

**AR 91**

February 2019 Dutch  
version

# Approval requirement 91

Metal fittings for the connection of metal pipes



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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 of 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 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 metal fittings for the connection of metal pipes

This GASTEC QA Approval requirements replace the GASTEC QA Approval Requirements 91 “Metalen koppelingen voor het verbinden van metalen en kunststoffen buizen voor gas” dated October 1996 and Amendment A1 dated March 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
- References to standards are updated
- Change of paragraphs
- Paragraph 1.2 scope is adapted. Galvanized steel precision pipe, ductile cast and grey ductile cast iron pipes are removed from the scope.
- The use on plastic pipes is removed, this scope is added to Approval requirement 70

The product requirements have not changed

## 1.2 Scope

These GASTEC QA approval requirements describe the requirements with regard to fittings for gas pipes with a maximum connection size of DN 400 mm, which are applied for connecting pipes with a maximum operating pressure of 8 bar at -20 to +60 °C.

Used pipes can be:

- Steel pipes according to AR 15
- Copper pipes according to AR 5
- Steel pipes with external PE layer according to AR 50

## 2 Definitions

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

**Board of Experts:** The GASTEC QA Board of Experts

**Coupling:** Construction element that contains one or more elements for the connection of pipes and which also ensures the sealing.

**Full end-load resistant coupling:** A coupling according to the definition of coupling which is able to absorb a force in the axial direction

**DN, nominal diameter:** numerical value for the connection dimensions for all components in a piping system.

**Insertion depth:** The insertion length that lies between the back of the seal ring and the end-stop for the pipe. In the case of couplings without an end-stop, this is half the distance between the sealing rings

**Flat spring / spring element:** A construction element that achieves the clamping strength by means of a spring force.

**Natural gas:** 2<sup>nd</sup> family gas in accordance with EN 437

**Nominal pressure:** Numerical value for pressure that is a convenient rounded number for reference purpose

**Pressure:** Static overpressure with respect to atmospheric pressure

**Pressure class:** Nominal pressure for which the coupling is suitable

**Protective cap:** Construction element between union nut or pressure ring and sealing ring to prevent damage to this ring

**Protection layer:** A layer that protects the metal against corrosion

**Sealing element:** A rubber ring that ensures the gas-tight seal of the coupling

**Tightening ring / union nut:** A construction element that ensures the sealing of the sealing ring and, if present, the rings for the purpose of the clamping resistance

# 3 Product requirements

## 3.1 Construction

The manufacturer shall declare, depending on the intended use, the medium supplied, the Maximum Operating Pressure (MOP), the pipe material(s) to be jointed, the use of an insert, the corrosion resistance, installation and operating temperature limits, as applicable and the use of lubricants or greases.

This information shall be included in the installation manual of the fitting in the Dutch language.

Couplings that are suitable for an operating pressure of 1 bar or higher shall be full end-load.

In case of full end-load couplings, the clamp resistance shall not be achieved by means of springs or similar spring elements.

The couplings shall be designed for mounting with commonly used tools.

The seals between fitting and associated pipe shall be made of rubber. The construction of the fitting shall be such, or measures shall be taken to ensure that, the sealing element is not damaged when assembled in accordance with the assembly instructions.

Sharp edges in chambers shall be rounded

The fittings shall have a smooth inner and outer surface and shall not show grooves, pits, blows or other irregularities.

If the manufacturer specifies the angular deviation between fitting and pipe, this shall be possible to be achieved with a moment as described in paragraph 4.4.

## 3.2 Connections

### 3.2.1 Threaded ends

The thread for connecting the fitting to the metal pipe shall meet the requirements of EN 10226-1. The maximum allowed thread size is 2".

### 3.2.2 Soldering connection

Connections for soldering fittings for example for the transition to copper pipes shall meet the requirements of approval requirement 6.

### 3.2.3 Flange connection

Flanges shall meet the requirements of ISO 7005, minimal PN 10 up to and including 4 bar and PN 16 up to and including 8 bar.

