AR 154
December 2024

Approval requirement 154

Insulation union couplings in gas conduits

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Foreword

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

In this AR is established which requirements a product and the requestor/ certificate holder of the GASTEC QA product certificate should meet and the matter to which Kiwa evaluates this.

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.

Approved by the Board of Experts: 13/12/2024

Accepted by Kiwa Nederland B.V.: 17/12/2024

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Contents

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 insulation union couplings in gas conduits.

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.
- Addition of requirement for uniform corrosion resistance
- Addition of requirements for stress corrosion resistance
- The requirement for resistance to high temperatures has been revised.
- Change of paragraphs.

The product requirements have changed.

1.2 Scope

This Approval requirement specify the requirements for insulation union coupling, installed inside buildings after the main shutoff valve, for the transport of gaseous fuels in accordance with the 2nd and 3rd family as per EN 437.

Insulation union couplings are able to make a removable pipe connection which is not electrically conductive. The insulation union couplings have a maximum nominal diameter of 50 mm. The insulation union couplings can be supplied as a single part or in combination with other parts and are used in gas distribution systems for gas pressure up to 1 bar.

The specific functional recommendations for application of insulation pieces, like these union couplings, in gas systems are described in NEN 7244 and national and international standards and/or regulations.

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.

Bending moment: The bending moment is the force applied on the insulation union coupling to cause a specified bending.

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

Compressive force: The compressive force is the axially force applied on the insulation piece during testing.

Clearance distance: The clearance distance is the shortest straight unimpeded distance measured between the electrically conductive components of the insulation union coupling.

Creepage distance: The creepage distance is, with regard to the surface of the insulation part, the shortest distance between the electrically conductive parts of the insulation union coupling.

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

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.

Tensile force: The tensile force is the axially force applied on the insulation union coupling during the test.

Test voltage: The AC voltage set for the test is the effective value of this AC voltage that is applied during the test period.

Torsional moment: The torsional moment is the force applied on the insulation union coupling to cause a specific torsion.

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 General

3.1.1 Error-free installation

The insulation union coupling shall be made in such a way that errors during installation that jeopardize the function of the insulation union coupling are not possible.

3.1.2 Durability

The insulation union coupling shall be made in such a way that that the proper functioning and durability are ensured under normal use.

3.2 Materials

3.2.1 Fit for use

The quality and thickness of the materials used shall be such that they can withstand the mechanical, chemical, and thermal forces during the lifetime of the insulation union coupling.

3.2.2 Resistance to gas

Components of the insulation union coupling that come into contact with the gas flowing through shall be resistant against the constituents of the gas.

3.2.3 Rubber

Rubber components in the couplings shall comply with EN 682, type GAL or GBL or to EN 549 Class A2 (-20 to 60 °C).

3.2.4 Metals

Metal pieces shall be made from brass as specified in European product requirements for copper alloys or registered by CEN/TC 133 or from steel with a minimum tensile strength of 350 N/mm^2, provided that the union couplings manufactured from them meet the functional requirements of these approval requirements.

3.3 Construction

3.3.1 Diameter

The minimum diameter of the opening of the insulation union coupling shall at no point be smaller than 75% of the DN.

The minimum area of an isolating coupling may not be less than 75% of the DN at any point.

De minimale doorlaat van een isolatiekoppeling mag op geen enkel punt kleiner zijn dan 75% van de DN.

3.4 Threaded connections

3.4.1 Use in metal components

The threaded connections shall only be made in metal components.

3.4.2 Insulation

The threaded connections shall be made in such a way that no electrical contact of the insulated components can be made after installation.

3.4.3 Dimensions

The dimensions of the threaded connections of the coupling nut and the coupling bolt shall be compatible with NEN 2542 or shall conform to the Dutch Code of practice NPR 7028.

In case the insulation union coupling is a loose part with a gas-tight screw-thread connection at the other end as well, the gas-tight screw-thread connection shall be made according to EN 10226-1.

When a screw-thread connection is applied, the inlet and/or outlet concerned shall be provided with points where mounting tools can be made to engage.

