

AR 186

November 2019

Approval requirement 186

Press fittings for joining copper pipes



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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.

Approved by Board of Experts : 08-11-2019

Accepted by Kiwa Nederland B.V. : 11-11-2019

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The use of this evaluation guideline by third parties, for any purpose whatsoever, is only allowed after a written agreement is made with Kiwa to this end

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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 press fittings for joining copper pipes.

This GASTEC QA Approval requirements replace the GASTEC QA approval requirements 186 “press fittings for joining copper pipes” dated February 2019.

List of changes:

- Minimum wall thickness for elbows pulled from copper pipes and chamber for the O ring, clause 3.3.6.

The product requirements are changed.

1.2 Scope

These approval requirements apply to metal press fittings for tensile resistance joining of half-hard copper pipes (R250) or annealed copper pipes (R220) with a maximum diameter of 54 mm according to GASTEC QA Approval Requirements 5.

Note; Joints with compression fittings and copper pipes with a reduced wall thickness are not part of this evaluation guideline.

The press fittings shall be used for domestic gas installations for the transport of gaseous fuels in accordance to the 2nd and 3rd family gasses according to table 1 of NEN-EN 437. The maximal operating pressure is 200 mbar.

The specific functional recommendations for application of these fittings are described in the requirements and measuring methods NEN 1078, NEN 2078, NEN 7244-6, NEN-EN 12007 and 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

The press fitting can consist of multiple metal parts. These parts shall be welded or soldered in the factory. The composition and dimensions of the press fittings shall comply with the construction drawings of the manufacturer.

If the fitting is already GASTEC QA Approved according to the GASTEC QA Approval Requirements 186 in combination with half hard copper pipe (R250), only the test as mentioned in the following list of requirements (Table 1) according to the GASTEC QA Approval Requirements 186 in combination with annealed copper tubes (R220) shall be executed.

Description of requirement	Clause of guideline KE 186	Annealed copper pipes (R220)
Resistance against high pressure	5.4	X
Resistance to bending	5.6	X
Resistance to dynamic loads	5.7	X
Resistance to pull-out forces	5.8	X
Resistance to torsion	5.9	X
Documentation	6.2	X
Internal support	3.3.7	X

Table 1: Additional testing program for use of press fittings in combination with annealed copper pipes (R220).

3.2 Materials

Fittings bodies shall be made from copper or copper alloys selected from materials either: specified in European copper and copper alloy product standards; or registered by CEN/TC 133, provided that the fittings of this materials meet the functional requirements of this standard.

NOTE Some of the standardized coppers and copper alloys commonly used for the manufacture of fittings are shown in table 2. Details of registered alloys can be obtained from the CEN/TC 133 Secretariat.

Material designation		Standard
Symbol	Number	
Cu-DHP	CW024A	EN 12449
CuSn5Zn5Pb5-C	CC491K	EN 1982
CuZn36Pb2As	CW602N	EN 12164
CuZn39Pb3	CW614N	EN 12164
CuZn40Pb2	CW617N	EN 12165
CuZn33Pb2-C	CC750S	EN 1982
CuZn15As-C	CC760S	EN 1982

NOTE These examples do not constitute an exhaustive list.

Table 2: Examples of commonly used materials.

3.2.1 Rubbers

Rubbers parts shall comply with EN 549, minimum type A2 or EN 682, type GAL or GBL.

3.3 Construction

3.3.1 General

The press fittings shall be clean on the inside and the outside. The press fittings are free of burrs and defects. Sharp corners or sides on the outside of the press fitting shall be avoided. The sealing shall be made by a rubber ring. The press fitting is joined by means of a press machine which is prescribed by the fitting manufacturer.

3.3.2 Pressing

The material can be treated by the manufacturer to prevent cracks in the material during pressing the fitting for installation.

3.3.3 Stop end

The fittings shall have a stop end which arrests the pipe and shall ensure the pipe end is past the clamping and sealing part of the fitting.

3.3.4 Connection threads

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

3.3.5 Spanner across flats

Spanners across flats shall be in accordance with ISO 272.

3.3.6 Wall thickness press fitting

The wall thickness of the fittings shall meet the requirements of table 3.

The minimum wall thickness "e" applies to almost the complete fitting, with exception of a bend made from pulled copper and to the chamber for the O Ring, where "e1" applies.

Dimensions e and e1 are illustrated in figure 1, 2 and 3.