### 3.2.4 Other connections

Other connection types are admissible according to other AR's or when mentioned in the gas installation regulations conform NEN 1078.

### 3.3 Dimensions

#### 3.3.1 Wall thickness

The wall thickness of the fittings shall comply with the values as mentioned in table 1. For transition fittings, the wall thickness at the connections shall comply with the DN value in table 1.

DN	Minimal wall thickness fitting/ fitting in mm		
	brass or bronze		Cast iron
	Cast	Hot formed	
10 t/m 20	1,6	1,4	2,2
25	1,8	1,5	2,4
32	1,9	1,6	2,8
40	2,2	1,8	3,0
50	2,3	2,0	3,2
(60)	2,8	2,3	4,7
65	3,4	2,6	4,7
80	3,9	2,9	4,7
100	4,5	3,3	4,7
125			4,8
150			4,8
200			4,9
250			5,2
300			5,6
350			6,0
400			6,4

Table 1: wall thickness metal fittings

#### 3.3.2 Admissable angular deviation

The admissable angular deviation for elbows and tees shall be less than 2°

#### 3.3.3 Insertion depth

For non-end load fittings, the insertion depth shall meet the values as mentioned in table 2.

DN	T <sub>s</sub> min. in mm
10 t/m 20	38
63	40
75	42
90	44
110	47
125	49
160	56
200	65
250	72
300	84
350	90
400	95

Table 2: insertion depth T<sub>s</sub>

### 3.4 Materials

Fitting bodies, union nuts and or pressure rings shall be manufactured from the following metals. Materials that the manufacturer can demonstrate to be at least equivalent to the metals listed below are also permitted.



#### **3.4.1 Copper-Zinc alloys**

The copper-zinc alloy shall at least comply with one of the following qualities:

- Hot formed brass Cu-Zn39 Pb3 according to DIN 17660
- Hot formed brass Cu-Zn40 Pb2 according to DIN 17660
- Hot formed brass Cu-Zn36 Pb1 according to DIN 17660
- Cast brass G Cu-Zn35 according to EN 1982
- Cast brass G Cu-Sn5Pb5 Zn5 according to EN 1982

Brass parts shall be stress free.

#### **3.4.2 Steel and cast iron**

When steel or cast iron is used, it shall be chosen from the following types:

- Steel with 0.2% yield strength of at least 200 N / mm<sup>2</sup> according to EN 10250-1 and EN 10250-2
- Cast steel with 0.2% yield strength of at least 185 N / mm<sup>2</sup> according to EN 10293
- Ductile iron with a 0.2% proof strength of at least 250 N / mm<sup>2</sup> in accordance with NEN 6002-D
- Malleable cast iron with a 0.5% proof strength of at least 200 N / mm<sup>2</sup> in accordance with NEN 6002-C
- Grey cast iron with a tensile strength of at least 200 N / mm<sup>2</sup> determined on a test bar diameter 30 mm in accordance with NEN 6002-A

#### **3.4.3 Clamp or closing rings**

Rings used to clamp – any protective caps for sealing elements, bolts and nuts – shall be made of the aforementioned metals or from another material which is corrosion solid or effectively protected against corrosion.

#### **3.4.4 Rubber components**

The material of the rubber components shall comply with EN 682, type GAL or GBL

## 4 Performance requirements and test methods

### 4.1 Leaktightness internal pressure

The fittings and the joints with metal pipes shall withstand an internal air pressure in accordance with table 3 at a temperature of  $-20 \pm 3$  °C and  $60 \pm 3$  °C, over a period of at least 15 minutes without showing leakage.

Pressure class	Non-end load fittings. Air pressure $\pm 0,1$ bar	Full-end load fittings Air pressure $\pm 0,1$ bar
$\leq 200$ mbar	0-1 bar	
1 bar	-	0-3 bar
4 bar	-	0-6 bar
8 bar	-	0-12 bar

Table 3: division pressure class

#### 4.1.1 Test method

Mount the fitting and the associated pipe according to the manufacturer's instructions. Condition the test pieces of fittings with metal pipes for at least 3 hours at  $-20 \pm 3$  °C respectively  $60 \pm 3$  °C. Subject the test pieces depending on the pressure class to an increasing internal air pressure according to table 4. Maintain each pressure at least 5 minutes. Check with every pressure level if there is leakage.

