

**AR 35**

September 2019

# Approval requirement 35

Compression fittings for joining copper pipes



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Progress**

# 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.

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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 compression fittings joining copper pipes.

This GASTEC QA approval requirements replace the GASTEC QA Approval Requirements 35 "Compression fittings for joining copper pipes" dated March 2012 and amendment November 2015.

List of changes:

- Requirements added for resistance to high temperature
- Requirement for impact resistance of joint assemblies is removed (Amendment November 2015)
- 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
- Update of list of referenced documents

The product requirements are changed.

## 1.2 Scope

This approval requirement applies to compression fittings for joining half-hard copper pipes (R250) or annealed copper pipes (R220) according to GASTEC QA Approval Requirements 5 for application in gas installations with a maximum working pressure of 1 bar. The compression fittings shall be used for domestic gas installations which come in contact with 2<sup>nd</sup> and 3<sup>rd</sup> family gasses according to table 1 of NEN-EN 437. The specific functional recommendations for application of these fittings are described in the requirements and measuring methods NEN 1078 and NEN 2078, as well as in the national and international norms and/or regulations.

## 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 General

Compression fittings for joining copper pipes shall comply with the requirements specified in NEN-EN 1254-2 Copper and copper alloys - Accessories - Part 2: Compression joints for use in combination with copper pipes.

Supplementary to that stated in NEN-EN 1254-2 the following mentioned requirements must be met:

### 3.2 Materials

The manufacturer shall declare in writing that the requirements below have been met.

#### 3.2.1 *Copper/Tin alloys*

The fitting shall be made of copper/tin alloys which shall meet the requirements according to NEN-EN 1254-2 article 4.2.

Note: The copper or copper alloys, Registered by CEN/TC 133 or Specified in European copper and copper alloy product standards have been in use for such a long time that the resistance against corrosion after 50 years, according to NEN 1078, is plausible.

### 3.3 Construction

#### 3.3.1 *Sealing*

The sealing shall be realized with a metal compression ring or cutting ring without any sealant or lubrication being applied during the assembly.

#### 3.3.2 *Transition fittings*

##### 3.3.2.1 *Connection with threads*

Gastight connection threads shall meet the requirements of NEN-EN 10226-1.

##### 3.3.2.2 *Capillar soldering*

Capillar soldering shall be according to Gastec QA Approval Requirements 6.

#### 3.3.3 *Nominal diameter*

Contrary to NEN-EN 1254-2, table 2, only the fittings of the following nominal diameters covered with these approval requirements:

DN10 - DN12 - DN15 - DN18 - DN22 - DN28 - DN35 - DN42 - DN54 - DN64 - DN76,1 - DN88,9 - DN108

Remark:

The abovementioned pipe diameters are generally applied in the Netherlands and are therefore included in GASTEC QA approval requirements 5.

### 3.3.4 **Across flats**

In addition to NEN-EN 1254-2, article 4.4.5 the width of the coupling nut flats shall be according to ISO 272.

If the width is greater than 46 mm, the flats might also be eight-sided. The height of the nut across flat shall be at least equal to the values given in table 1.

Flat width [mm]		Across Flat height [mm]
more than	up to and including	
	22	4
22	27	5
27	32	6
32	41	7
41	50	8
50	75	9
75		10

Table 1: Minimum height nut flats

### 3.3.5 **Adaptor fittings**

With adaptor fittings and reduced couplings the transition shall be carried out gradually. The angle with the axis of the fitting part concerned shall be 60° at the maximum.

### 3.3.6 **Hardness of the compression ring**

The Vickers hardness of the compression ring, measured according NEN-EN-ISO 6507-1, shall be within the values as stated by the manufacturer.

### 3.3.7 **Internal support**

Compression fittings suitable for use of annealed copper tubes (R220) shall be provided with an internal support. This support can be integrated to the fitting body or a loose part. The internal support shall be provided with means to control its position in the pipe.

