

AR 91

November 2024

Dutch version

Approval requirement 91

Metal fittings for the connection of metal pipes



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Foreword

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

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.

This AR, translated from Dutch, is used as supporting document. In case of doubt of interpretation of this AR, the Dutch version is leading.

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Contents

Foreword	1	
	Contents	2
1	Introduction	4
1.1	General	4
1.2	Scope	4
2	Definitions	5
3	Material and product requirements	6
3.1	Construction	6
3.2	Connections	6
3.2.1	Threaded ends	6
3.2.2	Soldering connection	6
3.2.3	Flange connection	6
3.2.4	Other connections	7
3.3	Dimensions	7
3.3.1	Wall thickness	7
3.3.2	Admissible angular deviation	7
3.3.3	Insertion depth	8
3.4	Materials	8
3.4.1	Copper-Zinc alloys	8
3.4.2	Steel and cast iron	8
3.4.3	Clamp or closing rings	9
3.4.4	Rubber components	9
3.5	Inserts	9
4	Performance requirements and test methods	10
4.1	Stress corrosion resistance	10
4.1.1	Test method	10
4.2	Uniform corrosion resistance	10
4.2.1	Test method	10
4.3	Leaktightness internal pressure	11
4.3.1	Test method	11
4.4	Leaktightness external pressure	11
4.4.1	Test method	11
4.5	Repeated assembly	12
4.5.1	Test method	12
4.6	Resistance against bending	12
4.6.1	Test method	12
4.7	Resistance against tension	13
4.7.1	Test method	13

4.8	Homogeneity of the fittings	13
4.8.1	Test method	13
5	Marking and instructions	14
5.1	Marking	14
5.2	Instructions	14
6	Quality system requirements	15
7	Summary of tests	16
7.1	Evaluation matrix	16
8	List of referenced documents and source	17
8.1	Standards / normative documents	17
8.2	Source of informative documents	17

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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 metal fittings for the connection of metal pipes.

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 February 2019.

List of changes:

- These approval requirements have been fully reviewed textually.
- Requirements for stress corrosion added.
- Requirements for uniform corrosion resistance added.
- References to standards are updated.

The product requirements have changed.

1.2 Scope

This approval requirement describes the requirements regarding fittings for gas pipes with a maximum connection size of DN 400 mm, which are applied for connecting pipes with a maximum operating pressure (MOP) of 8 bar at temperatures between -20 to +60 °C.

Used pipes can be:

- Steel pipes for welding or threading 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:

Austenitic stainless steel: Stainless steel (SS) is an iron alloy and has a high corrosive resistance. The addition of alloying elements provides specific properties. Austenitic stainless steel belongs to 1 of the 4 main groups of stainless steel. Austenitic stainless steel is characterized by nickel and chromium as the main alloying elements.

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

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

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

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

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

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.

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

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.

Stress corrosion: Type of corrosion caused by control stresses (via operations) and the simultaneous action of a corrosive medium. Stress corrosion cracking is a consequence of stress corrosion cracking.

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.

Uniform corrosion: Type of corrosion due to a natural interaction between a material and its environment. Oxygen corrosion is the most visible form of corrosion.

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

3 Material and product requirements

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

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 for use up to and including 4 bar and PN 16 for use 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 Admissible angular deviation

The admissible 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 _s 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_s

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 / mm² according to EN 10250-1 and EN 10250-2
- Cast steel with 0.2% yield strength of at least 185 N / mm² according to EN 10293
- Ductile iron with a 0.2% proof strength of at least 250 N / mm² in accordance with EN 1563
- Malleable cast iron with a 0.5% proof strength of at least 200 N / mm² in accordance with EN 1562
- Grey cast iron with a tensile strength of at least 200 N / mm² determined on a test bar diameter 30 mm in accordance with EN 1561

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

3.5 Inserts

When declared by the manufacturer, it is allowed to use inserts for connecting the fitting. The insert shall be supplied with the fitting or be available as separate part.

The insert shall be rigid and provide support over the entire compression area where the clamping force applies, applicable for mechanical joints.

The insert shall not be able to displace in longitudinal direction after assembly. After installation of the insert, the fitting shall show no signs of damage, scratches or cracks.

The material of the insert shall be fit for purpose. The minimal internal bore diameter of the fitting shall be stated by the manufacturer in the installation manual.

4 Performance requirements and test methods

This chapter contains the performance requirements and associated test methods that the products shall meet. This chapter also specifies the limit values, if applicable.

4.1 Stress corrosion resistance

All parts shall be resistant to stress corrosion.

For stainless steel parts the magnesium chloride test shall be performed according to paragraph 4.2.1. After exposure there shall be no visual signs of cracks using a magnification of 5 times.

Parts made from copper alloys shall be tested by an ammonium chloride test according to ISO 6957 (pH 9.5). No visual signs of cracks shall be observed with a magnification of 10 to 15 times.

4.1.1 Test method

The parts shall be degreased using acetone.

Dissolve 1000 g $MgCl_2 \cdot 6H_2O$ per 500 ml distilled water, or proportional amounts thereof. There shall be sufficient fluid to completely immerse the assembly.

Heat a vessel to 130 ± 2 °C and place the tube in the fluid for 108 hours let the fluid cool down to $70^\circ C \pm 2$ °C and leave the tube for 60 hours.

It can be necessary that a small amount of magnesium chloride or distilled water must be added in order to reach the 130°C. Make sure that the heating takes place uniformly (avoid bumps and jolts).