Nominal diameter D	Minimal wall thickness (mm)					
	Copper		Copper alloys		Copper and copper alloys (cast)	
	e	e ₁	e	e ₁	e	e ₁
12	1,0	0,54	1,1	0,60	1,1	0,71
15	1,0	0,63	1,2	0,66	1,2	0,78
18	1,0	0,72	1,4	0,77	1,4	0,91
22	1,0	0,81	1,4	0,77	1,5	0,97
28	1,0	0,81	1,5	0,82	1,8	1,17
35	1,2	0,90	1,6	0,88	1,8	1,17
42	1,2	0,99	1,8	0,99	2,0	1,30
54	1,3	1,08	1,9	1,04	2,3	1,49

Table 3: Minimal wall thickness press fitting.

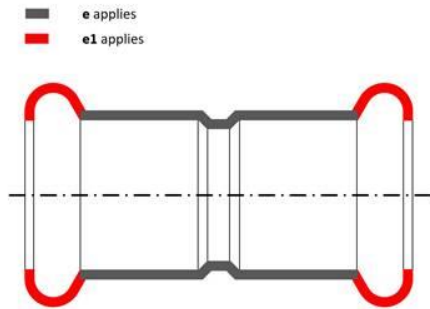


Figure 1: straight coupler

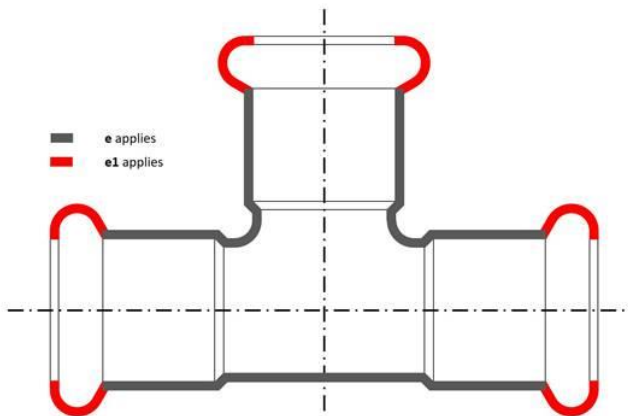


Figure 2: Tee

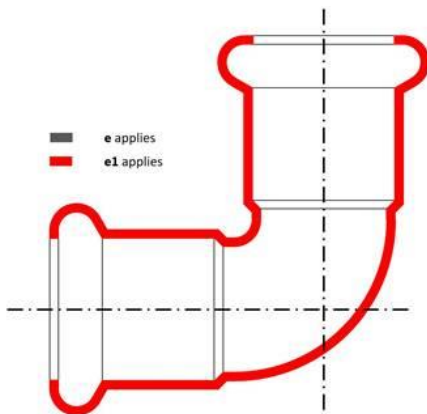


Figure 3: bend elbow

3.3.7 Insert

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

4 Functional requirements and test methods

4.1 General

The press fittings shall be assembled according to the instructions of the manufacturer. If required, special tools shall be supplied by the manufacturer. When applicable for the press fittings, the following tests shall be performed on both copper R220 and copper R250 pipes.

The tests shall be performed in threefold on three press fittings which are selected from the available diameters. Except test in paragraph 4.5, which is performed singular. Transition fittings shall also be used in the test assemblies. The selected diameters shall be the largest, smallest and a diameter in the middle.

The press fitting shall be capable to fit to pipes with the normal wall thickness range as mentioned in the GASTEC QA Approval requirement 5. Therefore, all tests shall be performed in conjunction with the standard wall thickness pipes.

The dimensions of the press fittings shall be checked with a proper measuring tool with a maximal measurement uncertainty of 0,05 mm.

The appearance and finishing shall be visually checked.

4.2 Resistance to high pressure

The press fitting assembled according to the instructions of the manufacturer, shall be leak tight at 23 °C according to 4.3.1 after tested at a high pressure.

Test samples.

The test samples shall be composed of a press fitting with pipes of 350 mm on both sides. The free end of one pipe is connected to the test installation. On the other pipe free end an end cap is mounted.

Apply an air pressure boost of $5 \pm 2\%$ bar for 10 ± 1 seconds to the press fitting.

4.3 Leak tightness

The press fitting assembled according to the instructions of the manufacturer, shall be tested for leak tightness at temperatures of 23 ± 2 °C, -20 ± 3 °C and 70 ± 3 °C. No leakages shall occur under these circumstances and the press fitting shall not be shifted.