## 3.4 **Additional requirements for GASTEC QA certified fittings**

If the fitting is already GASTEC QA approved according to the GASTEC QA approval requirements 35 in combination with half hard copper pipe (R250), only the tests as mentioned in the following list of requirements shall be executed according to the GASTEC QA approval requirements 35 in combination with annealed copper tubes (R220):

KE 35, Clause 3.3.7	Internal support
KE 35, Clause 4.4	<b>Error! Reference source not found.</b> Resistance to pull-out
KE 35, Clause 4.5	Resistance against bending
KE 35, Clause 4.6	Resistance against torsion
KE 35, Clause 4.7	Resistance to assembly forces
KE 35, Clause 4.9	Resistance to dynamic loads
KE 35, Clause 5.2	Assembly instructions



## 4 Performance requirements and test methods

### 4.1 General

Unless otherwise stated all testing must be carried out at a temperature of  $23 \pm 2$  °C. The accuracy of the measurements shall be according to table 2

		Temperature			
	Pressure	Time	>100 °C	-10 °C -100 °C	< -10 °C
Accuracy	5% Rdg	1 minute	5% Rdg	3 °C	5 °C

Table 2: accuracy of the measurements

#### 4.1.1 Samples

For each test three samples are needed. These samples must be composed according to NEN-EN 1254-2, article 5.2 and figure 5. The compression fittings shall be assembled according to the instructions from the manufacturer. The compression fitting shall be capable to fit at pipes with the normal and reduced wall thickness range as mentioned in the GASTEC QA Approval requirements 5. All tests shall be performed in conjunction with the standard wall thickness pipes. Tests as mentioned in the paragraphs 4.4, 4.5, 4.7 and 4.8 shall be additionally performed in conjunction with the reduced wall thickness pipes.

#### 4.2 Leak tightness under internal hydrostatic pressure

The testing according to NEN-EN 1254-2 article 4.6.1 "Leak tightness under internal hydrostatic pressure" shall also be carried out with an internal water pressure of 16 bar. No leakage is allowed during the test.

##### *Test method*

The test shall be carried out according to that stated in NEN-EN 1254-2, article 5.4., and supplementary tested with an internal water pressure of 16 bar.

### 4.3 Air tightness

The fitting assembly shall withstand an air pressure of 5 bar during 10 seconds. Afterwards the Compression fitting assembly shall be able to withstand an internal air pressure up to 3 bar at temperatures between -20 °C and +150 °C. No leakage is allowed during the test.

#### *Test method*

To determine the resistance against internal air pressure the test samples shall be included in an installation according to NEN-EN 1254-2, figure 5. In this installation, the pressure required shall be realized with compressed air at the required test temperature. The samples shall be immersed in a suitable liquid at the required test temperatures.

The test is carried out as follows:

1. Apply to the fitting assembly an air pressure of 5 bar during 10 seconds.
2. Apply directly after an air pressure of 3 bar to the test samples at room temperature and keep this pressure up.
3. Immerse the test samples in water at room temperature for 900 seconds.
4. Keep the test samples at a temperature of  $150 \pm 3^{\circ}\text{C}$  for 6 hours.
5. Immerse the test samples in a suitable liquid at a temperature of  $150 \pm 3^{\circ}\text{C}$  for 900 seconds.
6. Keep the test samples at a temperature of  $-20 \pm 3^{\circ}\text{C}$  for 6 hours.
7. Immerse the test samples in a suitable liquid at a temperature of  $-20 \pm 3^{\circ}\text{C}$  for 900 seconds.

No leakage shall occur under these circumstances.

### 4.4 Resistance to pull out

After testing, the compression fittings tested according to NEN-EN 1254-2 Article 4.6.2 "Resistance to pullout", shall additionally be tested with an internal air pressure of 3 bar during five minutes. No leakage is allowed during the test.