3.5 Design of insulation components

3.5.1 Clearance and creepage distances

The insulation components shall be designed in such a way that the clearance and creepage distances are at least 3 mm.

3.5.2 Dirt protected clearance and creepage distances

Unlike is stated in paragraph 3.5.1, clearance and creepage distances that are protected against dirt deposits shall be at least 2 mm.

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 General

The tests of the insulation union coupling shall be done in the sequence indicated and shall be either visually judged or with the help of measurement equipment.

The dimensions shall be measured with tools with a maximum uncertainty of ± 0.1 mm.

Threads shall be measured with calibrated caliber's suitable for the purpose.

During the tests as described in paragraph 4.5 up to and including 4.7, the insulation union coupling shall be assembled according to the instructions of the manufacturer.

4.2 Resistance against stress corrosion

All parts shall be free of stress corrosion.

The magnesium chloride test in accordance with paragraph 4.2.1 shall be used for stainless steel components. After exposure to the magnesium chloride solution, no cracks shall be observed when assessing visually with a 5 times magnification.

Part made from copper alloys shall be teste 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.

4.2.1 Test method

The test shall be performed on the components of stainless-steel. The components shall be degreased using acetone and shall be put in a vessel, free from the bottom.

Dissolve 1000 g $MgCl_2$ $6H_2O$ 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 ± 2 ºC 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.

4.3 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.

4.3.1 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 insulation union coupling will be exposed to the salt spray test unassembled (but capped).

After completion of the salt spray test, the insulation union coupling will be assembled, according to the instructions of the manufacturer and the leak tightness will be assessed according to paragraph 4.4. The sample will pass if the product is mountable and leak tight.

4.4 Leak tightness

The insulation union coupling shall be externally gas tight at temperatures of -5 °C, 23 °C and 50 °C when a torque of 6 Nm per mm is applied on the product and assembled according to the instructions of the manufacturer.

4.4.1 Testmethod

The insulation union couplings will be pressurised with air to a pressure of 1.1 bar (overpressure) and tested with appropriate equipment. The uncertainty of measurement shall not be greater than 5 cm^3/h and the resolution shall be 1 cm^3/h.

The leak tightness tests are performed for 600 seconds at a temperature of -5 ± 3 °C, 23 ± 3 °C and 50 ± 3 °C.

After the leak tightness tests, the insulation union couplings shall be de-assembled.

4.5 Resistance to mechanical loads

The construction of the insulation union coupling shall be such that all the components of the insulation union coupling have a leakage rate less than 30 cm^3/h after applying the loads as listed in table 1. The tests shall be performed according to paragraph 4.5.1 and 4.5.2 of this AR.

nominal diameter in mm	tensile force compressive force in N	torsional moment in Nm		bending moment in Nm
		at 50 ± 3 °C	at -5 ± 3 °C	at 23 ± 3 °C
10	1000	60	120	68
15	1300	80	160	125
20	1700	100	200	200
25	2500	120	240	400
32	4100	150	300	700
40	6400	180	360	925
50	9900	240	480	1700

Table 1: Resistance to loads

If angular deviation of 45° between the two halves of the insulation union coupling is reached before reaching the torsional moment according to table 1, the torsional moment that caused this 45° angular deviation will suffice.

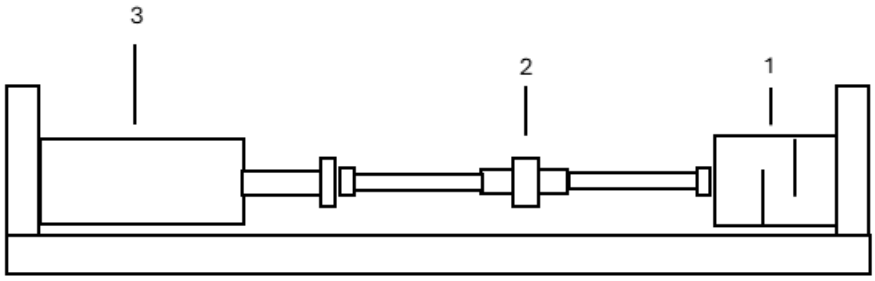
4.5.1 Testmethod - Leak tightness after exposure to tensile force, compressive force and torsial moment

The testing of the insulation union coupling for gas-tightness is done by placing the insulation union coupling in an oven at a temperature of 120 ± 3°C. Once the insulation union coupling has reached a temperature of 120 ± 3°C, it is kept at this temperature for 300 seconds and then cooled to room temperature in still air.