The visual assessment of sample takes place with the aid of a 5 times magnifying glass.

4.2 Uniform corrosion resistance

All parts shall be resistant against uniform corrosion. Parts made by a type of Austenitic RVS 300 series are exempt of this requirement due to the material characteristics related to the requirement of uniform corrosion.

All other metal materials shall be assessed according to paragraph 4.3.1 of this AR.

4.2.1 Test method

The uniform corrosion shall be assessed by performing the salt spray test according to ISO 9227, with a liquid according to paragraph 5.2.2 and a test duration of 168h.

The couplings will be exposed to the salt spray test unassembled (but capped).

After completion of the salt spray test, the couplings will be assembled, and the leak tightness will be assessed according to paragraph 4.3. The sample will pass if the product is mountable and leak tight.

4.3 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 ± 3 °C and 60 ± 3 °C, over a period of at least 15 minutes without showing leakage.

Pressure class	Non-end load fittings. Air pressure ± 0.1 bar	Full-end load fittings Air pressure ± 0.1 bar
≤ 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

4.3.1 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 ± 3 °C respectively 60 ± 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

4.4 Leaktightness external pressure

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

4.4.1 Test method

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

4.5 Repeated assembly

When the connection is detachable it shall meet the requirements in paragraph 4.3 of this AR, after 10 times assembling and de-assembling according to the instructions of the manufacturer, at a temperature of 23 ± 2 °C.

4.5.1 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 4.3.1 but at a temperature of 23 ± 2 °C.

4.6 Resistance against bending

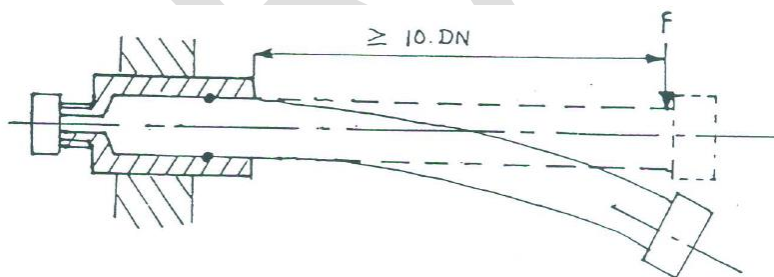
The fitting and connections to the associated pipes shall withstand a load (F) of $20 \times \text{DN}$ in Nm for metal pipes for at least 15 minutes.

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 4.3 of this AR however at a temperature of 23 ± 2 °C.

4.6.1 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 ± 2 °C a force F according to paragraph 4.6. 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 4.3.1 but at a temperature of 23 ± 2 °C.

4.7 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 5.

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 4.3 at 23 ± 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

4.7.1 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 5 at 23 ± 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 ± 10 mbar. Take the test piece out of the tensile machine and perform the leak tightness test according to the method stated in paragraph 4.3.1 but at a temperature of 23 ± 2 °C.

4.8 Homogeneity of the fittings

The fittings shall withstand during 15 minutes at a temperature of 23 ± 2 °C, a test pressure with an internal water pressure as described in table 6. The test piece shall show no leakage.

DN	Test pressure
≤ 300	25 bar
≥ 300 t/m 400	16 bar

Table 6: Density

4.8.1 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 with for example leak detection solution. 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, 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 operating pressure*
- The connection dimension and type of pipe to be connected*

*This information may also be placed on the smallest packaging.

5.2 Instructions

The manufacturer shall provide a clear and comprehensive instruction in the Dutch language and in the language of the country in which the products are used which shall include:

- 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
- If inserts shall be used

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 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.

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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 Evaluation 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	3.4.4	X	X	1 x / year
Inserts	3.5	X	X	1 x / year
Stress corrosion resistance	4.1	X		
Uniform corrosion resistance	4.2	X		
Leak tightness internal pressure	4.3	X	X	1 x / year
Leak tightness external pressure	4.4	X		
Repeated assembly	4.5	X		
Resistance against bending	4.6	X		
Resistance against tension	4.7	X		
Homogeneity of fittings	4.8	X	X	1 x / year
Marking and instructions	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 682: 2002+A1: 2005	Elastomeric seals – materials requirements for seals in pipes and fittings carrying gas and hydrocarbon fluids
EN 1561: 2023	Founding - Grey cast irons
EN 1562: 2019	Founding - Malleable cast irons
EN 1563: 2018	Founding - Spheroidal graphite cast irons
EN 1982: 2017	Copper and copper alloys - Ingots and castings
EN 10226-1: 2004	Pipe threads where pressure tight joints are male on the treads – Part 1 taper external threads and parallel internal threads.
EN 10250-1: 2022	Open die steel forgings for general engineering purposes - Part 1: General requirements
EN 10250-2: 2022	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
DIN 17660:1983-12	Wrought copper alloys; copper-zinc alloys; (brass); (special brass); composition
ISO 6957: 1988	Copper alloys – ammonia tests for stress corrosion resistance
ISO 7005-1:2011	Pipe flanges - Part 1: Steel flanges for industrial and general service piping systems
ISO 9227: 2022	Corrosion tests in artificial atmospheres – Salt spray tests

8.2 Source of informative documents

EN 437: 2021	Test gases- test pressure – appliance categories.
NEN 1078: 2024	Supply for gas with an operating pressure up to and including 500 mbar - Performance requirements - new estate.
General requirements GASTEC QA	