#### *Test method*

Carry out the testing as described in NEN-EN 1254-2 Article 5.5 "Resistance to pull-out". After the test, apply an internal air pressure of 300 kPa for 5 minutes.

#### 4.5 Resistance against bending

After testing, the compression fittings tested according to NEN-EN 1254-2 Article 4.6.3 “Leak tightness under internal hydrostatic pressure whilst subjected to bending”, shall additionally be tested with an internal air pressure of 3 bar during five minutes. No leakage is allowed during the test.

##### Test method

Carry out the testing as described in NEN-EN 1254-2 article 5.6 “Leak tightness under internal hydrostatic pressure whilst subjected to bending”. After the test, apply an internal air pressure of 300 kPa for 5 minutes. Determining the resistance against torsion

For determining the resistance against torque strain the test samples shall be included in an installation which can apply the required moment with the test sample immersed in water at room temperature. The required pressure can be realized with compressed air. The method of installation in the test installation is shown in figure 1.

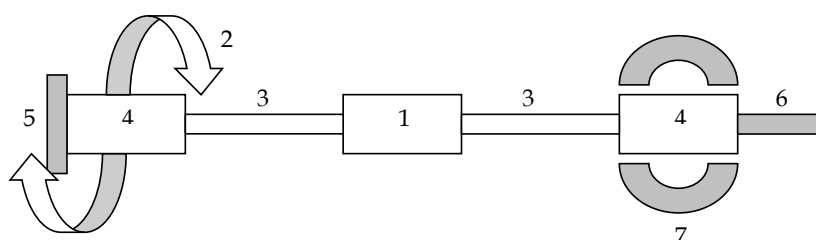


Figure 1: test installation

##### Legend:

- 1 = fitting to be tested
- 2 = torque
- 3 = copper pipe
- 4 = end fitting
- 5 = stop
- 6 = air pressure system
- 7 = clamp

Prior to testing the resistance against torque the test samples shall be tested according to article 4.2 and 4.4.

##### Working method for the resistance against torque:

1. Clamp the sleeve fittings in the testing installation.
2. Apply the required moment according to table 3 to one of the non-clamped fittings, perpendicular to the central axis of the copper pipe and maintain this moment.
3. Apply an air pressure of 300 kPa to the test samples and maintain this pressure.
4. Immerse the test samples under water for 900 seconds.

No leakage shall occur during the test.

External diameter of copper pipe in millimetres	10	12	15	18	22	28	35	42	>42
Moment in Nm	10	12	15	18	22	28	35	42	50

Table 3: required moment

#### **4.6 Resistance against torsion**

Compression fittings fitted to copper pipes must be able to withstand a torque applied at right angles to the central axis of the pipe at room temperature, determined according to paragraph 4.5 (test method). No damage or leakage may be detected, nor may the fittings shift from the original mounting position on the pipe.

#### **4.7 Resistance to assembly forces**

Compression fittings must be able to resist forces that arise because of tightening of the coupling nuts to a sufficient extent. Before and after this examination the fittings must be leak-tight in a test according to NEN EN 1254-2, article 5.4 with an internal water pressure of 16 bar, and an air pressure of 3 bar respectively. No damage or leakage may be detected after the test.

##### *Test method*

For determining the resistance to forces applied during assembly the test samples must be included in an installation according to NEN-EN 1254-2, article 5.4.1, in which the integrity of the joint is determined at room temperature and in which the coupling nuts of the joint can be tightened.

Mount the sample in the installation.

1. Determine the integrity of the joint according to paragraph 4.2 and 4.3 steps 1) and 2).
2. Then turn the coupling nuts of the sleeve joints another 180°.
3. Determine the integrity again as described in step 1).

#### **4.8 Resistance to repeated assembly**

After repeated assembly (25 times), the compression fittings shall not show signs of any leakage.