Then the following loads will be applied successively, according to figures 1, 2 and 3:

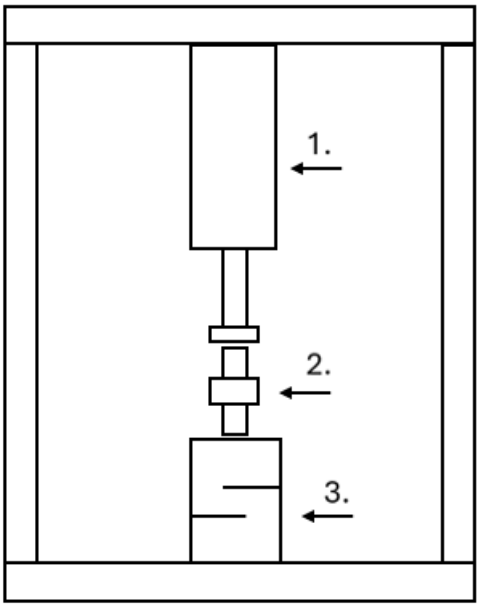
a. An axial tensile force in accordance with table 1 during 600 seconds at a temperature of 23 ± 3 °C.
b. An axial compressive force in accordance with table 1 during 600 seconds at a temperature of 23 ± 3 °C.
c. A torsional moment in accordance with table 1 or a torsional moment corresponding to an angular deviation of 45°. First during 600 seconds at a temperature of 50 ± 3 °C, then during 600 seconds at a temperature of -5 ± 3 °C.

After applying the mechanical loads, the leak tightness test of paragraph 4.4 is carried out, where the maximum leakage rate, per test temperature, is less than 30 cm^3/h.



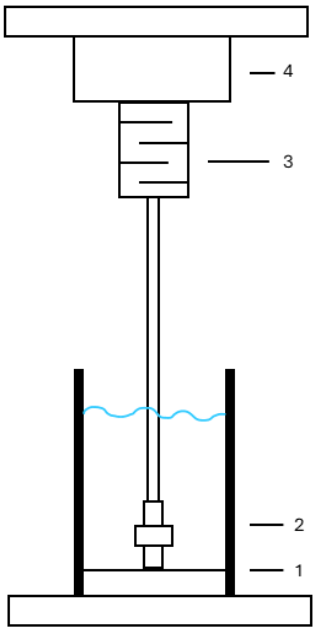
Legend:
1 Forcemeter
2 Sample under test
3 Pneumatic cylinder

Figure 1



Legend
1 Hydraulic press equipment
2 Sample under test
3 Loadcel

Figure 2



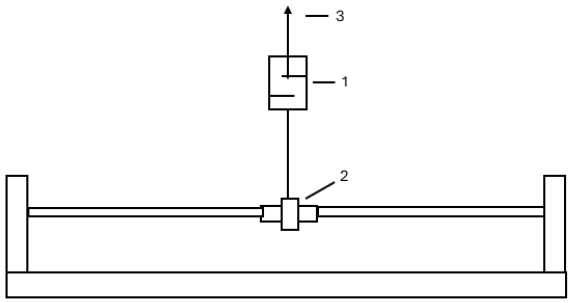
Legend:
1 Tank filled with liquid capable for -5 and 50°C
2 Sample under test
3 Torsion meter
4 Torsion equipment

Figure 3

4.5.2 Testmethod - Insulation and leak tightness during and after bending

The test piece from paragraph 4.5.1 is then blown dry and stored for 24 hours in a chamber with a relative humidity of 40 ± 3 %.

At a temperature of 23 ± 3 °C, the test piece is then loaded with a bending moment in accordance with table 1. For the test, the test piece is placed on two support points, according to figure 4 and loaded in the middle of the support spacing. The support points are positioned 800 mm from each other.



