English translation

AR 171
May 2019
validated Dutch version

Approval requirement 171

Thermally-responsive safety valves

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Foreword

This GASTEC QA (Dutch version) 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 (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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Contents

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 for thermally-responsive safety valves.

This GASTEC QA approval requirements replace the GASTEC QA approval requirements 171 “Thermisch aanspreekbare veiligheidskleppen” of March 1996 and amendment A1 from March 2012.

List of changes:

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

The product requirements have not changed.

1.2 Scope

The requirements in this approval requirement apply to thermally-responsive safety valves with a nominal addressing temperature of 70 °C or 105°C and a nominal passage of 10, 15, 20 and 25 mm. The maximum operating pressure is 4 bar.

2 Definitions

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

Board of Experts: The Board of Experts GASTEC QA

3 Product requirements

3.1 Compostion and use

The composition, dimensions and tolerances of the thermally-responsive safety valves shall match with the provided construction drawings.

3.2 Materials

The materials shall be able to withstand the during use occurring mechanical, chemical and thermal influences. The materials shall be selected in such a way that they will not influence each other negatively.

The body of the thermally -responsive safety valve shall be carried out in steel according to werkstof Nr. 1.4305, DIN 17440 or free cutting steel 9 S Mn 28 k. The closing element of the safety valve shall be carried out in steel according to werkstof Nr. 1.4310, DIN 17441. The spring and locking device shall be carried out in steel according to werkstof Nr. 1.4310, DIN 17224.

The melting element shall consist of an alloy to be specified by the manufacturer. The reproducibility of the melting rag shall be within ± 5 K.

3.3 Construction

The construction of the thermally-responsive safety valve shall be designed such that a safe and effective operation is being guaranteed without the need for maintenance. Threads at the connection sides shall comply with EN 10226-1.

Holes for bolts, centring pins or other openings shall not enter the gas carrying spaces of the body. The thermally-responsive safety valve shall be internally and externally clean, free of blisters and show no defects. External sharp edges and sides shall be avoided.

The spanner flats for mounting shall confirm to ISO 272 with a minimal height according to table 1:

Spanner flat S More than	Up to and including	Minimal height spanner flat in mm
-	22	4
22	27	5
27	32	6
32	41	7

Table 1: height spanner flats

The mounting height of the springs shall be such that the windings do not come together. Springs for closing force shall be, according to DIN 2089 part 1 and part 2 on durability at static loads, calculated and executed.

The closing force of the springs shall be in prestressed position and in the closing position greater than the in diagram DVGW-VP 301 indicated closing force. The diagram and the corresponding measurements shall be provided by the manufacturer.

The closing mechanism of the thermally-responsive safety valve shall not be lockable by means of a specially built- in mechanism.

Once the closing device has been activated, it shall no longer be possible to open it for reuse.

4 Performance requirements and test methods

4.1 General

The test shall be, unless otherwise specified, carried out with air in a temperature of 23 ± 5 °C. The measured values shall be reduced to 15 °C and 1013 mbar. Pressures shall be measured using a precision manometer according to NEN 927, class 1.

4.2 External gas tightness

The thermally-responsive safety valve shall, under test circumstances, be external gas tight at pressures of 6 mbar up to and including 6 bar. Mount the safety valve with the inlet and outlet side to a leakage measurement system with an inaccuracy of smaller than 5 $cm^3{}_s/h$. Measure the external gas tightness with the closing element in opening position at a pressure of 6 mbar, respectively 6 bar. The safety valve is considered gas tight with a leakage rate which is not greater than 20 $cm^3{}_s/h$.

4.3 Nominal load

The thermally-responsive safety valve shall, at a determined flow rate of air at a pressure of 25 mbar and a set pressure difference of 1 mbar, reduced to standard conditions, meet the in table 2 mentioned values. The nominal load shall be measured with an inaccuracy of smaller than 2%.

DN	Minimal flow in $m^3{}_s/h$
10	3
15	4
20	10
25	16

Table 2: minimal flow of rate of the air flowing through.

4.3.1 Test method

Mount the safety valve (6) to a measurement set up according to figure 1.