The test shall be performed according to 4.3.1, 4.3.2 and 4.3.3.

Test samples.

The test samples shall be composed of a press fitting with pipes of 350 mm on both sides. The free end of one pipe is connected to the test installation. On the other pipe free end an end cap is mounted.

4.3.1 Leak tightness at 23°C

1. Connect the test sample to a test installation which is capable to maintain an air pressure of $300 \text{ kPa} \pm 2\%$.
2. Apply the pressure of $300 \text{ kPa} \pm 2\%$ and maintain the pressure for at least 900 seconds
3. Check during the test time of 900 seconds the leak tightness by emerging the press fitting in water. Possible pressure built up because of the water above the fitting has to be compensated.

4.3.2 Leak tightness at -20°C

1. Connect the test sample, tested in 4.3.1 in a test installation which is capable to maintain an air pressure of 300 kPa \pm 2 %.
2. Place the test sample in a climate cabinet at a temperature of -20 \pm 3°C.
3. Condition the test sample for at least 4 hours.
4. Apply the pressure of 300 kPa \pm 2 % and maintain the pressure for at least 900 seconds
5. Check during the test time of 900 seconds the leak tightness by emerging the press fitting in a liquid of the same temperature. Possible pressure built up because of the liquid above the fitting has to be compensated.
6. Repeat the leak tightness test at 23 °C according to 4.3.1 after the sample is conditioned for at least 4 hours at 23 \pm 2°C.

4.3.3 Leak tightness at 70°C

1. Connect the test sample, tested in 4.3.2 in a test installation which is capable to maintain an air pressure of 300 kPa \pm 2 %.
2. Place the test sample in a climate cabinet at a temperature of 70 \pm 3°C.
3. Condition the test sample for at least 4 hours.
4. Apply the pressure of 300 kPa \pm 2 % and maintain the pressure for at least 900 seconds
5. Check during the test time of 900 seconds the leak tightness by emerging the press fitting in water of the same temperature. Possible pressure built up because of the water above the fitting has to be compensated.
6. Repeat the leak tightness test at 23 °C according to 4.3.1 after the sample is conditioned for at least 4 hours at 23 \pm 2°C.

4.4 Resistance against bending

The press fitting assembled according to the instructions of the manufacturer, shall resist a statically bending at a temperature of 23 \pm 2 °C. No leakage shall occur under these circumstances and the press fitting shall not be shifted.

Test samples.

The test samples, tested in 4.3.3, shall be used for resistance to bending test.

1. Connect the test sample in a test installation which is capable to maintain an air pressure of 300 kPa \pm 2 %.
2. Place the sample in an apparatus which is able to apply a bending force, according to figure 4 in a bath of water at 23 \pm 2 °C.
3. Apply a force on the fitting, perpendicular on the axis of the pipe. The force shall be according to table 4. The uncertainty of the applied force can be 2% maximum.
4. Apply an air pressure of 300 kPa \pm 2 %.
5. Check during the bending of the press fitting the leak tightness for a minimum of 900 seconds. Possible pressure built up because of the water above the fitting has to be compensated.
6. Remove the bending weight.
7. Check after the bending of the press fitting the leak tightness for a minimum of 900 seconds. Possible pressure built up because of the water above the fitting has to be compensated.

External diameter	12	15	18	22	28	35	42	54
Force in N (\pm 2%)	90	140	180	270	400	550	800	1200

Table 4: Bending force.

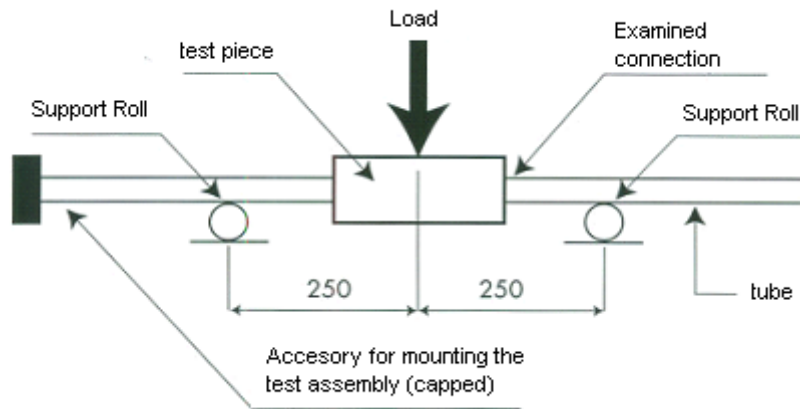


Figure 4: test assembly for testing resistance against bending

4.5 Resistance to dynamic loads

The press fitting assembled according to the instructions of the manufacturer shall be resist a dynamic load at a temperature of 23 ± 2 °C. No leakage shall occur under these circumstances and the press fitting shall not be shifted.