Legend
1. Force meter
2. Sample under test
3. Upwards force

Figure 4

First, the test pressure is applied. The load P is increased every minute by 20% of its end value and registered using a recorder that is connected. For the chosen test setup, the following applies to the bending moment M_b:

$M_b = P \cdot L/4$
If L = 0.8 then $M_b = 0.2 \cdot P$ in Nm; load $P = 5 \cdot M_b$ in N.

During a test period of 300 seconds, no short circuit shall occur in the insulated part (to be checked with 24 V AC voltage).

The leak tightness is then tested for 600 seconds while applying the load. The leakage rate shall be less than 30 cm^3/h.

After that, the load will be revoked and the leak tightness will be tested again, according to paragraph 4.4, with a leakage rate, per temperature, of less than 30 cm^3/h.

4.6 Effectiveness of the insulation

When a DC voltage of 500 V is applied, the resistance shall be at least 100 kΩ. No insulation breakdown and/or arcing shall occur when an AC voltage of 2500 V 50 Hz is applied.

4.6.1 Test method

For testing, the insulation union coupling mentioned in paragraph 4.5 is blown dry and placed in a chamber for 48 hours at a temperature of 23 ± 3 °C and a relative humidity of 93% to 95%.

The insulation union coupling shall take up a maximum of 1/10th of the volume of the chamber. Immediately after the insulation union coupling is taken out of the chamber, it is subjected to a DC voltage of 500 V, with the resistance being measured.

The insulation union coupling is then subjected to an AC voltage of 2500 V, 50 Hz. The voltage is increased in 10 seconds from 0 to 2500 V. The voltage of 2500 V is maintained for 60 seconds.

4.7 Resistance to high temperature

The insulation union coupling shall be resistant to a radiation heat of 10 kW/m^2 for 30 minutes. The leakage shall be ≤ 5 liters per hour after testing.

4.7.1 Test method

The test shall be performed at a temperature of 20 ± 5 °C. The test samples shall be conditioned at least 24h before testing at a temperature of 20 ± 5 °C and a relative humidity of 60 ± 20 %.

The test is performed in a horizontally test equipment as shown in figure 1. The leakage shall be measured in accordance with Annex A of EN 1775.

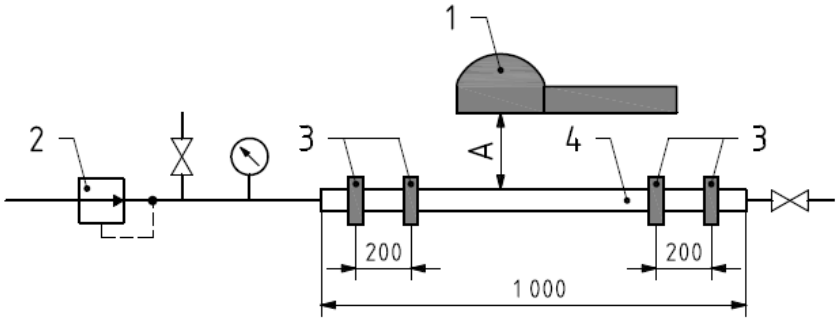


Figure 1

Legend:
1 heat cup
2 measuring system as described in appendix A of EN 1775
3 mounting brackets
4 to be tested sample
A distance between heat cup and surface of the assembled component (for example the outside of a casing)

The test sample shall be mounted in the test equipment without stress or tension on the test sample, see figure 1.

Before the start of the high temperature test, the sample is tested on leakage at 200 mbar for 5 minutes. Record the leakage value (l/h).

Expose the test sample for 30 minutes to a heat radiation of 10 kW/m2. The distance between the heating cup and the sample shall be calculated with the data on the calibration file of the heating cup.

Determine the leakage after the high temperature test during 5 minutes at 200 mbar. Record the value (l/h).

4.8 Resistance to liquid pentane

Components made of plastics should resist liquid pentane and their weight change shall remain within the determined values as described in paragraph 4.8.1.