##### *Test method*

To determine the resistance to repeated assembly the test samples must be included in an installation in which, during the assembly, the moment is determined that is required to tighten the coupling nuts and in which the integrity of the joint is measured at room temperature.

For this determination three test samples are needed, which must be composed according to NEN-EN 1254-2, article 5.2 and figure 5. The compression fittings shall be installed according to the manufacturer's instructions.

The test is carried out as follows:

1. Determine the maximum torque that is needed to install the coupling nuts of the sleeve joints according to the manufacturer's instructions.
2. Disassemble these joints.
3. Then assemble these joints by applying the moment determined by step 1).
4. Repeat the actions described in steps 2) and 3) 25 times.

Finally determine the integrity according to 4.3, steps 1) and 2).

#### 4.9 Resistance to dynamic loads

This requirement only applies to fittings for use with annealed copper pipe (R220). The fitting assembled according to the instructions of the manufacturer must, at a temperature of  $23 \pm 2$  °C, meet a dynamic load of  $1 \times 10^6$  cycles with a frequency of 10 Hz and amplitude according to table 4. After the test no leakage shall be detected at an air pressure of 300 kPa during 900 sec. The fitting is not allowed to displace.

Pipe diameter (mm)	Amplitude (mm)
$\leq 42$	$3 \pm 0,5$
$> 42$	$2 \pm 0,5$

Table 4: Amplitude for dynamic load

##### Test method

The test sample is made of an end-fitting and the joints are made in accordance with the manufacturer instructions. The pipe length is 500 mm.

The test is conducted as follows:

1. Put the assembly in an installation according to figure 2.
2. Apply at a temperature of  $23 \pm 2$  °C a dynamic load of  $1 \times 10^6$  cycles with a frequency of  $10 \pm 1$  Hz and amplitude according to table 2.
3. Check after ending of the dynamic load the fitting assembly at 300 kPa during 900 for leakage by means of suited soap solution.
4. The fitting is not allowed to displace.

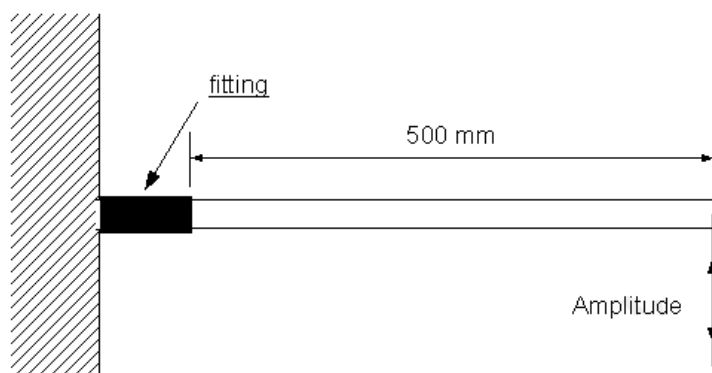


Figure 2: test assembly

#### 4.10 Resistance to high temperatures

The compression fitting (including protection/isolation) shall be resistant to a radiation heat of 10 kW/m<sup>2</sup> during 30 minutes. The leakage shall be ≤ 5 l/h after testing.

##### *Test method*

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

The test is performed in a horizontally test equipment as shown in figure 3. The leakage shall be measured in accordance to Annex A of EN 1775:2007.

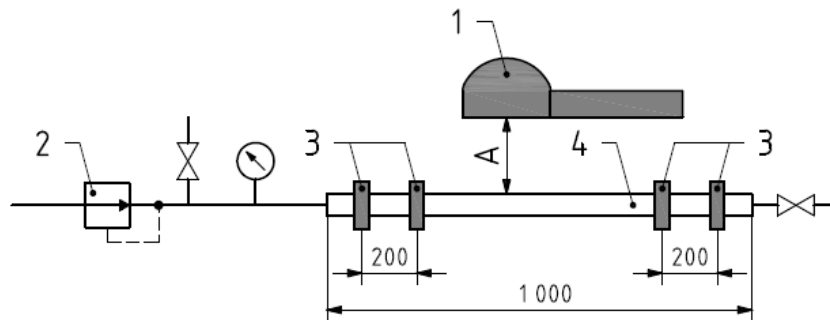


Figure 3

##### Legend:

1 heat cup

2 measuring system as described in appendix A of NEN-EN 1775:2007

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 3.