Test sample.

Assemble one test pieces which consists of six press fittings like stated in figure 5.

1. Install the test piece in an installation according to figure 5, which is capable to maintain an air pressure of $300 \text{ kPa} \pm 2\%$.
2. Apply an air pressure of $300 \text{ kPa} \pm 2\%$.
3. Apply a dynamic load of 1×10^6 cycles with a frequency of 10 ± 1 Hz and amplitude according to table 5.
4. Check during the testing for at least 900 seconds, the leak tightness of the fittings by means of applying a suited soap solution.
5. Remove the dynamic load
6. Check after the testing for at least 900 seconds, the leak tightness of the fittings by means of applying a suited soap solution.

Pipe diameter d	Amplitude (mm)
≤ 42	$5 \pm 0,5$
> 42	$3,5 \pm 0,5$

Table 5: Amplitude

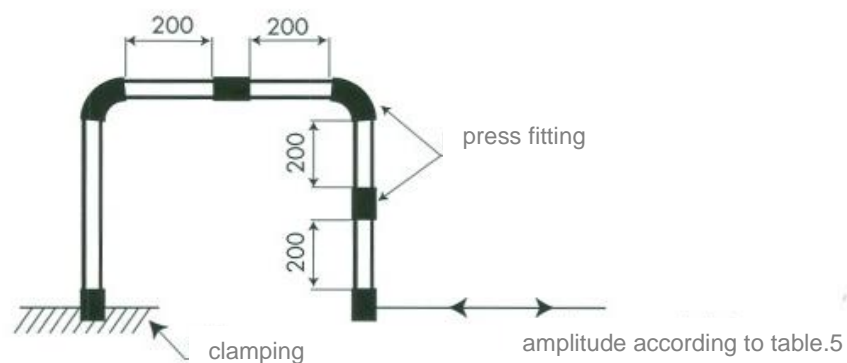


Figure 5: test assembly for testing resistance to dynamic loads

4.6 Resistance to pull-out

The press fitting assembled according to the instructions of the manufacturer shall resist a pull-out force at a temperature of 23 ± 2 °C. No leakage shall occur under these circumstances and the press fitting shall not be shifted.

Test samples.

The test samples, tested in 4.4, shall be used for resistance to pull-out.

1. Install the test piece in an installation according to figure 6, which is capable to maintain an air pressure of $300 \text{ kPa} \pm 2\%$.
2. Apply a tensile load of $1000 \text{ N} \pm 2\%$ at a temperature of 23 ± 2 °C.
3. Apply an air pressure of $300 \text{ kPa} \pm 2\%$.
4. Check during applying the tensile load the leak tightness of the press fitting for at least 900 seconds by emerging the press fitting in water. Possible pressure built up because of the water above the fitting has to be compensated.
5. Remove the tensile load.
6. Check after applying the tensile load the leak tightness of the press fitting for at least 900 seconds by emerging the press fitting in water. Possible pressure built up because of the water above the fitting has to be compensated.

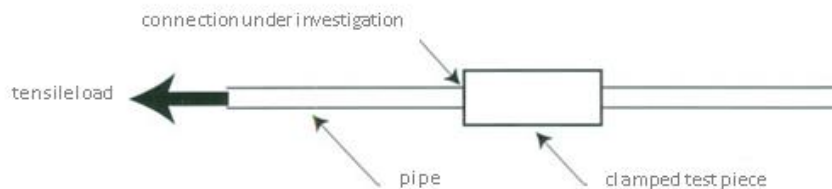


Figure 6: test assembly for testing the resistance to pull-out

4.7 Resistance against torsion

The press fitting assembled according to the instructions of the manufacturer shall resist 10.000 circumferential displacements at a temperature of 23 ± 2 °C. No leakage shall occur under these circumstances and the press fitting shall not be shifted.