4.8.1 Test method

Two test pieces of about 2 grams with a thickness of about 2 mm (if necessary, the entire component) are weighed to 0.1% accuracy after which they are submerged in liquid pentane at room temperature for 72 hours. The volume of the pentane shall be at least 25 x the volume of the test piece.

Immediately after the test pieces are removed from the pentane, and dried with filter paper if necessary, the weight is determined to 0.1% accuracy.

The weight change shall be no more than the following relative to the original weight:

- 15% weight for components that provide external gas-tightness, 20% for other components;

The test piece is then stored for 24 hours at room temperature and the weight is again determined to 0.1% accuracy.

- The weight change shall be no more than the following relative to the original weight: 10% for components that provide external gas-tightness, 15% for other components.

5 Marking and instructions

5.1 Marking

A permanent inscription shall be placed on each insulation union coupling in a clearly visible location that includes the following information:

- GASTEC QA, GASTEC QA logo or punch mark.
- Nominal dimensions in mm.
- The name of the manufacturer or the trademark.
- A type indication.
- The flow direction if not intended for two directions.

5.2 Instructions

The supplier shall provide installation instructions in the Dutch language and in the language of the country in which the product will be used.

Installation instructions shall be provided with every insulation union coupling. If the insulation union coupling consists of separate components, the assembly of the separate components shall be clearly indicated in the installation instructions.

At the same time, it shall be stated that the insulation union couplings shall not be contaminated during assembly.

These insulation union couplings shall be installed inside buildings and shall be installed after the main shutoff valve.

The installation instructions prescribe the torque to tighten the insulation union coupling.

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 design 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.

7 Summary of evaluation

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
Product requirements	**3**			
Error-free installation	3.1.1	X		
Durability	3.1.2	X		
Fit for use	3.2.1	X		
Resistance to gas	3.2.2	X		
Rubber	3.2.3	X	X	Each year
Metal	3.2.4	X	X	Each year
Diameter	3.3.2	X	X	Each year
Use in metal components	3.4.1	X		
Insulation	3.4.2	X		
Dimensions	3.4.3	X	X	Each year
Clearance and creepage distances	3.5.1	X	X	Each year
Dirt protected clearance and creepage distances	3.5.2	X	X	Each year
Perfomance requirements	**4**			
Resistance against stress corrosion	4.2	X		
Uniforme corrision resistance	4.3	X		
Leak tightness	4.4	X	X	Each year
Resistance to mechanical loads	4.5	X	X	Each year
Effectiveness of insulation	4.6	X	X	Each year
Resistance against high temperatures	4.7	X		
Resistance to N-pentane	4.8	X		
Marking	5.1	X	X	Each year
Instructions	5.2	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.

ISO 228-1: 2003	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation
ISO 6957: 1988	Copper alloys – ammonia tests for stress corrosion resistance
ISO 9227: 2022	Corrosion tests in artificial atmospheres – Salt spray tests
EN 549: 2019+A2: 2024	Rubber materials for seals and diaphragms for gas appliances and gas equipment
EN 682: 2002+A1: 2005	Elastomeric seals – materials requirements for seals in pipes and fittings carrying gas and hydrocarbon fluids
EN 1775: 2007	Gas supply - Gas pipework for buildings - Maximum operating pressure less than or equal to 5 bar - Functional recommendations
EN 10226-1: 2004	Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and design.
NEN 2542: 1967	Fittings and connections with outside thread for gas conduits

8.2 Source of informative documents

EN 437: 2021	Test gases- test pressure – appliance categories
NEN 7244-6: 2018	Gas supply systems - Pipelines for maximum operating pressures up to and including 16 bar - Part 6: Specific functional requirements for service lines
NEN 7244-10: 2021	Gas supply systems – Pipelines for maximum operating pressure up to and including 16 bar – Part 10: Specific functional requirements for housing for installations and housing for meters with a maximum inlet pressure of 100 mbar and a maximum design capacity of 650 mn^3/h
NPR 7028: 2022	Gas meters, swivel nuts and fittings – Dimensions
General requirements GASTEC QA	