Pressure level in bar	Pressure class			
	0,2 bar	1 bar	4 bar	8 bar
	0,025	0,025	0,025	0,025
	0,1	0,1	0,1	0,1
	1,0	1,0	1,0	1,0
		3,0	3,0	3,0
			6,0	6,0
				12,0

Table 4: leak tightness / pressure class

### 4.2 Leaktightness external pressure

The fittings and connections to the associated pipes shall be able to withstand, at a temperature of  $23 \pm 2$  °C for  $120 \pm 10$  minutes, an external water pressure of  $100 \pm 10$  mbar and subsequently during  $120 \pm 10$  minutes an external water pressure of  $800 \pm 80$  mbar without showing leakage.

#### 4.2.1 Test method

Subject the test pieces, which have already been tested according to clause 4.1., for  $120 \pm 10$  minutes at a temperature of  $23 \pm 2$  °C to an external water pressure of  $100 \pm 10$  mbar. Repeat the test with an external water pressure of  $800 \pm 80$  mbar. Determine if there is leakage.

### 4.3 Repeated assembly

When the connection is detachable it shall meet the requirements in paragraph 4.1, after 10 times assembling and de-assembling according to the instructions of the manufacturer, at a temperature of  $23 \pm 2$  °C.

#### 4.3.1 Test method

Mount the fitting and the associated pipe according to the manufacturer's instructions. Assemble and de-assemble the test piece 10 times. Subject the test piece to the leak tightness test according to the method stated in paragraph 4.1 but at a temperature of  $23 \pm 2$  °C

### 4.4 Resistance against bending

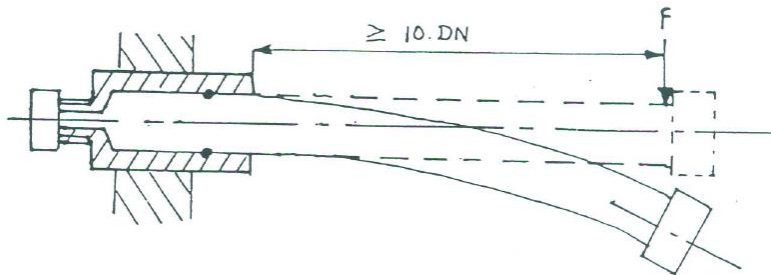
The fitting and connections to the associated pipes shall withstand a load of  $20 \times \text{DN}$  in Nm for metal pipes for at least 15 minutes.

Subsequently, the angle between the centre line of the coupling and the pipe is determined under the load. This shall be at least the value stated by the manufacturer.

The bending force is then increased until the maximal angular deformation has been reached. During the test, the test piece shall meet the requirements in paragraph 4.1 however at a temperature of  $23 \pm 2$  °C.

#### 4.4.1 Test method

Mount the fitting and the associated pipe according to the manufacturer's instructions. The free length of the pipe shall be at least 10 times the DN size. Clamp the fitting and apply at  $23 \pm 2$  °C a force F according to paragraph 4.4. on the test piece. The force shall be equally applied. Determine the angle between the centre of the fitting and the pipe if the manufacturer is allowing angular displacement.



Subsequently, subject the test pieces to a leak tightness test according to the method stated in paragraph 5.1 but at a temperature of  $23 \pm 2$  °C

### 4.5 Resistance against tension

Full end-load fittings with an associated pipe shall remain gas-tight during testing for 1 hour with an axial tensile load according to table 4.

With non-end load fittings and when the pipe is displaced in the fitting, the test shall be carried out with an extension length of not more than 0,5 times the insertion depth. The fitting shall be gas-tight both during and after the test. The gas-tightness shall be determined according to paragraph 4.1 at  $23 \pm 2$  °C.

