to the editions of the standards as mentioned in the list below.

ISO 295:2004	Plastics - Compression moulding of test specimens of thermosetting materials
ISO 527-1:1996	Plastics - Determination of tensile properties
ISO 17885:2015	Plastic piping systems – Mechanical fittings for pressure piping systems – Specifications
EN 682:2002 + A1: 2005	Afdichtingen van elastomeer – Materiaaleisen voor afdichtingen van verbindingen in buizen en hulpstukken voor gas en vloeibare koolwaterstoffen
NEN 1078:2004 nl	Voorziening voor gas met een werkdruk tot en met 500 mbar - Prestatie-eisen – Nieuwbouw
ISO 1167:2006	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure
ISO 1183:2004	Plastics - Methods for determining the density of non-cellular plastics
ISO 1872:1999	Plastics - Polythylene (PE) moulding and extrusion materials
NEN 7244	Gasvoorzieningsystemen - Leidingen voor maximale bedrijfsdruk tot en met 16 bar
EN 10204: 2004	Producten van metaal - Soorten keuringsdocumenten
EN 12007-1	Gas supply systems - Pipelines for maximum operating pressure up to and including 16 bar