Test samples.

Assemble the test pieces according to figure 7.

1. Install the test piece in an installation according to figure 7, which is capable to maintain an air pressure of $300 \text{ kPa} \pm 2 \%$.
2. Apply an air pressure of $300 \text{ kPa} \pm 2 \%$.
3. Apply 10.000 circumferential displacements of 4 ± 1 ° with a frequency of $1 \pm 0,2$ Hz at a temperature of 23 ± 2 °C
4. Check the leak tightness of the press fitting during the 10.000 circumferential displacements for at least 900 seconds by means of applying a suited soap solution.
5. Remove the circumferential displacements.
6. Check the leak tightness of the press fitting after the 10.000 circumferential displacements for at least 900 seconds by means of applying a suited soap solution.

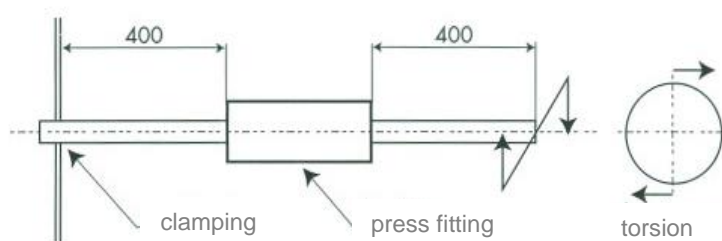


Figure 7: test assembly for testing the resistance against torsion.

5 Marking and instructions

5.1 Marking

The fitting shall be durably marked with the following information;

- Name of the manufacturer or the trademark,
- The external diameter of the pipe which is to be connected,
- The production code. This marking shall preferably be written on the fittings or alternative on the smallest packaging.
- The products are marked with the GASTEC QA word mark, logo or punch mark. This also applies for the internal support if used.
- If the press fitting is suitable for gas, the fitting shall be marked with the word 'GAS' or a yellow marking.
- The internal support shall be marked with the diameter x wall thickness.

5.2 Instructions

The manufacturer shall supply the documentation regarding the assembly and installation of the press fittings. The documentation also has to mention for which type of pipes the press fittings are suitable.

If internal support is necessary for use of annealed copper tubes (R220) the manufacturer has to describe the support and the assembly procedure in technical documents accompanying the product.

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
AR 186 requirements to be met:				
Materials	3.2	X	X	Each year
Rubbers	3.2.1	X	X	Each year
Construction	3.3	X		
General	3.3.1	X	X	Each year
Pressing	3.3.2	X		
Stop end	3.3.3	X		
Connection threads	3.3.4	X	X	Each year
Spanner across flats	3.3.5	X		
Wall thickness press fitting	3.3.6	X	X	Each year
Insert	3.3.7	X		
Functional requirements	4	X		
Resistance to high pressure	4.2	X	X	Each year
Leak tightness	4.3	X	X	Each year
Resistance against bending	4.4	X		
Resistance against dynamic loads	4.5	X		
Resistance to pull-out	4.6	X	X	Each year
Resistance against torsion	4.7	X		
Marking	5.1	X	X	Each year
Documentation	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.

GASTEC QA Approval Requirements 5: 2010	Copper tubes
NEN-EN 437:2003 + A1: 2009	Test gasses – test pressures – appliance categories
EN 549:1995	Rubber materials for seals and diaphragms for gas appliances and gas equipment
NEN-EN 682:2002 + A1:2005	Elastomeric seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
NEN-EN 1555-1: 2010	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 1: General
EN 1982: 2008	Copper and copper alloys - Ingots and castings
NEN 1078: 2004	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 7244	Dutch edition on base of NEN-EN 12007-1 – gas supply systems - Pipelines for maximum operating pressure up to 16 bar.
NEN-EN 10226-1: 2004	Pipe threads where pressure tight joints are made on the treads – Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation
NEN-EN 12007	Gas supply systems – Pipelines for maximum operating pressure up to 16 bar.
EN 12164: 1998	Copper and copper alloys – Rod for free machining purposes
EN 12165: 1998	Copper and copper alloys – Wrought and unwrought forging stock
EN 12449: 1999	Copper and copper alloys - Seamless, round tubes for general purposes
ISO 272: 1982	Fasteners -- Hexagon products -- Widths across flats
ISO 14531-1:2002	Cross linked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels -- Metric series -- Specifications -- Part 1: Pipes