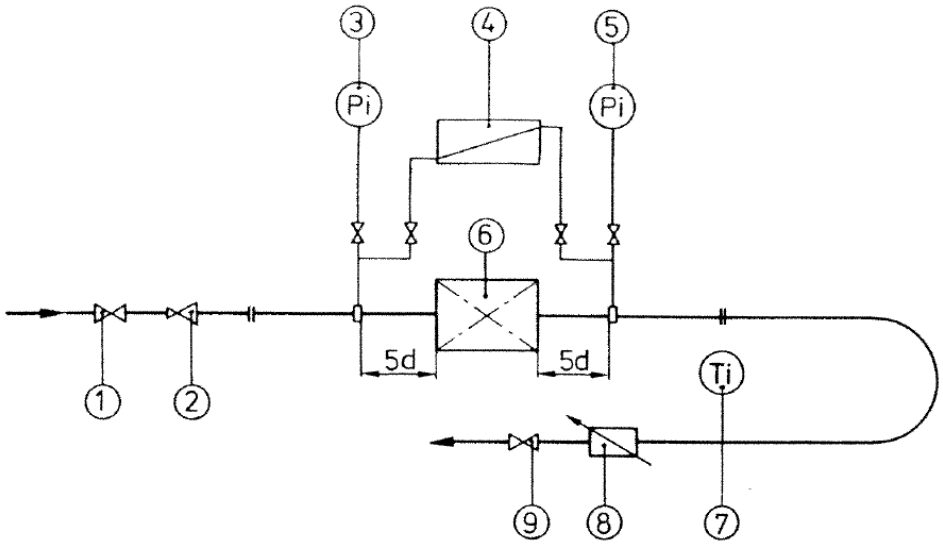


Figure 1: test set up – flow

1) Valve
2) Pressure regulator inlet pressure
3) Manometer inlet pressure
4) Pressure difference meter
5) Manometer outlet pressure
6) To be tested valve connected to measurement pipes: D, see table 3
7) Temperature meter
8) Flow meter
9) Control valve

Nominal bore DN	Inside diameter of the measurement pipe (D) in mm
10	13
15	16
20	22
25	28

Table 3: D

Set an outlet pressure of 25 mbar using the pressure regulator (2). Set the valve (9) so that the differential pressure gauge (4) indicates a pressure difference of 1 mbar. Reduce the air flow rate indicated by the volume flow meter (8) to standard conditions according to:

$$V_{st} = V * \frac{(P_\alpha + P)}{1013} * \frac{288}{273 + T}$$

In which:

V_{st} is the air flow under standard conditions in m^3 /h
V is the air flow during measurement in m^3 /h
P_α is the atmospheric pressure (absolute pressure) in mbar
P is the test pressure (over pressure) in mbar
T is the air temperature in °C

4.4 Resistance against torsion and bending

The thermally-responsive safety valve shall, during and after a torsional and bending load according to table 4, show no permanent deformation and or damage and shall be externally gas tight at 6 bar.

The safety valve shall not close during the test. Mt1 and Mb1 represent the during installation of the safety valve occurring torsion and bending forces. Mt2 and Mb2 are the in practice occurring torsion and bending forces on the safety valve. The table below shows this:

DN	Mt_1	Mt_2 in Nm	Mb_1	Mb_2
10	35	28	70	35
15	75	40	105	53
20	100	68	225	113
25	125	100	340	170

Table 4: Torsion and bending forces

4.4.1 Torsion test

Provide a safety valve at the in- and outlet side with connection pieces (pipe parts of steel, quality medium heavy according to NEN 3257, provided with not used thread as follows:

1) Screw pipe 1, provided with a non-hardening sealing gasket, in the inlet side (see figure 2 below)
2) Clamp the connection piece to the inlet side at a distance of > 2 DN
3) Screw pipe 2 similar to point 1 in the outlet side
4) Support pipe 2 on such a way that no bending forces are possible on the valve
5) Screw pipes 1 and 2
6) Apply a test pressure of 6 bar
7) Measure the external gas tightness during 600 seconds
8) Remove the test pressure
9) Apply during 10 seconds the prescribed torque Mt1 to pipe 2. The force should be applied evenly and at a constant speed. The speed at which the last 10% of the force is applied shall be chosen such that the torque applicable to the valve in question is not exceeded
10) Apply a test pressure of 6 bar
11) Measure the external gas tightness during 600 seconds
12) Apply during 900 seconds the prescribed torsion force Mt2 to pipe 2
13) Then measure, while maintaining the torsion force, the external gas tightness during 600 seconds
14) Remove the torsion force and test pressure