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

Expose the test sample during 30 minutes to a heat radiation of 10 kW/m<sup>2</sup>. 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).

# 5 Marking and instructions

## 5.1 Marking

In addition to NEN-EN 1254-2 the following marking shall be added.

- The products are marked with the GASTEC QA work mark or punch mark. This also applies for the inserts.
- This marking shall be placed on the fittings and the inserts for R220 copper pipes.
- The inserts are marked with the diameter x wall thickness.

## 5.2 Instructions

In addition to that stated in NEN-EN 1254-2, article 7, the manufacturer must also supply assembly instructions in Dutch.

This must also contain:

- The tightening moment or the number of times the coupling nut must be tightened during the assembly.
- The necessity to use inserts when fittings are used in combination with R220 copper pipes.

## 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
<b>NEN-EN 1254-2: 1998 requirements to be met</b>				
Materials	4.2	X	X	Once a year
Dimensions	4.3	X	X	Once a year
Design and manufacturer	4.4	X	X	Once a year
Pressure test bodies with cast microstructure	4.5.1	X		
Resistance to dezincification	4.5.2	X		
Leak tightness hydrostatic pressure	4.6.1	X	X	Once a year
Resistance to pull-out	4.6.2	X		
Leak tightness hydrostatic pressure under bending	4.6.3	X		
Resistance to stress corrosion	4.6.4	X		
<b>Additional GASTEC QA approval requirements</b>				
General	3.1	X		
Materials	3.2	X	X	Once a year
Copper/Tin Alloys	3.2.1	X	X	Once a year
Construction	3.3	X		
Sealing	3.3.1	X		
Connection threads	3.3.2.1	X	X	Once a year
Capillar soldering	3.3.2.2	X		
Nominal diameter	3.3.3	X	X	Once a year
Across flats	3.3.4	X		
Adaptor fittings	3.3.5	X		
Hardness of the compression ring	3.3.6	X	X	Once a year
Internal support	3.3.7	X	X	Once a year
Leak tightness hydrostatic pressure	4.2	X		
Air tightness	4.3	X	X	Once a year
Resistance to pull out and air pressure	4.4	X		
Leak tightness air pressure under bending	4.5	X		
Resistance against torsion	4.6	X		
Resistance to assembly forces	4.7	X	X	Once a year
Resistance to repeated assembly	4.8	X	X	Once a year
Resistance to dynamic loads	4.9	X		
Resistance to high temperatures	4.10	X		
Marking and instructions	5	X	X	Once a 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.

NEN-EN 45011:1998	General requirements for bodies operating product certification systems
GASTEC QA approval requirements 5: 2019	Copper tubes
GASTEC QA approval requirements 6: 2019	Plumbing fittings with ends for capillar soldering and/or threads connections
NEN-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
NEN-EN 248 : 2002	Sanitary tap ware - General specification for electrodeposited coatings of Ni-Cr
ISO 272:1982	Fasteners -- Hexagon products -- Widths across flats
NEN 1078:2018	Supply for gas with an operation pressure up to and including 500mbar – Performance requirements – new estate
NEN 2078:2001	Requirements for industrial gas installations
NEN-EN 1254-2:1998	Copper and copper alloys – Plumbing fittings – Part 2: Fittings with compression ends for use with copper tubes
NEN-EN-ISO 6507-1:2006	Metallic materials - Vickers hardness test - Part 3: Calibration of reference blocks

### 8.2 Source

Parts of the text of this approval requirement have been based on NEN-EN 1254-2.