DN	Tensile load in kN
10 up to and including 32	20,0
40 up to and including 65	25,0
80 up to and including 150	30,0
200 up to and including 400	50,0

Table 5: tensile load

#### 4.5.1 Test method

Mount the fitting and the associated pipe according to the manufacturer's instructions. Apply a tensile force to the joint according to table 4 at  $23 \pm 2$  °C, where the connection of the pipe in pull direction shall not lead to deformation of the pipe at the location of the connection. Increase the force at a constant speed for 10 mm/min until the prescribe tensile force F is reached. Maintain the tensile force "F" with an inaccuracy not exceeding  $\pm 3\%$  for 1 hour for full-end load fittings.

In case of non-end load fittings, the maximum displacement of the fitting at a constant speed of 10 mm/min is 0,5 times the insertion depth.

Check before and during the test, the test piece for leaks with an air pressure of  $100 \pm 10$  mbar. Take the test piece out of the tensile machine and perform the leak tightness test according to the method stated in paragraph 5.1 but at a temperature of  $23 \pm 2$  °C

#### 4.6 Homogeneity of the fittings

The fittings shall withstand during 15 minutes at a temperature of  $23 \pm 2$  °C, a test pressure with an internal water pressure as described in table 5. The test piece shall show no leakage.

DN	Test pressure
$\leq 300$	25 bar
$\geq 300$ t/m 400	16 bar

Table 5: density

#### 4.6.1 Test method

Perform the press test before any protection layer is applied. The test duration under the prescribed pressures shall be at least 15 minutes. Visually check for leaks. After the pressure has been removed, check the coupling for permanent deformation

# 5 Marking and instructions

## 5.1 Marking

The products shall be marked with:

- GASTEC QA, logo or punch mark
- Manufacturers name and/or trademark
- Type of material
- Manufacturing batch number and/or date
- Manufacturer's information for providing traceability
- Maximum permitted pressure
- The connection dimension and type of pipe to be connected.

## 5.2 Instructions

The manufacturer shall provide a clear and comprehensive instruction in the Dutch language, which includes:

- If the fitting is suitable for repeated assembly
- The maximal angular displacement
- If the fitting is full-end loaded or non-end loaded
- The number of the approval requirement upon which the fitting is certified.

## 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
Construction	3.1	X	X	1 x / year
Connections	3.2	X	X	1 x / year
Dimensions	3.3	X	X	1 x / year
Material	3.4	X	X	1 x / year
Rubber components (EN 682, Type GAL or GBL)	3.4.4	X	X	1 x / year
Leak tightness internal pressure	4.1	X	X	1 x / year
Leak tightness external pressure	4.2	X		
Repeated assembly	4.3	X		
Resistance against bending	4.4	X		
Resistance against tension	4.5	X		
Homogeneity of fittings	4.6	X	X	1 x / year
Marking and documentation	5	X	X	1 x / 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: 2003+A1: 2009	Test gases- test pressure – appliance categories
EN 10226-1:2004	Pipe threads where pressure tight joints are made on the treads - Part1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation
EN 682: 2002	Elastomeric seals - Materials requirements for seals used in pipes and koppelings carrying gas and hydrocarbon fluids
EN 1982:2017	Copper-zinc alloy castings (brass and special brass castings)
EN 10250-1:1999	Open die steel forgings for general engineering purposes - Part 1: General requirements
EN 10250-2:1999	Open die steel forgings for general engineering purposes - Part 2: Non-alloy quality and special steels
EN 10293:2015	Steel castings - Steel castings for general engineering uses
NEN 1078:2018	Supply for gas with an operating pressure up to and including 500 mbar - Performance requirements - New estate
NEN 6006-A:1966	Iron and steel - Qualities and test requirements - Grey cast iron
NEN 6006-C:1966	Iron and steel - Qualities and test requirements - Malleable cast iron
NEN 6002-D:1966	Iron and steel - Qualities and test requirements - Spherical graphite cast iron
DIN 17660:1983-12	Wrought copper alloys; copper-zinc alloys; (brass); (special brass); composition
ISO 7005-1:2011	Pipe flanges - Part 1: Steel flanges for industrial and general service piping systems