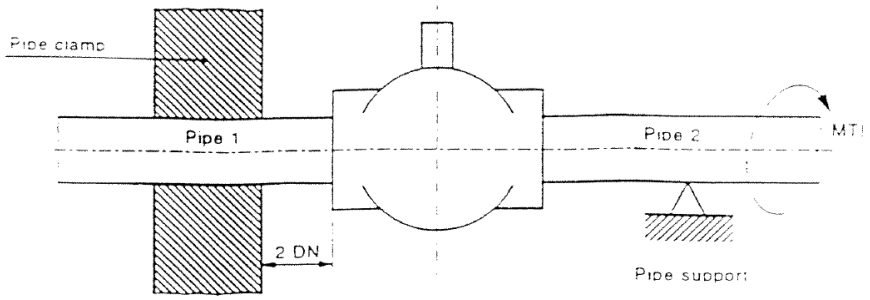
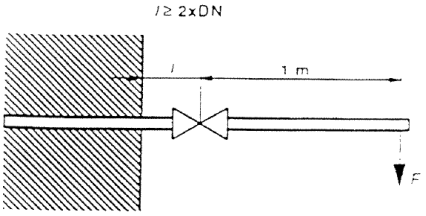


Figure 2: Schematical representation test – torsion and bending



4.4.2 Bending test

The bending test is executed on the same sample as used with the torsion test.

1) Apply during 10 seconds on pipe 2 the prescribed bending force matching with Mb1. The force shall engage on 1 m from the hard of the valve.
2) Apply a test pressure of 6 bar
3) Measure the external gas tightness during 600 seconds
4) Apply during 900 seconds the prescribed bending moment Mb2 to pipe 2
5) Then measure, while maintaining the bending force, the external gas tightness during 600 seconds.
6) Remove the bending force and sample

4.5 Closing time and internal gas tigthness

The closing time of the thermally-responsive safety valve shall be determined at a test temperature according to table 5. The valve shall close entirely within 40 seconds after placement in an oven. The test pressure during the closing test is 4 bar. The test pressure shall be applied to the inlet side of the safety valve. After closing, during 45 minutes at test temperature and then at room temperature, the internal gas tightness shall be determined.

The safety valve is considered gas tight if the measured leakage during the complete test period is smaller than 30 l/h. The measured values shall be reduced to 15 °C and 1013 mbar.

Nominal response temperature	Test temperature
70 °C	650 °C
105 °C	925 °C

Table 5: test conditions closing time

4.6 Response temperature

The reproducibility of the response temperature must be within ± 5 K. The thermally-responsive safety valve shall be, within 1 hour, subjected to a test temperature according to table 6. The test temperature shall be increased with maximally 2K/min until the safety valve responds.

The measured temperature at which the valve responds shall be within the ± 5 K of the nominal response temperature.

Nominal response temperature	Test temperature
70 °C	60 °C
105 °C	90 °C

Table 6: test conditions response temperature

5 Marking and instructions

5.1 Marking

On thermally-responsive safety valves the following shall be clearly and durably marked:

- GASTEC QA or the GASTEC QA logo
- Name or trademark of the manufacturer
- Nominal bore DN
- Response temperature
- Maximum operating pressure
- Direction of flow with the aid of an arrow

5.2 Instructions

The manufacture shall provide clear assembly instructions in the Dutch language for installing the thermally-responsive safety valves.

6 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.

7 Summary of tests

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

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

7.1 Test matrix

Description of requirement	Clause	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	Frequency
Composition and use	3.1	X	X	Each year
Materials	3.2	X	X	Each year
Construction	3.3.	X	X	Each year
External gas tightness	4.2	X	X	Each year
Nominal load	4.3	X		
Resistance against torsion and bending	4.4	X		
Closing time and internal gas tightness	4.5	X		
Response temperature	4.6	X	X	Each year
Marking and instructions	5	X	X	Each year

8 List of referenced documents and source

8.1 Standards / normative documents

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

EN 437:2018	Test gases- test pressure – appliance categories